

Chapter One

Introduction

1.1 Background to the Study

Obesity is a multifaceted illness, which affects people at all ages, but it is most common in infants, teenagers, and the elderly. Global health issues are now being created by the frightening rise in obesity. Nigeria is not exempt from the problem, which is currently spreading quickly throughout several middle- and low-income nations ¹. Weight gain that is abnormal or excessive and poses a risk to health is what is meant by the terms "overweight" and "obesity." Overweight is defined as a body mass index (BMI) of 25, and obesity as a BMI of greater than 30 ².

The majority of bodily systems are affected by obesity which have an impact on the reproductive system, joints, liver, kidneys, and heart. Numerous non-communicable diseases (NCDs), including type 2 diabetes, cardiovascular disease, hypertension, stroke, several types of cancer, and mental health problems are caused by it. Additionally, hospitalization for COVID-19 is three times more common in obese individual's³. Over 1 billion individual's, including 650 million adults, 340 million teenagers, and 39 million children, are obese globally. This figure is still rising. 167 million adults and children will have worse health by 2025 as a result of being overweight or obese³.

As predicted in 2020 that there will be 21 million and 12 million overweight and obese people in Nigeria, respectively, accounting for an age-adjusted prevalence of 20.3 percent and 11.6 percent⁴. It was noted that people are rapidly adopting less physically active lifestyles and eating more junk food in middle- and low-income countries due to growing urbanization, the mechanization of jobs and transportation, the availability of processed and fast foods, and reliance on internet for leisure⁵. A few of these have an effect on eating habits and physical activity levels. While numerous variables contribute to the development of obesity, an imbalance between energy intake and energy expenditure is implicated as a

primary contributor. The progressive weight increase shows that obesity is thought to be influenced by a lack of physical activity, as obese people may not spend as much time exercising as their non-obese friends ⁶. Regular exercise can reduce dependence on glucose-lowering oral medications and insulin in people with type 2 diabetes and other health-related illnesses ⁷.

Without a doubt, today's technology is dramatically transforming people's daily lives, as well as how they function. Machine has mostly taken the place of man power, thereby reducing the time man spend on exercise. Exercise is a sub-type of physical activity defined as any skeletal muscle action that results in energy expenditure, increasing body calorie output and heart rate, allowing the body to burn more calories and maintain physical fitness ⁸. Exercising is the act of physically exerting one's body through physical exercise in order to maintain or improve one's health and fitness.

The combination of physical activity and diets is intended to promote improved physical fitness, mental wellness, and overall health. Dieting is a mix of physical activity and consuming a range of meals to provide one with the nutrients required for energy and good health. Dieting is frequently used in conjunction with physical activity to help people lose weight, particularly those who are overweight or obese. Eating a range of meals that provide one with the nutrients needed to be healthy, feel well, and have energy is what healthy eating entails. Protein, carbs, fat, water, vitamins, and minerals are among the nutrients⁹.

Exercise involves engaging in physical activity and increasing the heart rate beyond resting levels. It is an important part of preserving physical and mental health. People may keep fit and healthy by exercising three to four times a week for at least 30 minutes, including dancing and walking. Obesity and weight gain are caused by a lack of activity and an unregulated diet, which increases the risk of cardiovascular disease⁷. Whether people engage in light exercise, such as going for a walk, dancing or high intensity activities, as such, uphill

cycling or weight training, regular exercise provides a huge range of benefits for the body and mind. Taking part in exercise of any intensity every day is essential for preventing a range of diseases and other health issues⁸.

Exercise has been linked to improved endurance and health-related quality of life. Breathing exercise was found to be an effective approach to prevent post-operative lung cancer problems, resulting in a higher quality of life for patients in a study on lung cancer⁴. Regular exercise can also help to avoid cardiovascular disease (CVD)¹⁰. Physical exercise is inversely associated to the risk of cardiovascular disease, according to another study¹¹. Exercise lowers the risk of cardiovascular events such as myocardial infarction (heart attack) and stroke by about 30%. As a result, exercise can help individual's feel better and live longer¹².

Dance, an energetic, non-competitive leisure sport, has the unusual feature of requiring all participants to do specific motions in the same rhythm, tempo, and dynamics so stimulating many muscle areas at the same time¹². Dance is generally classified as an intermittent exercise, characterized by a mixture of short sets of explosive moves and continuous adagio movement that requires sustained technical precision¹³. Nigeria is blessed with various dance steps that is beneficial and can be used as a form of exercise. A contribution of the most trending dance will be used along with the Afro-Pop music. Examples of this dance are, leg-work (Zanku), gbese, shaku-shaku, galala, warisi, among others. Dance also necessitates the adoption of various postures such as sitting, bending, standing, and knee bending. It has been reported to be effective in establishing a desirable body composition, improving motor ability, and improving pulmonary function status¹⁴.

In terms of metabolism, this means that dancers attain high peaks of exercise intensity that alternate with active or passive recovery periods, not allowing for oxygen consumption (VO₂) or heart rate (HR) stabilization over the course of the exercise. Dancing

is not only enjoyable, but it also provides a beneficial workout for weight loss. Every day, a 30-minute workout is required to maintain good health¹⁵. However, in order to lose weight, one must raise the intensity or duration of their workout. It goes without saying that one's diet is extremely important. To lose weight, one must decrease the calorie intake to generate a calorie deficit, which is the first stage. Some elements that influence calorie burn are beyond one's control. Two such influences are age and body composition.

The faster the dance, the more calories burnt. Various styles of dance aid in the burning of a variety of calories in the same period of time. One can burn twice as many calories in a ballet dance class has been done in a modern dance lesson. A person can burn 400 calories in one hour of dancing if they use the correct intensity, music, moves, and eat a well-balanced diet. People with a higher BMI can lose up to two to three pounds every week¹⁵. Dance, on the other hand, may only help persons with lower BMIs or who are older lose one to 1.5 pounds each week. Dancing is a total-body workout, and the music frequently causes people's feet to tap on their own. So, without a doubt, dancing is one of the best parameters to shed pounds. Dancing can be a way to stay fit for people of all ages, shapes and sizes. It has a wide range of physical and mental benefits including: improved condition of heart and lungs, increased muscular strength, endurance and motor fitness¹⁶.

It also bring about increased aerobic fitness, improved muscle tone and strength ,weight management, stronger bones and reduced risk of osteoporosis, better coordination, agility and flexibility, improved balance and spatial awareness, increased physical confidence, improved mental functioning, improved general and psychological well-being, greater self-confidence and self-esteem, better social skills¹⁷. One might dance as part of a party, with a partner, or alone. Dance can be enjoyed in a variety of settings, from dance classes, social venues, community centers, and even in one's house. Dancing may be performed in a competitive or social environment. It can be a great recreational and sporting

choice, because anyone of any age can take part. It doesn't matter whether it is cold or raining, as dancing is usually done indoors¹⁸.

Except for the severely crippled or the elderly, the most natural activity and the only continuous dynamic aerobic workout that everyone can undertake is walking. There are no particular skills or equipment needed. Walking is convenient and may be incorporated into daily routines at work and at home. Its intensity, duration, and frequency are all self-regulated, and it has a low ground impact, making it intrinsically safe. Walking, unlike many other forms of physical activity, shows minimal, if any, reduction as people age. It is an appealing alternative for improving physical activity in sedentary communities because it is a year-round, easily repeatable, self-reinforcing, habit-forming exercise¹⁹.

Walking is a rhythmic, dynamic, aerobic activity using big skeletal muscles that provides a wide range of health advantages with few side effects. Physical fitness is improved and maintained by walking faster than normal and in sufficient amounts into the 'training zone' of over 70% of maximal heart rate. Leg, limb girdle, and lower trunk muscles are strengthened, and cardinal joint flexibility is kept; posture and carriage may improve¹⁹. Walking expends energy in any amount and at any rate, implying that walking can help one lose weight in the long run. Walking improves a variety of biological processes that are inherent in skeletal muscle activity, such as high-density lipoprotein metabolism and insulin/glucose dynamics²⁰. Walking is also the most popular weight-bearing activity, with evidence of increased bone strength at all ages.

Along with rising trends in obesity rates, metabolic syndrome is becoming more common in children and adolescents. Walking is beneficial to one's health since it raises individual's fitness and/or individual's physiological activity and energy turnover. The two primary modes of action are acute, short-term effects of exercise and chronic, cumulative adaptations based on regular activity over weeks and months. Walking is routinely included

in exercise and illness studies, although it is seldom assessed separately²¹. Walking levels are frequently low in today's society. It is possible that familiar societal inequities are visible. There are signs that children's walking is declining, but more research on their activity, fitness, and health is needed. The disadvantage is the increased number of fatal and non-fatal road accidents, particularly among children and the elderly, as well as the decreasing air quality caused by traffic pollutants, which accumulating evidence links to various stages of respiratory disease²².

Walking is an excellent gentle start for the sedentary, particularly the elderly who are inactive and immobile, and it provides an added benefit of freedom and social well-being. On most days, a steady transition from slow to regular to 30 minutes or more of brisk (6.4 km/h) walking is recommended. These levels should provide significant increases in exercise and health-related fitness while causing no negative consequences. Personal motivation, therapeutic practice, and public health might all benefit from such goals. On a treadmill, Brisk-walking at 100 steps per minute or 3.5 miles per hour can improve physical, mental, and emotional wellness, which is faster than a stroll²³.

Walking has mental and emotional benefits in addition to physical ones. In a study of healthy older persons, the effects of exercise such as Brisk-walking were examined. Adults who took regular brisk walks fared better on cognitive tasks than adults who did not²⁴. An individual's can tell if he/she is walking briskly and they can still talk but cannot sing the words to a song. Brisk-walking has several physical health benefits, moderate exercise for 150 minutes per week can help one improve individual's cardiovascular health. Aerobic exercises like Brisk-walking are good for individual's heart. Moderate exercise can also aid in the reduction of blood pressure and cholesterol levels²⁵. It is also good for individual's longevity if one is fit enough to walk quickly. A group of older persons was evaluated, and it

was revealed that being able to walk quickly (100 or more steps per minute) could predict lower mortality²⁵.

Brisk-walking as a means to overcome obesity has been proposed as a modality for the overweight and obese individual's by previous researchers²⁶. Therefore, walking has been proposed as an ideal way for the overweight and obese individual's to begin an exercise Programme since it can be performed with minimal instructions or equipment and is cost effective. Anthropometry is a science of measuring human body part or segment in order to ascertain the average dimensions of the human body form at different ages and in different division of races, classes among others²⁷. Anthropometric is described as the measurement made of various parameters of the human body such as physical characteristics, body composition and circumference of various body parts²⁸. Anthropometric characteristics are traits that describe body dimensions, such as body weight, girth, and height and body fat composition. The physical therapist uses test and measurements to quantify anthropometric traits and compare an individual's current data with his or her previous data or with relevant predictive norms ²⁹.

Anthropometry is the measuring of a person's height, weight, and height. Since its inception in physical anthropology it has been employed for description, for the goals of interpreting human physical variety, in paleoanthropologists, and in numerous attempts to correlate physical with racial and psychological qualities¹³. The systematic measuring of the physical properties of the human body, especially dimensional descriptors of body size and shape, is known as anthropometry. Generally utilized tools and procedures for analyzing living conditions were insufficient, therefore historians turned to anthropometric history to find answers to their issues ³⁰.

Anthropometric measurements are a series of quantitative measurements of the muscle, bone, and adipose tissue used to assess the composition of the body. The core elements of

anthropometry are height, weight, body mass index (BMI), body circumferences (waist, hip, and limbs), and skin fold thickness. These measurements are important because they represent diagnostic criteria for obesity, which significantly increases the risk for conditions such as cardiovascular disease, hypertension, diabetes mellitus, and many more. There is further utility as a measure of nutritional status in children and pregnant women³⁰.

Additionally, anthropometric measurements can be used as a baseline for physical fitness and measure the progress of fitness. Anthropometry is used to produce goods in industries like as automotive design, textile design, ergonomics, and construction, where longitudinal data on population body proportions is used. Changes in population habits, diet, and ethnic composition contribute to changes in body dimension distribution (for example, the growth in obesity) and necessitate the constant update of anthropometric data ³¹. The cardiovascular system adjusts cardiac output, blood flow, and blood pressure in response to changing demands on the body. The product of heart rate and stroke volume, which indicates the volume of blood pumped by the heart per minute, is referred to as cardiac output.

Due to an increase in both heart rate and stroke volume, cardiac output rises during physical exercise. The cardiovascular adaptations to exercise are quick at first: "Within a second following muscle contraction, vagal outflow to the heart is withdrawn, followed by an increase in sympathetic stimulation of the heart. "This causes an increase in cardiac output, which ensures that blood supply to the muscle matches metabolic demands"³². The ability of the circulatory and respiratory systems to give oxygen to skeletal muscles during persistent physical activity is referred to as cardiorespiratory fitness (CRF).Cardiorespiratory fitness (CRF) is another dimension of physical health that relatively linked to beneficial health outcomes to individual's. CRF is a trait and is defined as the ability of the circulatory, respiratory, and muscular systems to supply oxygen during prolonged moderate-to-vigorous dynamic exercise ²⁹. Therefore, physical activity and cardiovascular fitness are related, but

not identical. CRF is usually measured using treadmill or ergometer exercise tests and is often expressed as maximal oxygen consumption (VO₂max), whereas PA is often assessed through self-report³³.

Non-communicable diseases (NCDs) eradicate 41 million people each year, equivalent to 71% of all deaths globally³⁴. Over 23.3 million people would die each year from cardiovascular disease by 2030, according to estimates, and the majority of these deaths will occur in low- and middle-income countries, which are undergoing fast dietary and socio-economic changes³⁵. As a result of these changes, there has been a significant shift in behavior and lifestyle, with a high prevalence of sedentary lifestyles causing energy imbalances, leading to overweight and obesity, which are well-established risk factors for various chronic metabolic diseases, including cardiovascular diseases, independently regarded as the world's fifth leading cause of death^{36,37}.

Central obesity presents a much higher risk for CVD than general obesity or body fat accumulation in the body. The effectiveness of lifestyle change with an emphasis on regular physical exercise has been demonstrated in intervention and preventative techniques. Interventions to counter the rising prevalence of obesity in less developed developing and developed countries should be culturally suitable, cost efficient, convenient, fun, and easy to maintain over time.

However, to the best of researcher's knowledge, little or no research work had been carried out on the efficacy of Dance as an Exercise and Brisk-walking, especially in Lead City University, when considering cost, convenience and interest as one of the major barrier to exercise. An exercise prescription that delivers benefits with less cost, fun-filled and minimal time investment is considered attractive. The focus of the present study, therefore, evaluated the effectiveness of dance-exercise and brisk-walking on anthropometrics and Cardiorespiratory indices of obese undergraduates of Lead City University.

1.2 Statement of the Problem

There is no denying that technological advancements are dramatically transforming people's daily lives and how they function. The increase in the prevalence of obesity worldwide has prompted most countries to focus on its prevention and treatment to improve public health. Exercises such as dance and Brisk-walking are parameters to gain fitness, lose weight, become healthy and particularly have all-round development in the body. However, it was observed that onsets, specifically undergraduates of tertiary institutions dedicate little time to well-planned exercises and fitness programmes.

It was also observed that undergraduates engage in sedentary life styles such as internet surfing, studying and hanging out with friends, such undergraduates equally involve in consumption of junks such as carbonated substances and snacks, which in the long can lead to development of obesity. Undergraduates who are obese are likely to remain so into adulthood as this is also a high risk period for weight gain. In spite of the of undergraduates' involvement in sedentary life styles and consumption of unhealthy foods (junks); previous studies focused more on cardiorespiratory fitness and body weight status as well as impact of step-aerobic dancing training programme on body composition markers in middle-aged inactive obese women and effect of brisk-walking on anthropometric indices and physiological characteristics of obese adults^{38, 39, 40}.

On the other hand, previous studies paid little concentration on the effect of Dance-exercise and Brisk-walking on the anthropometric as well as cardiorespiratory indices of

obese undergraduates particularly in Lead City University. This study therefore, investigated the extent to which each treatment (training) will have effect on the anthropometric and cardiorespiratory indices of the obese undergraduates, and which of the treatments will be more effective on anthropometric and cardiorespiratory indices of the obese undergraduates.

1.3 Aim and Objectives of the Study

The aim of this study was to investigate the effectiveness of dance-exercise and brisk-walking on the anthropometric and cardiorespiratory indices of obese Undergraduates in Lead City University, Ibadan, Nigeria. The following objectives were pursued:

- i. determine the prevalence of obesity among obese undergraduates in Lead City University
- ii. assess the effect of Dance-exercise and Brisk-walking on the anthropometric indices (BMI and WHR) of obese undergraduates in Lead City University, Ibadan, Nigeria.
- iii. determine the effect of Dance-exercises and Brisk-walking on the Cardiorespiratory indices (heart rate and blood pressure) of obese undergraduates in Lead City University, Ibadan, Nigeria.
- iv. examine the effect of sex on the anthropometric indices of obese undergraduates in Lead City University, Ibadan, Nigeria.
- v. ascertain the effect of sex on the Cardiorespiratory indices of obese undergraduates in Lead City University, Ibadan, Nigeria.
- vi. assess the interaction effect of treatments (Dance-exercise and Brisk-walking) and sex on the anthropometric indices (BMI and WHR) of obese undergraduates in Lead City University, Ibadan, Nigeria.

- vii. assess the interaction effect of treatments (Dance-exercise and Brisk-walking) and sex on cardio respiratory indices (heart rate and blood pressure) of obese undergraduates in Lead City University, Ibadan, Nigeria.

1.4 Research Question

The research question form the basis of the study.

1. What class of obesity is most prevalent among overweight undergraduates in Lead City University in Ibadan, Nigeria?

1.5 Hypotheses

The following hypotheses were tested.

H₀₁ There will be no significant main effect of treatments (Dance-exercise and Brisk-walking) on the anthropometric indices (BMI and WHR,) of obese undergraduates in Lead City University, Ibadan, Nigeria.

H₀₂ There will be no significant main effect of treatments (Dance-exercise and Brisk-walking) on the cardiorespiratory indices (heart rate and blood pressure) of obese undergraduates in Lead City University, Ibadan, Nigeria.

H₀₃ There will be no significant effect of sex on the anthropometric indices of obese undergraduates in Lead City University, Ibadan, Nigeria.

H₀₄ There will be no significant effect of sex on the cardiorespiratory indices of obese undergraduates in Lead City University, Ibadan, Nigeria.

H₀₅ There will be no significant interaction effect of treatments (Dance-exercise and Brisk-walking) and sex on the anthropometric indices (BMI and WHR,) of obese undergraduates in Lead City University, Ibadan, Nigeria.

H₀₆ There will be no significant interaction effect of treatments (Dance-exercise and Brisk-

walking) and sex on cardio respiratory indices (heart rate and blood pressure) of obese undergraduates in Lead City University, Ibadan, Nigeria.

1.6 Significance of the Study

Findings from this study may provide empirical basis on the relative effectiveness of dance-exercise and brisk-walking as modality for influencing anthropometric and cardiorespiratory indices of obese individuals. Also, the outcome of this study may reveal the benefits associated with active participation in physical activity and exercise. Furthermore, the outcome of this study could provide information to professionals on alternative types of exercise that can be utilized to meet the preferences of individual's averse to typical routine exercise in the quest for improving their weight. Finally, the findings of this study could be widely disseminated to health professionals such as nutritionists, physiotherapists, and doctors may be able to use them to build channels (campaigns, media outreach) to educate the public about the dangers of inactivity.

1.7 Scope of the Study

The scope of this study focused on independent variables of dance-exercise and brisk-walking, while anthropometrics and cardiorespiratory indices of obese undergraduates was examined as dependent variables. The participants consisted of 60 obese undergraduates in Lead City University. The obese undergraduates were divided into three groups of 20 participants each assigned to dance-exercise, brisk-walking and control group. The intervention programme was conducted at Lead City University stadium. Anthropometric and Cardiorespiratory indices of the participants are variables of interest.

1.8 Limitation of the Study

There were difficulties in recruiting obese, therefore, the researcher obtained ethical approval from Health Research Ethical Committee (HREC) of Lead City University as well as liaising with the University's hospital for easy recruitment. Additionally, the researcher

persuaded the participants during one-on-one approaches and group and assured them that their details would be maintained with the utmost confidentiality. Furthermore, to stimulate the participants, the researcher gave rewards (fruits and water). There were also participant's mortality throughout the course of the study, but the researcher was able to develop a roaster to make up for the days each participants were absent.

Furthermore, the researcher was unable to monitor whether the participants were engaging in any other form of exercise that could interfere with the efficacy of the treatment programme on the participants; thus, the researcher advised the participants not to engage in any exercise other than the ones that would be conducted for them during the course of the programme. Finally, because the researcher was unable to monitor the participants' diet, which might have an influence on their anthropometric and cardiorespiratory indices, the researcher provided the participants a nutrition education before the commencement of the training Programme. In spite of the above limitations, the results of these findings remain valid.

1.9. Operational Definition of Terms

The terms that are relevant to the study were appropriately defined

Physical Activity: It refers to activities that are not planned which is as a result of daily activities and are of benefit to one's health

Dance-exercise: Dance is a rhythmic activities, that incorporate songs or beat style which makes exercise fun and enjoyable.

Brisk-walking: Walking beyond resting level. On a treadmill, Brisk-walking at 100 steps per minute or 3.5 miles per hour can boost physical, mental, and emotional wellbeing, which is faster than a stroll

Anthropometric: refers to the portions of human's body.

Anthropometric Measurement: Anthropometric measurements are measurements of the muscle, bone, and adipose tissue used to assess the composition of the body.

Cardiorespiratory Indices: Relating to the heart, the lungs, and the tubes and muscles in the body responsible for breathing.

Obese: Obesity is a condition in which the body has collected an excessive amount of fat.

Undergraduate: are categories as students that are in higher institution.

Endnotes

1. A.L Brosse., E. Sheets., H.S.,Lett., & J.A., Blumenthal. *Exercise and the Treatment of Clinical Depression in Adults, Recent Findings and Future Directions.Sports Med*,32(12),2022,741760.https://www.researchgate.net/publication/11151794_Exercise_and_the_Treatment_of_Clinical_Depression_in_Adults.
2. World Health Organisation. 2022. https://www.who.int/health-topics/obesity#tab=tab_1.
3. World Health Organisation Day, <https://www.who.int/news/item/04-03-2022-world-obesity-day-2022-accelerating-action-to-stop-obesity>.
4. Ann Med, ‘*Estimating the prevalence of overweight and obesity in Nigeria in 2020: a systematic review and meta-analysis*’, 53(1), 2021 495–507.
5. Chinmoy Sarkar, Chris J. Webster & Pablo Monsivais, *Examining the Interaction of Fast-Food Outlet Exposure And Income on Diet And Obesity: evidence from 51,361 UK Biobank participants. International Journal of Behavioral Nutrition and PhysicalActivity*, (15)71,AvailableOnline:<https://ijbnpa.biomedcentral.com/articles/10.1186/s12966-018-0699-82018>.
6. Isabelle Romieu, Laure Dossus, Simón Barquera, Hervé M. Blotière, Paul W. Franks, Marc Gunter, Nahla Hwalla, Stephen D. Hursting, Michael Leitzmann, Barrie Margetts, Chizuru Nishida, Nancy Potischman, Jacob Seidell, Magdalena Stepien,Onefa Wang,Klaas Westerterp, Pattanee Winichagoon, Martin Wiseman & Walter C. Willett, Energy balance and obesity: what are the main drivers,28(3),2017, 247–258.

7. K. Aleisha Fetters, Dose-Response Effects of Exercise on Glucose-Lowering Medications for Type 2 Diabetes: A Secondary Analysis of a Randomized Clinical Trial. 2020.
8. M. Murad, N.A. A Rahman, NIA Rahman & M Haque. “*Knowledge, Attitude and Practice Regarding Exercise Among People Exercising In Gymnasium And Recreational Parks Around Kuantan, Malaysia*”. **J App Pharm Sci**, 6 (06), 2016, 047-054.
9. <https://timesofindia.indiatimes.com/life-style/health-fitness/weight-loss/left-sweets-for-weight-loss-take-a-look-at-this-mans-42-kg-weight-loss-and-he-had-laddoos/articleshow/64173281.cms>. 2018, 14:34.
10. World Health Organization, monitoring health for the SDGs, sustainable development goal:WorldHealthOrganization,AvailableOnline:<https://apps.who.int/iris/bitstream/handle/10665/324835/9789241565707-eng.pdf2019>.
11. D. Colin, Mathers. History of global burden of disease assessment at the World Health Organization. *Mathers Archives of Public Health* 2020.78:77.
12. K. Dhana, C.M. Koolhaasm., E.F.C Rossum., M.A. Ikram., A. Hofman & M. Kavousi, Metabolically healthy obesity and the risk of cardiovascular disease in the elderly population, 2016, 11, e0154273.
13. Manuela Angi ,George S Metsios, Yiannis Koutedakis & Matthew Wyon, *Fitness in Contemporary Dance A Systematic Review*.**International Journal of Sports Medicine**,AvailableOnline:<https://www.researchgate.net/publication/443925622022>.
14. M.E. Mikela & Nylander-French Oxygen Consumption during Rehearsal and Performance in Collegiate Dancers, Thesis, 2018.
15. MatteoGiuriato,ValentinaBiino,MariannaBellafiore,*Gross_Motor_Coordination_We_Have_a_Problem_A_Study_With_the_Korperkoordinations_Test_fur_Kinder_in_Oneth*, 2021, 6-13.
16. Josianne Rodrigues-Krause, Mauricio Krause & Álvaro Reischak-Oliveira, *Cardiorespiratory Considerations in Dance*.2015.
17. Running vs. dancing: What to choose if one want to lose weight,Available Online <https://timesofindia.indiatimes.com/life-style/health-fitness/weight-loss/running-vs-dancing-what-to-choose-if-one-want-to-lose-weight/articleshow/641911352018>.
18. Eduardo Rossato de Victo., Gerson Luis de Moraes Ferrari., João Pedro da Silva Junior., Timóteo Leandro Araújo., Victor Keihan & Rodrigues Matsudo, *Lifestyle*

Indicators and Cardiorespiratory Fitness in Adolescents,35(01), Available Online : <https://doi.org/10.1590/1984-0462/;2017;35;1;000162017>.

19. Xiangren Yi , One Fu, Ryan Burns & Meng Ding. Weight Status, Physical Fitness, and Health-Related Quality of Life among Chinese Adolescents: A Cross-Sectional Study, Available Online: <https://pdfs.semanticscholar.org/1b7d/da1973296f2d75be9b928e851a379596a385.pdf>2019.
20. Atividade física, aptidão cardiorrespiratória e síndrome metabólica em adolescents .Physical Activity, Cardiorespiratory Fitness and Metabolic Syndrome in Adolescents24 (4), Available Online <https://doi.org/10.1590/1517-8692201824041745022018>.
21. Dania Al-Hamad & Vandana Raman. Defining the Metabolic Syndrome in Children And adolescents: TranslPediatr,6(4),2017,397407.
22. G.L. Ferrari, M. M. Bracco, VK. Matsudo & M. Fisberg, *Cardiorespiratory Fitness and Nutritional Status Of Schoolchildren: 30-Year Evolution*, **J Pediatr (Rio J)**. 2013; 89, 366–373.
23. All Health Matters Ltd, Benefit of Walking for health and Longevity, |2022.<https://www.allhealthmatters.co.uk/post/six-benefits-of-walking-for-individual's-health-and-longevity>
24. J.I. Zhiguang, L.I. Anmin Li, Tian Feng, LIU. Xiaolei , ONE. Yihong, Fanying Meng, Ruoqing Wang, Jialing Lu, & Chunhua Zhang, The benefits of Tai Chi and Brisk-walking for Cognitive Function And Fitness In Older Adult, 2017. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5652256/>.
25. J Gen Intern Med. Walking Cadence and Mortality among Community Dwelling Older Adult, 29(9), 2014, 1263-9. doi: 10.1007/s11606-014-2926-6. Epub.
26. Ford & Swaine, *Effects of a 15-Week Accumulated Brisk-Walking Programme on The Body Composition Of Primary School Children*. **Journal of Sports Sciences**, 31(2), 2012. DOI:10.1080/02640414.2012.723816. Source PubMed
27. Abubakar, Dominic, & Adeoye. Ghana Journal of Health, Physical Education, Recreation, Sports and Dance. **(GJOHPERSD)**, 10(1)2018.
28. Oluwafunmilola Leah Dominic, Nurudeen. O. Abubakar & Sikiru Adeoye, Comparative analysis of Anthropometric and Physiological Characteristics of Kwara State Judo and Javlin Athletes, Available Online: https://www.researchgate.net/publication/350385876_comparative_analysis_of_anthropometric_and_physiological_characteristics_of_kwara_state_judo_and_javelin_athletes2021
29. Geetha Raghuvver, Jacob Hartz, David R. Lubans, Timothy Takken, Jennifer L. Wiltz, Michele Mietus-Snyder, Amanda M. Perak, Carissa Baker-Smith, Nicholas Pietris &

Edwards, Cardiorespiratory Fitness in Oneth: An Important Marker of Health: **A Scientific Statement From the American Heart Association**, 142(7), Available Online: <https://doi.org/10.1161/CIR.00000000000008662020>

30. Kyle Casadei & John Kiel, Anthropometric Measurement: In Stat Pearls, **Treasure Island (FL): Stat Pearls Publishing**; 2022, **30726000**. Bookshelf ID: NBK537315. <https://pubmed.ncbi.nlm.nih.gov/30726000/>.
31. Catherine S, Jefferson & Missouri, Anthropometric Measurements: Characteristics & Purpose, Available Online: <https://study.com/learn/lesson/anthropometric-measurements-purpose.html2022>
32. Jordan King & David R. Lowery. Physiology, Cardiac Output, 2022. <https://www.ncbi.nlm.nih.gov/books/NBK470455/>.
33. Johannes Zeiher, J. Katherine, Ombrellaro, Nita Perumal, Thomas Keil, B. Gert, M. Mensink, & Jonas D. Finger, *Correlates and Determinants of Cardiorespiratory Fitness in Adults: a Systematic Review*. **Sports Med Open**, 5(39). doi: 10.1186/s40798-019-0211-2
34. World Health Organisation. Non-communicable diseases, Available Online : <https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases2021>.
35. Maedeh Amini, Farid Zayeri & Masoud Salehi. *Trend Analysis Of Cardiovascular Disease Mortality, Incidence, and Mortality-To-Incidence Ratio: Results From Global Burden Of Disease Study 2017*, **BMC Public Health**, 21(401), 2021.
36. Anthropometric Units of Measurement., Last Edited on 2 september 2021 <https://en.wikipedia.org/wiki/Anthropometry>.
37. Baten, Joerg & Komlos, John. "Looking Backward and Looking Forward: Anthropometric Research and the Development of Social Science History". Social Science History, via **Elsevier Science Direct**, (28): 2004, 191–210.
38. Tai-Hsiung Hung, Pei-An Liao & Hung-Hao Chang, *Examining the Relationship between Cardiorespiratory Fitness and Body Weight Status: Empirical Evidence from Population-Based Survey of Adults in Taiwan*. **The Scientific World Journal**. 2014, 7.
39. A. Arslan, "Impact of an eight-week step-aerobic dancing training programme on body composition markers in middle-aged inactive obese women". International Federation of Sports Medicine, 2011. <https://journals.co.za/doi/pdf/10.10520/EJC48419>.
40. Ismail-Orire, Halimat I'ya. Effect Of Brisk-walking On Anthropometric indices and Physiological Characteristics Of Obese Adults In Ilorin Metropolis, Kwara State University (Nigeria) ProQuest Dissertations Publishing, 2021. 28542722. <https://www.proquest.com/openview/4d0ad5c42ea2afba741f39ac1d4393b4/1?pq-origsite=gscholar&cbl=2026366&diss=y>

Chapter Two

Literature Review

The related literature to this research were reviewed.

2.1 Conceptual Studies

2.1.1 Concept of Obesity

Defining and Assessing Obesity

The previous definition of obesity was an increase in body weight of over 20% over the optimal body weight of an individual which was the weight associated with the lowest risk of mortality given the individual's age, height, and gender. Based on these criteria, it is possible to define overweight as a 15-20% rise over optimal body weight. Today, however, measurements of height and weight—rather than morbidity—are used to define overweight and obesity. These measurements are used to determine the body mass index (BMI). This figure parallels fatness but is not a precise indicator of body fat and is essential to establishing if a person is clinically characterized as obese. BMI values are interpreted using categories of

weight status, such as underweight, healthy weight, overweight, and obese, which are then adjusted for age and sex. For all individual's over the age of 20, BMI values correspond to the same classifications of weight status; for instance, a BMI between 25.0 and 29.9 is considered to be overweight, while 30.0 or more is considered to be obesity. A BMI of 40.0 or greater is regarded as morbid obesity, commonly referred to as excessive or severe obesity. (See diet and chronic disease: nutritional disease.)¹. Current classification of a person's with a BMI of less than 25 is not obese.

The aforementioned definition of obesity, however, does not discriminate between obesity-related overweight and muscle hypertrophy. Furthermore, while obesity is a simple weight-for-height index that is frequently used to classify adults as overweight or obese, it does not always equate to the same level of fatness in different people. Being obese refers to weighing more than is normal for one's height. Obesity is a persistent, dangerous illness. It may cause additional health issues including diabetes, heart disease, and some types of cancer.² BMI is the most helpful population-level metric despite being a poor predictor of overweight and obesity since it is the same for men and women of all ages. However, Body mass index and waist circumference, the two most popular anthropometric measurements, were completely ineffective at capturing changes in body composition over a 12-month period of follow-up, whereas DXA was able to identify regional changes that were partially mirrored by changes in biochemical indices ³. Body mass index (BMI), which is calculated by dividing a person's weight in kilograms by their height in meters squared (kg/m^2), is a tool frequently used to categorize adult overweight and obesity. According to the WHO, obesity is classified as a BMI of 30 or above, while overweight is defined as a BMI of 25 or higher ⁴. A BMI of 30 or higher is considered obese, with overweight women having a BMI that is 27.3 percent or higher than the normal BMI for their height and weight and overweight men having a BMI that is 27.8 percent or higher.

Visceral fat appears to be more accurately identified by hormonal blood tests and CT scans than by measuring waist circumference ⁴. According to studies, those with a BMI of 23.0–24.9 kg/m² had a 43% higher chance of developing diabetes than those with a BMI of 18.5–22.9 kg/m². In Asia and America, the ideal BMI cutoff for diabetes screening is 23.8 kg/m², respectively. As a result, BMI categorization numbers shouldn't be consistent across all nations. BMI defines more than half of persons with an abnormal BFP as normal⁵. However, one research demonstrated that the presence of contrast, the HU range of visceral fat, sex, the breath-cycle, and the measurement level of the spine substantially influence CT measurements of visceral fat area and radiation attenuation. Using several fat HU ranges, we measured contrast and non-contrast reference values for lumbar and thoracic CT visceral fat measurements at diverse vertebra levels in a healthy adult US population ⁶. Another study found that the compliance of anthropometric measurements and visceral fat tissue measurements, such as ultrasonography and bio impedance analysis (BIA), with CT results varied by gender and BMI. These results show that methods and processes for calculating obesity in humans need to be more exact.

It is important to make accurate comparisons between different obesity assessment techniques. Some of the more recent technologies being evaluated include enhanced CT imaging, dual energy X-ray absorptiometry (DEXA), bio impedance analysis (BIA), and their combinations.^{7,8}

Global Trends of Obesity

Over 1 billion individual's, including 650 million adults, 340 million teenagers, and 39 million children, are obese globally. This figure is still rising. According to the WHO, 167 million adults and children will have worse health by 2025 as a result of being overweight or obese⁹. Obesity rates rise with age, reaching 50 or 60 years old. Obesity rates are on the rise all around the world, with emerging countries seeing record rises. The term "globesity" has

been coined to describe the epidemic's global nature. Obesity rates are increasing most rapidly in metropolitan areas. Sub-Saharan Africa is the only remaining region where obesity is not common, but it is on the rise. In the past, obesity was thought to be a problem that only afflicted the wealthy, but recent research have shown that obesity is a global issue that affects everyone, even rural populations. Self-perceived health and weight appropriateness are essential factors in eating and weight reduction behaviors, and local, social, and cultural patterns may act as mediators.

The development and implementation of clinical and public health policies should consequently place a strong emphasis on it in addition to the quality of life evaluation¹⁰. The majority of bodily systems are affected by obesity. It has an impact on the reproductive system, joints, liver, kidneys, and heart. Numerous non-communicable diseases (NCDs), including type 2 diabetes, cardiovascular disease, hypertension, stroke, several types of cancer, and mental health problems are caused by it. Additionally, hospitalization for COVID-19 is three times more common in obese individual's⁹.

Women have been disproportionately affected by the rise in obesity; in more than 20 nations in Latin America and the Caribbean, female obesity rates are 10 percentage points higher than male obesity rates¹¹. Obesity, on the other hand, appears to diminish when incomes rise in the region's middle income countries, particularly among women. Dietary changes and increased inactivity are to blame for rising obesity rates, particularly among low-income populations who see their incomes rise but still eat high-fat, high-carbohydrate, and energy-dense meals. More fatalities are associated with obesity and overweight than underweight globally. Every region, with the exception of some areas of sub-Saharan Africa and Asia, has more fat individuals than underweight people worldwide ¹². Higher intake of these goods showed a detrimental impact on grain, fruit, and vegetable consumption in the same population groups. Type 2 diabetes mellitus (T2DM) is one of the most prevalent

illnesses in the world. T2DM has a complex etiology that includes reversible risk factors like diet, exercise, and smoking as well as irreversible risk factors like age, genetics, race, and ethnicity¹³. High rates of obesity and overweight in Nigeria. This is particularly noticeable in metropolitan Nigeria and among women, which may partly be attributable to widespread sedentary lifestyles and an increase in processed food outlets, a tendency that is prevalent in many African settings¹⁴. The scientists blamed the growth in obesity on malnutrition in infants and fetuses, a lack of or inadequate education, socioeconomic conditions, dietary shifts toward energy-dense foods, and physical inactivity.

A person's intake of energy and/or nutrients might be deficient, excessive, or unbalanced in the case of malnutrition. Three major categories of conditions are covered by the term malnutrition:

Under nutrition, which includes stunting (low height for age), underweight (low weight for age), and wasting; micronutrient-related malnutrition, which includes excess or deficiency of certain vitamins and minerals; and overweight, obesity, and non-communicable diseases linked to diet (such as heart disease, stroke, diabetes and some cancers) ¹⁵. In the United States, childhood and teenage obesity is reaching epidemic proportions. Approximately 17% of US onengsters are currently obese. Children's entire physical and psychological health, as well as their cardiovascular and psychological health, can all be impacted by obesity. Obesity is a public health issue for kids and teenagers since it is linked to other illnesses. Numerous research investigations have been carried out to determine what linkages and risk factors enhance the likelihood that a kid may present with obesity as a result of the rise in the incidence of obesity among onengsters.

The combination of diet, exercise, physiological factors, and psychological factors is important in the control and prevention of childhood obesity, even though a complete

understanding of all the risk factors associated with obesity is still elusive; consequently, all researchers concur that prevention is the primary strategy for managing the current issue¹⁶. Overweight remained relatively consistent at 50% in the first 8 years of the Russian Federation's transition to a market economy, according to a nationally representative study of Russian people aged 19 to 55 years. Obesity climbed from 13.3 to 16 percent in the adult population¹⁷.

Data on obesity (percentage) (females vs. males) in the following nations were published by the Food Standards Agency of the United Kingdom between 1999 and 2000: Russia (25 vs. 10), Mexico (25 vs. 15), Argentina (25 vs. 28), France (7 vs. 8), the United Kingdom (24 vs. 21), Germany (19 vs. 17), Italy (9.9 vs. 9.5), and Spain (9.9 vs (15 vs. 12). However, given the passage of time since the date, these estimates could have changed.

Childhood and adolescent underweight, overweight, and obesity are all linked to negative health outcomes over the course of a person's life. Our goal was to estimate global trends in mean body mass index (BMI) and a wide range of BMI categories for children and adolescents, ranging from underweight to obesity, and to compare those trends to those for adults¹⁸. According to estimates, obesity rates range from about 5% in China, Japan, and a number of African nations to over 75% in urban Samoa.

Regional Levels of Obesity

In the US, the prevalence of obesity was 41.9% from 2017 to March 2020. From 1999 –2000 through 2017 –March 2020, US obesity prevalence increased from 30.5% to 41.9%. During the same time, the prevalence of severe obesity increased from 4.7% to 9.2%. Obesity-related conditions include heart disease, stroke, type 2 diabetes and certain types of cancer. These are among the leading causes of preventable, premature death.

The estimated annual medical cost of obesity in the United States was nearly \$173 billion in 2019 dollars. Medical costs for adults who had obesity were \$1,861 higher than medical costs

for people with healthy weight¹⁹. Gender and ethnicity have an impact on the rates. It is higher in women than in men (35 vs. 33%), as it is in other parts of the world. In the United States, African-Americans are more affected than other races. Aboriginal people in Canada are fatter than Caucasian people. More over 30 percent of annual deaths in the United States are reported to be linked to obesity-related ill-health issues as a result of the rapid growth in Class III obesity²⁰.

Black women had the highest incidence of overweight and obesity (58.5%), followed by women of mixed ancestry (52%) and white women (49.2%) in a survey of 7786 South African women aged 19 to 95. (49.2 percent). 42.8 percent. Urban women had a greater BMI than rural women, and both groups' BMI rose with age. Urban African women (42%) had a higher prevalence of central obesity (defined as a waist-to-hip ratio of 0.85 for women and 1.0 for males), with African and mixed-race women being most impacted. Overweight and obesity in adults are increasing globally and in South Africa (SA), contributing substantially to deaths and disability from non-communicable diseases. Compared to men, women suffer a disproportionate burden of obesity, which adversely affects their health and that of their offspring. This study assessed the changing patterns in prevalence and determinants of overweight and obesity among non-pregnant women in SA aged 15 to 49 years (women of childbearing age (WCBA)) between 1998 and 2017²¹.

In a cross-sectional research, it was discovered that among the Luo, Maasai, and Kamba people of rural and urban Kenya, waist circumference, arm fat area (AFA), and visceral and subcutaneous abdominal fat increased with age. Waist circumference, visceral and subcutaneous abdominal fat, and AFA were all greater in Maasai and urban populations. Men's AFA increased only as they aged. Kenyan urban dwellers had a higher prevalence of obesity (BMI 30) and overweight (BMI 25) than did people of rural regions (39.8 percent vs. 15.8 percent). The thickness of visceral and subcutaneous fat in the abdomen was highest in

people who lived in cities. A significant frequency of overweight and obesity was discovered in this Kenyan study, with the Maasai having the fattest buildup. In 2004, the national prevalence rate in Kenya was reported to be 13 percent. Anthropometric measurements of fat accumulation, particularly central features of Obesity is an important marker of cardio metabolic health in Kenya, both rural and urban populations ²².

Asian children had an obesity incidence of 5.8% overall and 8.6% among adolescents. Children were 11.2% overweight and teenagers were 14.6% overweight, respectively. The general prevalence of obesity in children was 7.0% and 4.8% in boys and girls, respectively, while the prevalence of overweight in children was 11.7% and 10.9% in boys and girls. The prevalence of obesity in urban adolescent boys and girls was 10.3% and 6.6%, while the prevalence of overweight was 17.1% and 14.8%, respectively, according to our findings. Additionally, we found that the prevalence of childhood obesity in urban boys and girls was 6.6% and 4.6%, while the prevalence of overweight was 12.6 and 10.8%²³.

The Obesity Outlook in Africa

Since 2000, there has been a nearly 24% increase in the proportion of under-5-year-old overweight children in Africa. In 2019, Asia was home to over half of the world's oneng overweight or obese children ²⁴. In South Africa, one in every three males and one in every two women is overweight or obese. These values for South Africa are comparable to those for the United States. Obesity is projected to affect 40% of the population in Morocco, while it affects just approximately 12% of the population in Kenya. The most concerning trend in Kenya and other developing nations is childhood obesity among well-fed and sedentary school-aged onengsters. Since 2000, there has been a nearly 24% increase in the proportion of under-5-year-old overweight children in Africa. In 2019, Asia was home to over half of the world's oneng overweight or obese children.

In 2020, it was projected that 12 million people in Nigeria were obese, with women having a far greater prevalence. Obesity appears to be on the rise in the nation as a result of nutritional and epidemiological changes brought on by demographic shifts, growing incomes, urbanization, bad lifestyles, and consumption of foods that are heavily processed ²⁵. It has typically been discovered that eating while watching TV increases both immediate and delayed calorie consumption ²⁶. The shortage of room in African towns for sports grounds and facilities is contributing to the epidemic's spread in urban areas. The practice of families sitting for extended periods of time watching TV, movies, and children playing computer games for long periods of time is likely to contribute to increased obesity and overweight rates among affluent and middle-class city inhabitants.

Obesity affects a growing number of African men and women each year. All African nations with available data are falling short of meeting global adult obesity objectives. According to the most recent data, 18.4% of women and 7.8% of men on the continent are obese, up from 12% and 4.1%, respectively, in 2000²⁷.

Causes and Aetiology of Obesity

Adipose tissue dysfunctions in obesity, generating a pro-inflammatory, hyperlipidemic, and insulin-resistant milieu that leads to type 2 diabetes mellitus (T2DM). Concurrently, comparable characteristics associated with adipose tissue dysfunction cause cardiovascular disease (CVD) via processes that can be exacerbated by T2DM²⁸. An incorrect energy balance leads to an increase in energy storage, predominantly as fat, and is the root cause of obesity. Being overweight and obese can be harmful to one's health. The two types of fat deposition are visceral fat deposition and subcutaneous fat deposition. High visceral fat deposition is typically linked to elevated plasma low-density lipoprotein (LDL) cholesterol, which can cause hypertension, diabetes, heart disease, and stroke. Although women are more obese than males, their Pretestmenopausal fat distribution is primarily

subcutaneous rather than abdominal, which may lessen their vulnerability to Pretestmenopausal hypertension, high LDL-cholesterol, and type 2 diabetes.

Obesity and overweight are linked to an increased risk of cardiovascular and metabolic illness, as well as poor overall health outcomes. Menopause is associated with major body composition changes and the buildup of peri-abdominal or visceral fat. There have been changes in energy expenditure and spontaneous activity. Obesity and its related dangers can be exacerbated by these mid-life changes²⁹. Contrarily, visceral fat is linked to the accumulation of fat in the body's belly. CT scans revealed a relationship between the quantity of active testosterone and, to a lesser extent, estradiol (the main form of estrogen) in women and the body's visceral fat. Women have greater diffuse obesity but less central obesity than males, and obesity affects minorities disproportionately. Obesity rates among children (ages 2 to 19) are rising over the world, which is cause for concern. This tendency is projected to drive the worldwide obesity pandemic for decades to come, affecting population health, causing infrastructure issues as governments try to fulfill increased health-care needs, and significantly raising global health-care costs³⁰.

Obesity is a major risk factor for developing type 2 diabetes (T2D), and its prevalence is increasing globally. White adipose tissue (WAT) is essential for maintaining systemic energy balance. Adipose tissue grows due to an increase in adipocyte size (hypertrophy) and number (hyperplasia). Rather than just inflating the cells, recruitment and differentiation of adipose precursor cells in subcutaneous adipose tissue (SAT) might guard against obesity-related metabolic problems³¹. The relationship between overall and central obesity and irregular menstrual cycle events is hypothesized to be mediated by hormones such insulin, sex hormone binding globulin, and testosterone. Obesity, low steroid hormone-binding globulin (SHBG), and hypertension are all risk factors. Bio mediators and early warning signs include androgenemia, insulin resistance, and compensatory hyperinsulinemia.

Predictors of PCOS metabolic complications there are still concerns concerning the true risk of CV illnesses in PCOS and the molecular processes behind CV problems³².

Age, changes in the distribution of fat deposits, the size and total number of adipocytes may all contribute to the form of women after menopause. Estrogen, the hormone that controls a woman's monthly cycle, declines during this stage of life and is thought to make post-menopausal women more susceptible to cardiovascular disease and type 2 diabetes than their younger counterparts. This is because fat migrates from the hips, arms, and thighs to the abdomen during this time. Women who have larger subcutaneous abdominal adipocytes are also more likely to develop type 2 diabetes later in life. A positive family history of diabetes is a key risk factor for type 2 diabetes mellitus (T2DM). First degree relatives (FDR) of T2DM patients exhibit higher insulin resistance and bigger abdominal subcutaneous adipocytes than those without a family history. Our goals were to see if a family history of T2DM is connected with bigger abdominal adipocytes regardless of age, gender, or abdominal subcutaneous fat, and to see if FDR of T2DM is similarly related to femoral adipocyte size, visceral fat, and fasting plasma triglyceride (TG) concentrations³³.

During menopause, progesterone and estrogen production fall off simultaneously, forcing the body to produce more of both hormones. To do this, the body deposits more fat cells in the thighs, hips, and breasts. Weight gain results from the body retaining more fluid when progesterone levels decline. Thus, fat serves as the central component of a complex system that coordinates a number of bodily functions, yet its excessive accumulation can be dangerous to one's health. Overeating, inactivity, and dietary changes are all associated with obesity, as are urbanization, modernity, social position, and, in a small percentage of cases, a physical condition or metabolic disorder. Obesity is increasing in every part of the world, even the poorest LMICs. Over the last half-century, the food environment has been a major contributor to the global growth in obesity.

Diet, physical exercise, the built environment, genetics and epigenetics, environmental contaminants, and stress are all proven and developing contributory variables. Although each driver may have only a little impact on obesity risk, the sum of several minor impacts may explain the significant increases in overweight/obesity reported in LMICs. Perhaps the most notable characteristic of the obesity pandemic in LMICs is that it is taking place against a backdrop of widespread maternal and child malnutrition and associated diseases³⁴. High calorie intake, frequent eating of fatty meats and fatty meals, as well as heavy alcohol use combined with insufficient exercise, are likely to lead to obesity. Alcohol use that is habitually heavy and other indulgences that give more energy than is necessary for survival can lead to the deposition of visceral fat.

Adiposity and, ultimately, obesity may occur from changes in leisure activities that require minimal energy expenditure. Several studies have found that gains in life expectancy are now accompanied with an increase in disability rates. The aging population's increased lifetime provides a challenge to the ongoing rise in chronic illness. Overweight and obesity are becoming increasingly common in many regions of the world. Obesity, in addition to accelerating the start of metabolic imbalances, reduces life span and affects cellular and molecular processes in a manner similar to aging³⁵.

Other Factors Influencing Obesity

Obesity has become a serious clinical and public health problem in recent decades. Despite the range of therapies available, the outcomes are often disappointing, owing to high rates of nonresponse and recurrence. Obesity, interestingly, is being linked to an increase in neuropsychiatric issues, which are very undoubtedly related to the pathophysiology of this illness and are expected to have a significant impact on its treatment and prognosis. In terms of neurobiology, a growing body of evidence suggests that immune-metabolic-endocrine dyscrasias, which are commonly associated with excess body weight/adiposity, affect and

impair the morpho-functional integrity of the brain, potentially contributing to neuroprogressive/degenerative processes and behavioral deviances³⁶. Obesity appears to be impacted by a variety of cultural variables, the rise in the prevalence of obesity in Eastern

Mediterranean populations has been linked to a number of sociocultural, behavioral, and environmental changes, including the nutrition transition, changes in socioeconomic status, cultural and social factors, and urbanization, all of which have harmed the quality and quantity of food consumed and encouraged sedentary behavior.³⁷ Moderate obesity in African women was shown to be appealing to males in a social research done in South Africa, whereas Sumo wrestlers in Japan must be overweight to some degree, but not all of it must be muscular. Boys eat more calories than females, while adolescents consume more calories than adults. Individual'sity has an impact on food consumption and, as a result, adiposity and obesity risk. Many more seemingly strange factors are currently being investigated as potential obesity causes.

Sleep health, as well as its adaptability to individual's and environmental circumstances, is critical for promoting physical and mental well-being in all animal species. In recent years, there has been a growing body of information pointing to the association between sleep and the immune system, and how sleep disruptions can upset the delicate balance, with serious consequences for health outcomes. In vivo sleep deprivation studies, for example, have revealed numerous substantial negative consequences on immune health, including induced failure of host defense in rats and an increased risk of metabolic syndrome (MetS) and immunological suppression in people³⁸. In most cases, being in an atmosphere that is extremely hot or cold increases calorie expenditure. In contrast, consuming less calories occurs when one is in an air-conditioned setting. Obesity is caused by a combination of genetic, biochemical, behavioral, dietary, and cultural variables. Excessive food

consumption, a lack of physical activity, or both are the primary reasons. Obesity develops when a person consumes more calories than his or her body burns

Obesity is 50% more likely in a child who has one fat parent. When both parents are fat, their children have an 80% probability of being obese. Many genetic and environmental variables influence how many calories people consume and burn, which is why weight loss and gain differs from person to person³⁹.

2.5.7 Genetic Defects, Endocrine Factors, Trauma and Obesity

Obesity is often blamed on poor dietary habits and inactivity, but It is not always that simple. Other factors, some of which are beyond a person's control, can have a significant impact on body weight and obesity. These include genetics, environmental factors, certain medical conditions, and more.⁴⁰ Prader-Willi syndrome (PWS) is a complicated hereditary condition characterized by uncontrollable hunger, extreme obesity, and a variety of endocrine issues. Understanding the processes that cause hyperphagia and obesity in PWS is crucial for understanding and managing PWS patients. So far, early intensive nutritional therapy combined with behavioral adjustments has proven to be the most effective strategy of controlling hunger and obesity in PWS. Several clinical trials, however, are now underway to investigate appetite suppression and obesity control. To address these difficulties, we intend to try pharmacotherapy in the near future⁴¹.

Women's obesity frequently coexists with puberty, pregnancy, or menopause, suggesting an endocrine connection. Despite this, the majority of obese persons show no clinical symptoms of an endocrine disorder, and routine testing may reveal that their endocrine gland function is normal. Newer diagnostics may identify endocrine or metabolic dysfunctions that were previously undiscovered but are likely important and may contribute to obesity. Despite being rare, obesity can develop after a brain injury or other localized lesion damages the hypothalamus and its connections. It has been demonstrated that lesions

of the hypothalamic ventromedial nucleus result in increased food intake, which, if other factors are present, may induce obesity.

Obese male mice fare worse than damaged female mice. This information may help to explain the long-term consequences of persistent secondary brain damage in obese people following a single moderate Traumatic Brain Injury (TBI). This findings may also influence how overweight/obese people are followed in the days and months following a TBI⁴².

Effects of Obesity on Human Health

Obesity is a multifaceted illness. It affects people at all ages, but it is most common in infants, teenagers, and the elderly. Even being overweight appears to increase the risk of type 2 diabetes, hypertension, stroke, heart attack, congestive heart failure, and a variety of malignancies (mostly colorectal and prostate cancers)⁴³. Type 2 diabetes mellitus (T2DM) is a growing global public health issue. Despite the fact that the glucocorticoid receptor (GR) is a key regulator of glucose metabolism, the link between circulating glucocorticoids (GCs) and T2DM characteristics is still debated. We show here that 17-hydroxyprogesterone (17-OHP), an intermediary steroid in the biosynthetic route that transforms cholesterol to cortisol, interacts to and activates GR transcriptional activity⁴⁴. Obesity is most likely the cause of these metabolic alterations, not the cause. Obesity is linked to macrophage infiltration as well as adipocyte hyperplasia and hypertrophy, leading to a chronic disease-prone condition in obese people. Inflammation, with increased accumulation and inflammatory polarization of immune cells, occurs in various tissues in obesity, including adipose tissue, skeletal muscle, and liver, gut, pancreatic islet, and brain, and may contribute to obesity-linked metabolic dysfunctions, leading to insulin resistance and type 2 diabetes mellitus⁴⁵.

Nutritional excess is a primary risk factor for type 2 diabetes because it increases insulin production while decreasing its metabolic effects in the liver, skeletal muscle, and adipose tissue. However, conflicting data reveals a lack of understanding of the timing of

these processes throughout the development of obesity and diabetes, which is a critical gap in our understanding of metabolic illness. This Perspective examines alternative perspectives and current findings about the temporal and molecular links between hyperinsulinemia, obesity, and insulin resistance⁴⁶. As a result, many fat persons may be Pretestdiabetic. Obesity is linked to a number of comorbidities, such as diabetes, cardiovascular disease, obstructive sleep apnea, and cancer; nevertheless, modest weight loss of 5%-10% or more can considerably improve health-related outcomes.

Many people struggle to sustain their weight reduction, despite the fact that methods such as realistic goal setting and increased consultation frequency can significantly enhance the success of weight management programmes⁴⁷. Shortness of breath with exertion and weariness with continued physical activity are signs of exercise intolerance. This could be related to the increased weight, as well as a diminished capability of the circulatory and respiratory systems, which are working with handicaps imposed by internal fat masses and fat infiltration of muscle. The most prevalent causes of fatty liver in the United States and other Western nations are: excessive alcohol use, Obesity Excess body weight, insulin resistance (as seen in diabetes), and excessive levels of lipids (triglycerides and cholesterol) in the blood are all examples of metabolic disorders.

Toxins, Certain medications, such as corticosteroids, tamoxifen, and chemotherapy medicines, Hereditary, metabolic, and other disorders Pregnancy. Metabolic syndrome refers to the combination of excess body weight, insulin resistance, and excessive triglyceride levels. All of these situations induce fat to accumulate in liver cells by increasing fat synthesis or slowing fat breakdown (metabolizing) and excretion. As a result, fat builds up and is deposited inside liver cells. A high-fat diet alone will not result in fatty liver, Fat can occasionally build in the liver during late pregnancy. This condition, known as fatty liver of pregnancy or micro vesicular steatosis, is typically thought to be distinct from fatty liver⁴⁹.

In recent years, both the actual number of overweight/obese people and their share of the global population have continuously increased, and obesity-related disorders have emerged as serious public health issues. Furthermore, because obesity is related with an increased prevalence of gastroenterological malignancy, the number of obese patients in the area of gastroenterological surgery has been growing. While the impact of obesity on gastroenterological surgery has been extensively researched, relatively few papers have employed a cross-sectional study design to focus on individual's organs or surgical procedures⁵⁰. Class III obesity, often known as morbid obesity, is a complicated chronic disease that can lead to a number of major health problems. Class III obesity treatment options include healthy lifestyle modifications, behavioral and psychological counseling, medication, and surgical treatments⁵¹. This may support, among other things, the use of cognitive-psychological therapies in their treatment and management.

Control and Treatments of Obesity

The illness can be treated easily in principle. The surplus energy stores in adipose tissue will be used up if a patient consumes a diet that is 500–1000 Kcal (1–4 MJ) below what is needed for daily exercise, and weight loss will occur at a rate of 0.5–1 kg per week. A calorie deficit arises when the body receives less calories than it need to maintain calorie expenditure on a constant basis. An online calculator may be used to determine maintenance calories. Alternatively, for a more precise figure, track individual's calorie intake and weight for 10 days. Creating a calorie deficit through food rather than exercise is likely to be more sustained. Physical activity, on the other hand, is beneficial to many facets of health⁵². However, in fact, most patients find this difficult since it calls for fresh discipline, similar to what an athlete imposes on herself when she starts training. It also requires changes to long-standing habits.

Physical Exercise and Dietary Advice

To lose weight and maintain a healthy weight over time, physical fitness should be improved by engaging in as much activity as possible in addition to restricting food consumption. Many patients may find exercise challenging in the early stages of intense workouts to which they are not used. Patients can only lose weight and keep it off if they have significant motivation for a long time. Doctors, dieticians, and peer support at slimming clubs can all help with morale. While exercise can aid in weight loss, dietary restriction and management are more beneficial in the treatment of obesity. All obesity therapy options should incorporate diet, exercise, and behavioral change for BMIs of 25 kg/m² or higher. When possible, other tools, such as pharmacotherapy for BMI of 27 kg/m² or higher with comorbidity or BMI over 30 kg/m², and bariatric surgery for BMI of 35 kg/m² with comorbidity or BMI over 40 kg/m², should be used as adjuncts to behavioral modification to reduce food intake and increase physical activity⁵³.

Obese patients are advised to walk instead of driving or using public transit, as well as to engage in one or more physically demanding hobbies and use the stairs instead of the elevator. Dancing, swimming, jogging, golf, and gardening are all activities that are suited for middle-aged and senior people who require physical activity. Physical exercise is generally recognized to be crucial for maintaining good health, and consistent exercise can lower the risk of cardiovascular disease, obesity, and diabetes. Exercise training has also been shown to increase muscle protein synthesis and activate signaling pathways that govern the metabolism and function of muscle fibers. As a result, in many of these disorders, exercise can be utilized to cure muscle atrophy⁵⁴. While obesity is a known risk factor for postmenopausal breast cancer, research on weight reduction and breast cancer has been conflicting. As a result, in the Women's Health Initiative (WHI) Observational Study, we looked at the links between weight change and breast cancer risk in postmenopausal women.

Postmenopausal women who lose weight have a decreased risk of breast cancer than those who maintain their weight. These data imply that postmenopausal women who lose weight may lessen their chance of developing breast cancer⁵⁵. Patients also deserve effective food and health recommendations based on actual facts, rather than on erroneous concepts of little practical use that are frequently circulated and readily accepted by despondent patients. It is a good idea to set a goal weight and a realistic time frame for achieving it. BMI is highly clinically significant. At each consultation, patients should be evaluated for an abnormal BMI. Most clinics perform this as part of their vital signs. An appropriate BMI can assist individual's primary care physician lead individual's treatment in terms of cholesterol workup and management, diabetes screening, thyroid screening, diet/exercise advice, and so much more.

A rapid, unintended decline in BMI might alert the provider to more comprehensive cancer tests, an eating disorder, or malabsorption concerns. BMI is taken into account in various clinical settings, such as surgical clinics, when estimating the risk of soft tissue infections and recovery time⁵⁶. Individual's' eating habits and dietary practices are the food choices and observances they make throughout their lives. Age, sex, diet, physical activity, behavior, illness, cultural, social, economic, religious, environmental, and food safety can all have an impact. Although a considerable number of diabetics evaluated can make educated decisions, significant proportions require extensive nutrition instruction on eating habits and adherence to nutritional guidelines⁵⁷.

Dietary recommendations should be made with the patient's former eating habits in mind, and they should be as detailed as feasible. Refined sugar, sweets, candies, jams, jellies, honey, syrups, dried fruits, cakes, ice cream, fatty meats, sausages, fatty fish, fried foods, mayonnaise and salad dressings, cream sauces, carbonated beverages, beers, spirits, and all alcoholic beverages in general should be avoided because they contain a lot of calories. In

order to prevent excessive snacking on "junk" foods in between meals, it is also reasonable to avoid skipping any regular meals in the patients' dietary history. However, any decrease in food consumption has the potential to restrict the consumption of important nutrients. To prevent this, all diets should contain enough portions of fruits and vegetables to give adequate amounts of dietary fiber, vitamins, and minerals.

The consumption of fruits and vegetables has been linked to a lower risk of chronic illnesses and weight control, although the specific mechanism is uncertain. The World Health Organization and the United Nations Food and Agriculture Organization suggest that individual's take at least five servings of fruits and vegetables each day, avoiding starchy vegetables. Many nations have witnessed rapid improvements in nutrition education trends, and the majority of programmes have been successful in raising fruit and vegetable consumption. To achieve better outcomes, health providers should employ several interventions to give knowledge in smaller doses over time⁵⁸. Their abundance enhances satiety and enjoyment while eating. Anemia caused by iron deficiency should be treated with hemoglobin or an iron supplement. It is critical that patients do not lower their dietary energy intake below 1000 kcal/day unless under medical supervision. Excessive losses of potassium and nitrogen may occur if dietary intake is less than 1000 kcal/day, hence patient urine outputs should be examined on a frequent basis. Acute inflammation is catabolic, and the following release of bacterial products (e.g., LPS), inflammatory cytokines, and stress hormones predicts morbidity and death. Although lipid intermediates may limit protein loss, the effects of free fatty acids (FFAs) and ketone bodies during acute inflammation remain unknown.

During acute inflammation, 3OHB has powerful anticatabolic effects in muscle and throughout the body; in muscle, reduced protein breakdown outweighs suppression of synthesis⁵⁹. One method of intermittent fasting is alternate-day fasting. One fast every other

day on this regimen but eat anything one want on the non-fasting days. The most popular kind of this diet is "modified" fasting, in which one can consume up to 500 calories on fasting days. Alternate-day fasting may aid in weight loss and the reduction of risk factors for heart disease and type 2 diabetes. Here's a step-by-step introduction to alternate-day fasting for beginners⁶⁰.

Surgical Treatment of Obesity

Surgical intervention with the gastrointestinal tract targeted at reducing food intake may be investigated in patients who have not responded to pharmacological therapy as described in earlier chapters and whose lives have been made unpleasant by extreme obesity. Numerous illnesses can disrupt the physiological systems that provide correct nutrient digestion and absorption (macro- and micronutrients), resulting in a wide range of symptoms and nutritional effects. Many illnesses of the small intestine, as well as diseases of the pancreas, liver, biliary system, and stomach, can induce malabsorption. The gastrointestinal tract's (GI) proper intake of nutrients, vitamins, and minerals involves numerous processes, each of which might be affected in sickness. In a healthy state, the GI tract will consume nutrition, produce energy, and expel waste. However, a number of illnesses can disrupt the physiological systems that ensure correct nutrient digestion and absorption (macro- and micronutrients), resulting in a wide range of symptoms and nutritional repercussions⁶¹. Due to challenges brought on by malabsorption and the blind loop syndrome, such procedures are seldom carried out. Lowering the stomach's capacity is an alternative method that can make the patient eat less.

During a treatment called a gastropasty, the stomach is reduced to a tiny reservoir in the fundus with a capacity of approximately 60 mL. This reservoir drains into the duodenum by a narrow channel with a diameter of about 12 mm that runs along the greater curvature. The stomach is the first intra-abdominal part of the gastrointestinal (GI) tract, also known as

the digestive tract. It is a muscular, highly vascular bag-shaped organ that is distensible and can take various shapes depending on the person's build and posture, as well as the organ's state of fullness ⁶². Individual's who underwent vertical band gastroplasty (VBG) were better and longer able to sustain their weight reduction than those who underwent gastric bypass surgery, while having similar weight loss to controls. In the mid- and long-term, up to 50% of patients having vertical banded gastroplasty (VBG) encounter failure or problems and require revisional bariatric surgery. The purpose of this study was to assess our experience with patient outcomes following VBG revisions and compare them to the advantages of primary laparoscopic Roux-en-Y gastric bypass (LRYGB) surgeries ⁶³. Gastric bypass surgery, also known as Roux-en-Y (roo-en-wy) gastric bypass surgery, is a form of weight-loss surgery that involves constructing a tiny pouch from the stomach and connecting it straight to the small intestine.

Swallowing food will flow into this little pouch of stomach and then directly into the small intestine after gastric bypass, skipping most of individual's stomach and the first portion of individual's small intestine. Gastric bypass surgery is one of the most frequent forms of bariatric surgery. Gastric bypass surgery is performed when diet and exercise have failed or when one have major health concerns as a result of individual's weight ⁶⁴. Insufficient weight loss can be a sign of inadequate restriction (band too loose), pouch or esophageal expansion, and it can be accompanied by additional symptoms including heartburn, regurgitation, or vomiting. In this scenario, expanding the band would be inappropriate. A closed stoma may occur from excessive restriction ⁶⁵. Jaw wiring is an uncommon way of weight reduction. In the 1970s and 1980s, surgeons wired people's jaws shut for up to a year in order to help them lose weight. People did lose weight while their mouths were wired shut, similar to others who had bariatric surgery, but many of them gained weight once the jaw wires were removed ⁶⁶. The patient can communicate and consume

liquids but not food. The only foods consumed are low-energy-density liquids. However, when the jaws are unwired, patients go back to their previous eating habits and put on weight.

Liposuction (lipo sculpture) is a surgical technique that breaks down and eliminates the subcutaneous fat layer (fat immediately under the skin) in areas of the body that are notoriously and persistently resistant to diet and exercise. This is not a weight reduction technique; rather, it is a method of removing a pocket of fat that is inactive in otherwise healthy people⁶⁷. Individual'sized medicine projects are mostly concerned with uncommon disorders or cancer. Individual'sizing therapy for non-communicable chronic diseases such as obesity a chronic, relapsing condition that is a key cause of Type 2 diabetes, fatty liver disease, cardiovascular disease, and cancer has received little attention. Obesity therapies include diets, gadgets, surgery, and drugs. However, little is known about the factors that predict responsiveness to obesity therapies⁶⁸.

2.1.2 Concept of Anthropometric Indices

Body Composition

The measurement of a person's height, weight, and height is known as anthropometry. Since its origin in physical anthropology, it has been utilized for identification, studying human physical diversity, paleoanthropology, and countless efforts to connect physical with racial and psychological aspects. Anthropometry is the systematic measurement of the physical attributes of the human body, particularly dimensional descriptors of body size and

shape. [Needs a reference] The study of trends in human body size and their correlates across time is known as historical anthropometrics. While social researchers, public health professionals, and physical anthropologists have long used anthropometric measures as indices of well-being, historians have only just begun to make considerable use of such data⁶⁹. Today, statistical data on the distribution of body measurements in the population is used to optimize items in areas like as industrial design, clothing design, ergonomics, and architecture. Changes in population habits, food, and ethnic composition result in changes in body dimension distribution (e.g., the rise in obesity) and demand anthropometric data collecting updates on a regular basis.

Anthropometric indices are a collection of measures. They're required for interpreting measurements: a figure for body weight, for example, makes no sense unless It is related to a person's age or height (4). For example, weight and height measurements can be combined to create the body mass index ($\text{weight}/\text{height}^2$) or a Pondera index ($\text{weight}/\text{height}^3$), or weight and height can be linked using reference data. The three most often used anthropometric indices in children are weight-for-height, height-for-age, and weight-for-age; additional indices are employed for other age/physiological groups, such as pregnancy weight increase in pregnant women. Anthropometric measures are noninvasive and simple to collect, and they have a wide variety of applications in both juvenile and adult populations. It is a critical tool in pediatric populations for detecting metabolic and developmental problems early on so that they may be handled effectively. They can be used to identify the severity of disorders such as obesity and cognitive impairments in adults, as well as to track patients over time to check for progress following therapy. Although there is some inherent measuring error, it may be reduced by utilizing well-calibrated gear and training⁷⁰. Z-scores, percentiles, and percent of median are anthropometric indices that may be used to compare a kid or a group of children to a reference population. The definitions of various reporting systems are as follows:

- Z-score (or standard deviation score) (5, 6) - the difference between an individual's value and the median value of the reference population, divided by the standard deviation of the reference population:

$$\text{Z - score or SD - score} = \frac{(\text{observed value}) - (\text{median reference value})}{\text{standard deviation of reference population}}$$

A fixed height or weight difference is implied by a predetermined Z-score interval for children of a specific age. For population-based applications, this approach offers the benefit of allowing the mean and standard deviation of a set of Z-scores to be computed.

- Percentile - a person's position on a certain reference distribution, represented as a percentage of the group that the person equals or surpasses. As a result, a child in the 10th percentile of his or her weight weighs the same as or more than 10% of the reference population of children of the same age. Sometimes measurement units are significant, but one still wants to know where one stands in relation to others. For example, if a one-month-old newborn weighs five kilos, one would question how it compares to other babies' weights. That is the 77th percentile for a one-month-old newborn girl. A one-month-old girl weighs more than 77% of other girls her age, while 23% weigh less. One can tell where she belongs in with her group⁷¹.

Percentiles are frequently employed in therapeutic settings because they are simple to interpret. However, depending on which section of the distribution is being considered, the same interval of percentile values correlates to distinct changes in absolute height or weight, making it improper to construct summary statistics such as means and standard deviations for percentiles. Furthermore, when there is a significant change in weight or height status, there is little change in percentile values at the extremes of the reference distribution.

- Percent of median - the percentage difference between a measured value in an individual's, such as weight, and the median value of the reference data for the same age or height.

The absence of accurate connection with a fixed point in the distribution across age or height status is the system's fundamental flaw. For example, depending on the child's age, 80 percent of the median weight-for-age might be above or below -2 Z-scores, resulting in distinct risk classifications in terms of health. Furthermore, typical percent of median cut-offs vary by anthropometric indices; for example, to approximate a cut-off of -2 Z-scores, the normal cut-off for low height-for-age is 90%, and for low weight-for-height and low weight-for-age is 80%. (7-9). If the distribution of reference values is normal, a mathematical transformation is used to link percentiles and Z-scores (bell-shaped or Gaussian).

The Z-score is the difference between an individual's value and the median value of the reference population, divided by the standard deviation for the reference population. For children of a particular age, a set Z score interval indicates a fixed height or weight difference. Advantage: - Allows for the computation of mean and standard deviation for a collection of Z scores in population-based applications. When a sequence of data is sorted in ascending order for a measurement, the percentile refers to a point on the scale. It is an ordinal scale that just indicates the order of ratings on the scale. A person's rank position on a specific reference distribution, expressed in terms of what percentage of the group the individual's equals or surpasses. For example, a kid of a specific age whose weight falls in the 10th percentile weighs the same as or more than 10% of the children of the same age in the reference population⁷²

Individual's variation

Auxologic: Auxologic is a comprehensive term that encompasses all areas of human physical development.

Height: Human height varies greatly between people and populations for a variety of complex

biological, genetic, and environmental causes, among others. Due to methodological and practical concerns, its measurement is also susceptible to substantial statistical sampling error. Average height is usually proportional among a large number of persons in genetically and environmentally homogenous populations. Within such a group, Gigantism or dwarfism, which is caused by specific genes or endocrine issues, can create remarkable height variance (around 20% deviation from the community's average). The World Health Statistics series is an annual compilation of health statistics for the World Health Organization's (194) 194 Member States.

World Health Organizations' (WHO) Division for Data, Analytics, and Delivery created the series in partnership with WHO technical divisions and regional offices. The World Health Statistics 2019 report outlines current trends and levels in life expectancy and causes of death (Section 1), as well as reporting on the health and health-related Sustainable Development Goals (SDGs) and associated objectives (Sections 2–8). It then highlights the important results, including the availability of underlying data for tracking progress toward the SDGs linked to health (Section 9), and closes by briefly exploring the implications for health policy and programme development (Section 10). Annex 1 contains information at the regional level, Annex 2 contains statistics at the national level for selected health-related SDG indicators, and Annex 3 highlights WHO regional groupings⁷³.

In Nigeria, for example, the average female height is 142.2 cm (4 ft 8.0 in), whereas the average male height in the Dinaric Alps is 185.6 cm (6 ft 1.1 in), a 43.4 centimeter difference (1 ft 5.1 in). The group's shortest and tallest members, Chandra Bahadur Dangi and Robert Wadlow, stood at 1 ft 9 in (53 cm) and 8 ft 11.1 in (272 cm), respectively. Most females stop growing between the ages of 15 and 18, whereas most males stop growing between the ages of 18 and 21.

Weight: Individual's and population weights vary widely, with Lucia Zarate weighing 4.7 lb (2.1 kg) and Jon Brower Minnoch weighing 1,400 lb (640 kg) being the most extreme reported adults, and population extremes ranging from 109.3 lb (49.6 kg) in Bangladesh to 192.7 lb (87.4 kg) in Micronesia.

Body Composition:

Water, protein, minerals, and fat make up the human body. The body is divided into a fat component and a fat-free component in a two-component model of body composition. The most changeable component of the human body is fat. Essential fat and storage fat make up the overall amount of body fat. Essential fat is found in the marrow of bones, the heart, lungs, liver, spleen, kidneys, intestines, muscles, and lipid-rich tissues throughout the central nervous system, whereas store fat is found in adipose tissue. Essential fat is required for proper body function. Women's essential fat is higher than men's because it includes sex-specific fat associated with childbearing. Internal storage fat surrounds internal organs and is found directly beneath the skin (subcutaneous storage fat). It protects the body and acts as an insulator to keep the body warm. The link between subcutaneous fat and interior fat may not be the same for everyone, and it might change over one's life.

The weight of individual's muscles, bones, ligaments, tendons, and internal organs is referred to as lean body mass. Fat-free mass differs from lean body mass. Because essential fat is found in the marrow of individual's bones and internal organs, a small percentage of individual's lean body mass is essential fat. The two-component model of body composition, on the other hand, estimates these sources of essential fat and subtracts them from total body weight to get fat-free mass. The two-component (fat and fat-free mass) model of body composition is used in practical methods of assessing body composition such as skinfolds, bioelectrical impedance analysis (BIA), and hydrostatic weighing.

Standards of Body Fat Necessary

Essential fat is required by our bodies since it is a critical metabolic fuel for energy synthesis and other regular body functions. Table 1 shows that men's essential fat requirements are 5% and women's essential fat requirements are 8%. If body fat levels fall below the acceptable levels for men (5%) and women (5%), normal physiological functioning may be compromised (15 percent). The recommended body fat levels for excellent health (18 percent -30 percent for women and 10% -25 percent for men) are based on a number of general population epidemiological research. Body fat percentages for optimal fitness and athletics are lower than those for excellent health since excess fat might hinder physical performance and activities.

To account for individual's variances, utilize a range of values rather than a single value when prescribing optimal body fat for a client. After the age of 20, one should expect a 1-3 percent fat increase per decade until one reach the age of 60, after which fatness will progressively reduce. Furthermore, as people age, they lose bone mass or density, particularly women after menopause. Calcium and other minerals are lost from the bones.

The vertebrae are the bones that make up the spine. A gel-like cushion exists between each bone (called a disk). As we age, the trunk (center of the body) grows shorter as the disks lose fluid and become thinner.

Vertebrae also lose part of their mineral content, resulting in thinner bones. The spinal column curves and compresses (packed together). Bone spurs can grow on the vertebrae as a result of age and general spine use ⁷⁴. Because fat and lean tissue play such a significant role in lipid metabolism and insulin resistance, measuring the body's tissue composition is an important part of the body composition assessment procedure. The most common methods for assessing body composition are anthropometry, body density, and dual-energy X-ray absorptiometry (DXA). Depending on the clinical condition, the human body can be

quantified on different levels. The basic elements of carbon, calcium, potassium, and hydrogen can be measured at the atomic level; amounts of water, protein, and fat can be measured at the molecular level; extracellular fluid and body cell mass can be measured at the cellular level; and amounts and distributions of adipose, skeletal, and muscle tissues can be measured at the tissue level. From the atomic to the cellular level, direct body composition approaches such as neutron activation, isotope dilution, and total body counts are utilized to examine. X-ray or magnetic imaging techniques are used to characterize the quantities and distributions of skeletal, muscular, and adipose tissues, or to measure a quality of the body, such as density. Criterion techniques include densitometry, computed X-ray tomography (CT), magnetic resonance imaging (MRI), and DXA. Indirect approaches such as anthropometry and bioelectrical impedance analysis (BIA) create estimates or indices of body composition based on the results of direct or criteria methods.

The biological interactions between direct or criterion-measured bodily components and tissues, as well as their distribution among healthy persons, are used in indirect techniques.

As a result, indirect methods have larger prediction errors than direct methods, and their accuracy is impacted by sample specificity and sickness states. Body composition analysis is critical in nutritional evaluation and intervention. A variety of strategies are available for usage with various age groups. When comparing different methodologies, it is critical to examine both accuracy and precision. When selecting a suitable technique, factors such as practicality, cost, technical skill required, degree of accuracy, participants burden, radiation exposure, time consumed, validation in an appropriate population, and availability of reference data must be addressed ⁷⁵.

There are numerous ways for measuring whole-body AT, fat, and LT. DXA and MRI are equivalent in terms of precision and accuracy since they demonstrate high agreement

following a linear transformation. The agreement, however, is substantially lower for compartmental metrics such as VAT. Furthermore, MRI allows for precise and direct measures of diffuse AT infiltration in muscles and ectopic fat (eg, liver fat). Rapid MRI scanning techniques, along with effective image analysis tools, have elevated MRI to a competitive choice for advanced body composition evaluation, allowing for a more comprehensive description of a person's body composition profile from a single test⁷⁶.

All body composition approaches are based on assumptions about body tissue density, water and electrolyte concentrations, and/or biological interrelationships between body components and body tissues, as well as their distributions across healthy persons. Obese people and people with chronic diseases, whose metabolic and hormonal difficulties, as well as comorbid disorders, modify the fundamental assumptions, interrelationships, and validity of body composition methodologies, do not have the same assumptions. Furthermore, because their bodies surpass the boundaries of the existing equipment, the use of body composition technologies is limited among most obese adults and many older obese children.

As a consequence of the difficulty in acquiring such data from a significant number of obese persons during health surveys, epidemiological and national obesity prevalence data are not totally reliant on direct assessments of body fatness. Similarly, monitoring and treating obesity is difficult without an easily acceptable evaluation technique or index, as well as a reference population.

Indirect Methods

Anthropometric measures are the most fundamental method of determining body composition. Body mass, size, shape, and fatness are all described by anthropometric measurements. Because body size fluctuates with weight gain, anthropometry allows a researcher or clinician to accurately quantify an individual's overall adiposity. However, as weight is acquired or reduced, the association power of anthropometric measures and indices

changes. Obesity and overweight raise the risk of metabolic disorders and chronic diseases such as diabetes; cardiovascular diseases, particularly heart failure and coronary heart disease; nonalcoholic fatty liver disease; neoplasms (endometrial, breast postmenopause, prostate, liver, pancreas, colorectum, and kidney); musculoskeletal disorders; and respiratory diseases⁷⁷. For comparisons between clinical and research studies, standardized anthropometric methodologies are required, and video and text media describing these approaches are available. These resources should be used by anyone interested in using anthropometric equipment and methodologies.

Weight, Stature, and Body Mass Index (BMI)

The most common metric for determining obesity is body weight. People who are overweight have more body fat than those who are underweight. For precise weight measurements, a number of scales are available, and these should be calibrated on a regular basis. Changes in body weight are accompanied by changes in water, fat, and/or lean tissue. The weight of children changes as they grow, whereas the weight of adults changes as they gain weight. Body weight alone, without other measurements of body size, can be deceiving because a person's weight is strongly tied to stature (i.e., tall people are generally heavier than short people). A variety of wall-mounted equipment can be used to measure stature. Additional approaches for estimating stature when it cannot be assessed directly, such as for the handicapped or mobility impaired, have been developed.

The body mass index is one technique to compensate for the lack of specificity in body weight. BMI is a body mass index that includes both lean and obese people and is calculated as weight divided by stature squared (kg/m^2). The availability of broad national reference data and its known connections with levels of body fatness, illness, and mortality in adults is a significant advantage of BMI. With a weight change of about 3.5 kg required to produce a unit change in BMI, BMI is particularly useful in monitoring the treatment of

obesity. Adults with a BMI of 25 or higher are at an elevated risk of morbidity and mortality, with BMIs of 30 or higher defining obesity⁷⁵ Because their BMI points were above the chart cutoff, children with extreme obesity could not be plotted on the standard CDC BMI percentile chart. On the usual BMI percentile chart, children with a low BMI (3%) were likewise difficult to follow. The inclusion of the %BMI scale to the regular BMI percentile chart allowed for the monitoring of highly obese children; however, it did not handle severely underweight children and needed a unit shift within the chart when moving from normal to obese BMIs.

The redesigned BMI z score chart enabled consistent tracking, the modified CDC z score chart is appropriate for tracking the growth of children with normal and abnormal growth patterns; the measurements correlate well with the %BMI_{p95}, and the chart may be simply incorporated into current electronic health record systems for clinical usage⁷⁸. The use of BMI alone is particularly discouraged among athletes and those with specific medical conditions (e.g., sarcopenia), where the proportions of muscle and fat mass can drastically alter body weight.

Abdominal Circumference

Increased intra-abdominal fat is usually connected with obesity. The deposition of both intra-abdominal and subcutaneous abdominal adipose tissue is linked to a centralized fat distribution. It should be highlighted that abdomen circumference is a poor indication of intra-abdominal adipose tissue since it comprises both subcutaneous and visceral fat deposits. This does not negate its utility, however, because it is linked to certain health risks. Obese people, especially those with type 2 diabetes and the metabolic syndrome, are at a higher risk of morbidity, including type 2 diabetes and the metabolic syndrome, as well as mortality. Other body parts, such as the arm and leg, can be circumscribed, but there are little reference

data available for comparison. Furthermore, in obese people, the estimation of fat and muscle regions of the arm is inaccurate and invalid.

The ratio of abdominal circumference to hip circumference (often referred to as "waist" circumference) is a basic indicator for determining adipose tissue distribution or fat patterning. Abdomen-to-hip ratios of more than 0.85 indicate a concentrated fat distribution. Most men and women with a ratio more than 1.0 and 0.85 are at an elevated risk of cardiovascular disease, diabetes, and cancer.

Skinfolds

Skinfold measures are used to determine the thickness of subcutaneous fat in various areas of the body, however they are of limited benefit in overweight or obese adults. The main drawback is that most skinfold calipers have a measurement limit of 45 to 55 mm, limiting their application to subjects who are moderately overweight or thin. A few skinfold calipers can capture huge measurements, but because it is difficult to grasp and hold a large skinfold while reading the caliper dial, this isn't a substantial improvement. The majority of national reference data for skinfolds in the triceps and subscapular regions is available. The triceps skinfold differs greatly between men and women, and it can represent changes in the underlying triceps muscle rather than a change in body fatness. Because of their tiny body size, skinfolds are especially useful in monitoring changes in fatness in children, and even obese children's fat is mostly subcutaneous. However, in children and adults, the statistical connections between skinfolds and percent or total body fat are generally not as significant as those found in BMI. Furthermore, because most obese children and adults have not had their skinfolds examined, the exact higher distribution of subcutaneous fat measures is unknown.

2.1.3 Concept of Cardiorespiratory Indices

The respiratory system takes oxygen from the air we breathe into our lungs and then diffuses it into the circulation via a system of tubes, whereas carbon dioxide travels in the reverse direction.

Cardiorespiratory fitness (CRF)

The ability of the circulatory and respiratory systems to give oxygen to skeletal muscles during persistent physical activity is referred to as cardiorespiratory fitness (CRF). VO₂ max is the major indicator of CRF. CRF should be classified as a clinical vital sign and measured routinely as part of clinical practice, according to an official scientific statement published by the American Heart Association. Regular exercise increases the number of tiny arteries in trained skeletal muscles, which give more blood to working muscles, and enlarges the heart muscle, allowing more blood to be pumped with each stroke. By boosting the amount of oxygen inhaled and transported to bodily tissue, exercise benefits not only the respiratory system but also the heart. Physical exercise programmes are helpful for boosting cardiovascular fitness, according to a 2005 Cochrane review.

Cardiorespiratory fitness has numerous advantages. Heart disease, lung cancer, type 2 diabetes, stroke, and other disorders can all be reduced with it. Cardiorespiratory exercise improves lung and heart health while also elevating feelings of well-being. CRF may also be a greater predictor of mortality than other well-known risk factors such as smoking, hypertension, high cholesterol, and type 2 diabetes, according to emerging data. High levels of CRF were connected to early mortality in recent generations under the age of 65 years. Physical inactivity affects a variety of phenotypes, organ systems, and illnesses, including behavior, the central nervous system, cardiorespiratory fitness, metabolism, adipose tissue, skeletal muscle, bone, immunity, digestion, and cancer. Importantly, physical inactivity frequently plays an independent role as a direct cause of accelerating the loss of

cardiovascular and strength fitness, shortening health span, and lowering the age for the onset of the first chronic disease, all of which reduces quality of life, raises health-care costs, and increases mortality risk⁷⁹.

In the United States, a low CRF may be a risk factor for early death among Baby Boomers and Generation Xers. To increase the validity of risk prediction, CRF can be added to these standard risk variables. The American College of Sports Medicine recommends 30–60 minutes of moderate-intensity aerobic exercise three to five times per week at a heart rate of 65–85 percent of maximum heart rate⁷⁹.

Cardiovascular System

The cardiovascular system adjusts cardiac output, blood flow, and blood pressure in response to changing demands on the body. The product of heart rate and stroke volume, which indicates the volume of blood pumped by the heart per minute, is referred to as cardiac output. Due to an increase in both heart rate and stroke volume, cardiac output rises during physical exercise. The cardiovascular adaptations to exercise are quick at first: "Within a second following muscle contraction, vagal outflow to the heart is withdrawn, followed by an increase in sympathetic stimulation of the heart. "The amount of blood pumped by the heart is proportional to global metabolic requirements. Changes in cardiac output from the baseline are proportional to changes in total body oxygen requirements. To guarantee appropriate tissue perfusion during periods of physiologic stress, cardiac output will rise"⁸⁰. Heart rate and stroke volume are directly proportional to the intensity of the activity done, and continual training can result in significant improvements⁸⁰.

Another crucial issue is blood flow modulation during activity. The goal of respiration is to supply oxygen to the tissues while also removing carbon dioxide from the tissues. To do this, four important events must be regulated: Ventilation of the lungs. Oxygen and carbon dioxide diffusion between the alveoli and the blood. Oxygen and carbon dioxide transport

through the blood and bodily fluids, as well as to and from cells Ventilation control and other components of respiration: These components vary as a result of exercise, yet the body is intended to preserve homeostasis ⁸¹. Because blood vessels are constrained by sympathetic tone, the release of noradrenaline and adrenaline causes vasoconstriction of non-essential tissues such the liver, intestines, and kidneys, as well as a decrease in neurotransmitter release to active muscles, resulting in vasodilation.

The goal of vasodilation is to enhance blood flow to the body's tissues. Tissues can produce endogenous vasodilators in response to a requirement for oxygen or nutrients. As a result, vascular resistance decreases and capillary perfusion increases. Exercise is a frequent example of this vasodilation reaction. When exercising, the oxygen consumption of skeletal muscles rapidly rises, necessitating an increase in oxygen delivery, because they regulate arterial blood pressure around a higher systemic pressure during exercise, these pressure receptors are crucial.⁸². To supply oxygen to the working muscles and eliminate carbon dioxide from the body, the cardiorespiratory system works in tandem.

Muscles require more oxygen to contract and produce more carbon dioxide as a waste product during exercise. To meet the muscles' increasing demand, the following occurs: Breathing is a complicated process that is strongly reliant on the coordinated activity of the respiratory muscles and the control center in the brain. The lungs' principal purpose is to allow gas exchange between inspired air and the circulatory system. It aids in the transport of oxygen into the blood and the removal of carbon dioxide from the organism. Oxygen is required for healthy cellular metabolism, but carbon dioxide is required for optimum PH levels ⁸³.

Heart rate increases – This speeds up the passage of oxygen from the bloodstream to the working muscles and carbon dioxide from the working muscles to the lungs. The person's resting heart rate is around 60 beats per minute; at 8 minutes, just before starting to exercise,

their heart rate rises – this is called the anticipatory increase in heart rate and occurs when a person begins to think about exercising; at 10 minutes, the person begins to exercise and their heart rate rises rapidly to 145 beats per minute; at 13 minutes, the heart rate remains high during exercise; and when the person stops exercising, their heart rate drops

Heart Rate

The amount of times individual's heart beats in one minute is known as individual's heart rate or pulse. Heart rates differ from one person to the next. When one is at rest, it is lower, and when one exercises, it is higher. The number of times the heart beats in one minute is known as the heart rate or pulse. Individual's heart rates differ. It is lower at rest and higher while one exercises. Knowing how to check individual's pulse will help and individual determine the ideal fitness regimen for individual. If an individual is taking cardiac medication, measuring a pulse every day and reporting the readings to individual's doctor might help one figure out if individual's therapy is working⁸⁴.

Blood Pressure vs. Heart Rate

Individual's heart rate and blood pressure are two different things. This is the power of individual's blood against individual's blood vessel walls. Low blood pressure with a fast pulse might be a typical reaction to some conditions, such as exercise or rising up too rapidly. Symptoms can be caused by underlying diseases or life-threatening events, such as shock. Low blood pressure may not be a problem unless it creates symptoms. Low blood pressure can cause mild to significant symptoms in certain persons. The normal blood pressure range for most healthy persons is less than 120/80 millimeters of mercury (mmHg). While there is no exact cutoff point for low blood pressure, the National Heart, Blood, and Lung Institute (NHBLI) defines low blood pressure as anything less than 90/60 mm Hg. A high pulse or

heart rate is defined as more than 100 beats per minute. Other variables may also create differences in this quantity⁸⁵.

Normal Heart Rate

The normal resting heart rate ranges from 60 to 100 beats per minute. It is possible that individual's number will differ. Children's resting heart rates are higher than adults'. The optimum time to test individual's resting heart rate is right after one wake up, before one move around or consume any caffeine.

Lowering Resting Heart Rate

A lower resting heart rate is more common in those who are physically fit and less stressed. One can slow it down by making a few lifestyle changes:

- 1. Exercise on a Regular Basis.** For a short period, exercise boosts individual's heart rate, but over time, it strengthens individual's heart and allows it to perform more efficiently.
- 2. Eat Healthily.** Individual's resting heart rate may be slowed if one lose weight. Men who eat more fish have lower heart rates, according to research.
- 3. Deal with Tension.** Every day, set aside time to unplug from technological gadgets and unwind. Meditation, tai chi, and breathing techniques can also aid in the healing process.
- 4. Quit Smoking.** It is one of the healthiest things one can do for individual' self.

Maximum Heart Rate

Maximum heart rate can be calculated by subtracting individual's age from 220. For instance, if a person is 45 years old, subtract 45 from 220 to get a maximum heart rate of 175 beats per minute. This is the maximum number of beats per minute that a person's heart should have during exercise⁸⁶. A 40-year-maximal old heart rate, for example, is projected to be around 180 beats per minute. A graded exercise test might help one discover individual's true maximum heart rate. If one on medication or have a medical condition like heart disease,

high blood pressure, or diabetes, talk to individual's doctor about modifying individual's exercise routine to maintain individual's heart rate below a certain level.

Target Heart Rate

When one workout in a "target heart rate zone," one reap the maximum advantages. This is usually when the heart rate (pulse) is 60 to 80 percent of its maximum. Doctor may reduce ONE target heart rate zone to roughly 50% in some circumstances. Before beginning an exercise Programme, see individual's doctor. They can assist one in developing a routine and target heart rate zone that is appropriate for individual's needs, objectives, and overall health. If one haven't exercised consistently previously, one may need to gradually work individual's way up to individual's target heart rate zone when one begin an exercise Programme. Slow down if the activity feels too difficult. If one don't try to overdo it, one will reduce individual's risk of injury and have more fun with the workout. Aerobic exercise occurs when individual's heart rate is between 70% and 85% of individual's MHR. When individual's heart rate reaches 50 to 70% of individual's MHR, one also getting a workout⁸⁷.

Gaseous Exchange

Gas exchange happens in the lungs' alveoli and is accomplished through diffusion, which is the flow of gas from a high-concentration location to a low-concentration area. Because oxygen and carbon dioxide diffuse between the air in the alveoli and the blood in the capillaries, the alveoli are surrounded by capillaries. The transfer of gas from a high-concentration area to a low-concentration area is known as diffusion. The alveoli have a high oxygen concentration and the blood has a low oxygen concentration, oxygen diffuses from the alveoli into the blood.

Carbon dioxide diffuses from the blood into the alveoli because the blood has a high concentration and the alveoli have a low concentration.

The oxyhemoglobin dissociation curve is a critical tool for understanding how oxygen is transported and released by blood. Oxygen is carried throughout the body primarily by hemoglobin, a protein molecule found inside red blood cells. Although oxygen can be carried throughout the body by dissolving in blood plasma, this dissolved portion accounts for only a small portion of the total amount of oxygen transported in the bloodstream⁸⁸.

Cardiovascular Exercise

Any action that requires the utilization of aerobic metabolism is known as cardiovascular exercise, often known as aerobic or endurance exercise. That is, oxygen plays an important part in the cellular activities that provide the energy necessary to keep the activity running during the activity. Individual's heart rate increases and one breathe more deeply to increase the quantity of oxygen in individual's blood and help one utilize it more efficiently. As a consequence, one will feel more energized and won't become tired as quickly. Any intense activity that raises heart rate and respiration while engaging large muscle groups in a repeated and rhythmic manner to improve oxygen and blood flow throughout the body is referred to as cardiovascular exercise. The function and performance of individual's most vital internal physical organs, such as the heart, lungs, and circulatory system, are gradually tested and improved as a result of this exercise.

Cardio helps, among other things, heart health, mental health, mood, sleep, weight control, and metabolism. In reality, when the heart pumps oxygen-carrying blood, the lungs improve their ability to take in oxygen and the muscles adapt to use more oxygen, the heart gets more efficient with each beat. Even yet, the increase in individual's breathing and heart rate should not be so significant that one feel obliged to stop and rest. While exercising cardio like quick walking, cycling, swimming, running, or speed climbing, if one experience a

strong urge to stop and rest, unexpected discomfort, or worrisome symptoms, one must immediately stop and get medical treatment. To be classified as cardio, an exercise must elevate individual's heart rate and breathing rate to a moderate to strong intensity level (at least 50% of individual's typical rate) for at least 10 minutes. As a result, activities that build strength, such as resistance training, using weight machines, lifting weights, and core exercises, are not classed as cardio since the heart rate does not rise throughout the activity period. Weightlifting and sprinting both require quick bursts of energy. They are done at maximum effort for a short period of time⁸⁹.

Major Categories of Cardiovascular Exercise

There are three forms of cardiovascular exercise: high-impact cardio, low-impact cardio, and no-impact cardio.

High-impact Cardio

Any cardiovascular activity that needs one to raise both of individual's feet off the ground at any time throughout the activity is classified as high-impact cardio. Because one using individual's limbs to support individuals body weight against gravity, It is also known as a weight-bearing exercise. Jumping rope, high-impact aerobic dancing, and particular sorts of advanced strength training are all examples of advanced strength training.

Low-impact Cardio

Any cardiovascular activity in which one foot is constantly on the ground. Low-impact cardio, on the other hand, should not be mistaken with low-intensity cardio, as many low-impact activities are high-intensity. Low-impact cardio is still a weight-bearing workout that improves bone health as well as lung and heart fitness. Low-impact cardio includes activities such as walking, hiking, and low-impact aerobic dancing.

No-impact Cardio

Because being submerged in water reduces the force of gravity on the body, water-based cardiovascular exercise is referred to as "no-impact." As a result, swimming and water aerobics are low-impact cardio workouts. Because the bike's tires and frame carry the majority of the body's weight, bicycling is also a low-impact cardio workout. Weightlifting and sprinting require quick bursts of energy. They are performed at maximum effort for a short period of time ⁹⁰.

Reasons to Engage in Cardiovascular Exercise

Cardio exercise is using individual's body's large muscles for an extended period of time while maintaining a heart rate of at least 50% of its maximum level. If one practice aerobic workouts on a regular basis, individual's circulatory system will be stronger, with more capillaries giving more oxygen to the cells in individual's muscles. Individual's stamina and endurance will grow with each workout.

Specific Benefits of Cardio Exercise Include

Improved Heart Health

Engaging in 30-60 minutes of cardiovascular exercise daily can help one build stronger muscles, including those in individual's heart, that control individual's blood pressure, improve HDL (good cholesterol), reduce anxiety and stress, decrease blood proteins and fats that contribute to blood clots, prevent heart disease, and manage diabetes.

Enhanced Brain Health

The areas of the brain that affect memory and reasoning skills develop in volume or size when one do cardio on a regular basis. In addition, frequent cardiovascular activity slows the shrinkage of the brain in older adults, enhancing their cognitive performance. Cardio, on the other hand, can help one get a good night's sleep, which is essential for individual's mental health. People who exercise on a daily basis do so because it offers them a

tremendous sense of well-being. They have more energy throughout the day, sleep better at night, have clearer memory, and are more calm and optimistic about themselves and their life. It is also an effective treatment for a variety of common mental health issues ⁹¹.

Increased Metabolic Rate

All types of cardio increase metabolism by producing the hormone Fibroblast Growth Factor (FGF21), which increases metabolism, suppresses hunger, and increases calorie expenditure.

Weight Regulation

Cardio raises heart rate to the target heart rate zone, which is the zone in which the body burns the most calories, assisting in calorie burning and weight management. Walking, swimming, running, and jogging are all exercises that burn a lot of calories over time, whereas moderate to high intensity cardio burns a lot of calories every time one does it. Jumping rope, running stairs, walking, rowing, cycling, and high intensity interval training (HIIT) are some of the most effective cardio routines for weight loss⁹².

Improved Mood and Energy

Cardiovascular activity causes an increase in the synthesis of endorphins, which are neurochemicals that cause euphoria. Cardio also increases the creation of mood-enhancing neurotransmitters including dopamine, serotonin, and norepinephrine. When individual's mood improves, one feel more energized and ready to tackle individual's daily tasks. Increased hormone release, on the other hand, lowers stress, enhances energy, and improves memory and mental focus.

Stronger Immune System

Regular exercise helps individual's body fight infections by increasing the production of antibodies and white blood cells. The release of FGF21 improves the immune system and

accelerates metabolism. Cardio activity, in reality, helps the body fight ailments including hypertension, stroke, osteoporosis, diabetes, and heart disease.

Management of Arthritis

Through movement, cardiovascular exercise helps to alleviate the pain associated with arthritis and to reduce stiffness at the joint⁹³. Although medicine is normally used to treat arthritis, a personalized arthritis exercise Programme can help reduce pain and tiredness while also preserving joint structure and function. Arthritis-related stiffness, discomfort, and edema can significantly limit joint range of motion (the distance joints can move in certain directions). Avoiding physical exercise due to pain or discomfort can also result in severe muscle loss and weight gain. Exercise, when combined with a complete arthritis treatment plan, may enhance joint mobility, muscular strength, and general physical conditioning, as well as assist one in maintaining a healthy weight.

To get the most out of cardiac activity, it should be done at least three times a week. If one have more time on weekends, one may schedule Saturday and Sunday as the first two days, then seek for a third day in the middle of the week. So one don't have to squeeze in all of individual's exercises throughout the week though if one can do so. Cardiovascular exercise does not have to be done for an extended amount of time. Short aerobic workouts (as little as 5 minutes) are equally as effective as longer sessions, as long as the intensity and total training duration are comparable. For example, twelve 5-minute bursts of high-intensity aerobics are equally as beneficial as a 60-minute session. If one worried about individual's hectic schedule, cardio is a great option for one. Many aerobic routines do not need any special equipment or a gym membership. Start with low-to-moderate-intensity sports like walking, bicycling, swimming, dancing, jogging, martial arts, in-line skating, canoeing, golfing, and water aerobics if one a novice. One will be able to accomplish activities for

longer durations of time and gain greater health advantages as a consequence. However, find hobbies that one enjoys so that one can remain with them as one progresses.

Furthermore, increasing the intensity of an activity over time is preferable to increasing the volume or length of the activity. Cardio is not something one should overdo, and running at a low-to-moderate speed for hours on end will not provide one with any additional benefits. So, once one has mastered 30-45 minutes of an exercise 3-4 times each week, one should progress to its advanced principles. Every aerobic exercise session should include a warm-up and cool-down. The warm-up time should not consist of static stretching, but rather of a steady rise in the tempo and intensity of the activity. This permits the body to enhance blood flow to the muscles, lowering the chances of a muscle or joint injury. Warm-up time should be between 5 and 10 minutes. The cool-down session should last about as long as the warm-up, with the tempo progressively slowing⁹⁴.

Guidelines for Successful Cardiovascular Exercise

Start Slowly

Begin with the basics. Start with a 5-minute stroll in the morning and another 5-minute walk in the evening, for example. After then, progressively increase the time by a few minutes at a time. One will be able to walk for 30 minutes every day in no time. As one gets started, establish a list of activities that interest one and that one can do without spending too much money or time. Hiking, jogging, cycling, rowing, running, and elliptical exercise are all viable possibilities. Just keep in mind that it is any exercise that makes individual's breathing and pulse rate faster.

Warm Up

Take 5-10 minutes at the start of each exercise to gradually rev up individual's cardiovascular system and increase blood flow to individual's muscles. Warming up entails doing lower-intensity versions of the cardio activity one will be doing. If one is going for a

brisk walk, for example, one can warm up by walking slowly. Warming up should take at least 5 to 10 minutes. The longer individual's warm-ups, the more severe individual's workout will be. Focus on broad muscular groups initially, followed by warm-up's that resemble some of the motions one will do when exercising. For example, if one going to run or ride individual's bike, start slowly to warm up ⁹⁵.

Conditioning

Move at individual's own speed to prepare individual's body to be able to undertake at least 30 minutes of cardio every day. One must first increase individual's aerobic capacity by increasing individual's heart rate, breathing depth, and muscular endurance to the point where one can comfortably perform at least 30 minutes of individual's chosen exercise before one can benefit from cardio.

Cool Down

At the end of each session, take 5-10 minutes to cool down. Calf muscles, upper thighs (quadriceps), lower back, hamstrings, and chest should all be stretched to relax. Individual's muscles, lungs, and pulse rate will soon return to normal after this post-workout stretch.

2.1.4 Physical Activity

Physical activity is defined as "any physical movement produced by skeletal muscles that requires energy expenditure" and is defined as "any bodily movement produced by skeletal muscles that requires energy expenditure." ⁹⁶. This broad term encompasses a wide range of physical activities, from professional sports to ordinary hobbies. Physical exercise is defined as "movements that improve health" (US Department of Health and Human Services 2008), and as little as 15 minutes per day can result in significant reductions in all-cause mortality, cancer mortality, and cardiovascular mortality ¹. The link between physical activity

and health, on the other hand, is more complicated. Physical activity, fitness, and health are all interconnected and are influenced by both hereditary and environmental variables.⁹⁷

Based to some studies suggestions, fitness level is a better predictor of all-cause death than physical activity level. According to a recent study, wearable activity trackers may pave the way for a better approach of predicting short-term death risk than other risk factors such as smoking and medical history⁹⁸. Exercise prescription is a precise schedule of fitness-related activities tailored for a specific goal that is typically established for the client or patient by a fitness or rehabilitation professional. Because of the client/individual's patients and unique demands and interests, the purpose of exercise prescription should be the effective integration of exercise principles and behavioural strategies that motivates the participants to remain compliant, therefore accomplishing their goals⁹⁹.

Several therapies have been developed to lower anthropometric and cardiorespiratory indices. Indigenous people make up about 5% of the world's population. However, they frequently have a disproportionately higher burden of CVD risk and chronic kidney disease (CKD) than the general population. Several non-pharmacological therapies (e.g., educational) have been employed among Indigenous cultures to lower CVD and renal disease risk factors¹⁰⁰. The study found that while poly-pill pharmacological therapy were the most cost-effective, the community-based intervention provided the highest health benefits. Physical activity and exercise may help to reduce the risk and development of cardiovascular disease.

Benefit of Physical Activity

1. Physical Activity, Exercise and Obesity

A large body of evidence suggests that regular physical activity helps to avoid harmful weight gain. A sedentary lifestyle encourages weight gain, and if one already overweight or obese, one will add even more fat. Weight gain is more aggravating when one don't know what's causing it. While eating is often the most important element in weight gain,

other variables such as stress and lack of sleep may also play a role ¹⁰¹. Overweight and obese teenagers, regardless of gender, have poorer levels of physical fitness than their normal-weight counterparts. Adolescents with normal-range body composition values have higher levels of physical fitness ¹⁰². According to statistics from the UK Nurse's Health Study, nearly 30% of new instances of obesity might be avoided by adopting a lifestyle that comprised more than 30 minutes of vigorous exercise per day and less than 10 hours of television viewing each week¹⁰³. However "The current physical activity recommendation for adults is important for limiting health risks for a number of chronic diseases, including coronary heart disease and diabetes.

This recommendation calls for 30 minutes of moderate intensity activity every day, preferably on all seven days of the week. However, in the current context, many people are likely to find that this guideline is insufficient for preventing weight gain or return. There is strong evidence that previously obese people need to engage in 60–90 minutes of moderate intensity exercise or less strenuous activity to avoid weight gain ¹⁰⁴. Different levels and intensities of physical activity, even without dieting, can have different effects on anthropometric measurements. Overweight men and women were able to reduce body mass and fat mass without dietary calorie restriction in many randomized controlled trials (RCTs) lasting 3–12 months and consisting of 3–5 30–60 minute exercise sessions per week¹⁰⁵.

Other RCTs have found that exercise reduces fat mass in a dose-dependent manner, with the amount of physical activity being more important than the intensity; thus, the higher the total energy expenditure, the greater the effect in reducing body adiposity, weight, BMI, percent body fat, fat mass, and waist circumference . While a light-intensity exercise intervention can substantially reduce body weight and body fat, a 12-week high-intensity exercise intervention with high energy expenditure can significantly reduce body weight, body fat, WC, WHR, and WHR ¹⁰⁶.

Overweight people could lose weight and fat mass without dieting in a dose-dependent manner, with the amount of physical activity being more essential than the intensity.

In a study of 52 obese males, the effects of food and exercise on subcutaneous fat, visceral fat, skeletal muscle mass, and insulin sensitivity were investigated. Over the course of three months, participants were assigned to one of four groups: diet-induced weight loss, exercise-induced weight loss, exercise without weight loss, and control. Both weight loss groups lost 7.5 kg (8%) of body weight when compared to the control group, diet-induced weight loss and exercise-induced weight loss, and cardiovascular fitness improved significantly (16%) in the exercise groups. According to the researchers increased daily physical activity, even without caloric restriction, can significantly reduce obesity. The fast rise in obesity rates, despite greater emphasis on weight loss, demonstrates the limitations of this weight loss-centric strategy to obesity management. Nonetheless, obesity management recommendations continue to promote the practices of restricting calorie consumption and boosting physical activity levels¹⁰⁷.

Another eight-month trial was conducted to see how different quantities and intensities of exercise training affected the effects of mild to moderate dyslipidemia in overweight sedentary men and women (aged 40–65 years). Adults who are overweight or obese benefit from exercise training in terms of weight and body composition. Exercise has been shown to reduce body weight, total body fat, and visceral adipose tissue ¹⁰⁸. Weight return after an initial successful weight loss in obese persons is a significant and unresolved issue. Until recently, there has been no well-documented study on which treatment strategy is best for sustaining a healthy weight reduction ¹⁰⁹.

2. Physical Activity and Insulin Sensitivity

Metabolic syndrome is characterized by a pro-inflammatory and prothrombotic condition that contributes to endothelial dysfunction. The rising incidence of abdominal obesity, which has reached epidemic proportions, raises the risk of metabolic syndrome¹¹⁰. Insulin resistance may affect anyone, and it can be transitory (for example, using steroid medicine for a short period of time produces insulin resistance) or chronic. Excess body fat, particularly around the abdomen, and a lack of physical exercise appear to be two major contributors to insulin resistance. Insulin resistance is common in people with prediabetes and Type 2 diabetes. Insulin resistance can occur in people with Type 1 diabetes¹¹¹. They are also predisposed to dyslipidemia, which is defined by low HDL cholesterol and high triglycerides. Metabolic syndrome is linked to fatty liver, cholesterol gallstones, obstructive sleep apnea, gout, depression, musculoskeletal disorders, and polycystic ovarian syndrome. The metabolic syndrome is a collection of interconnected metabolic risk factors (metabolic risk factors) that appear to directly increase the development of atherosclerotic cardiovascular disease¹¹². Obesity, insulin resistance, type 2 diabetes, dyslipidemia, and hypertension are all risk factors for issues with cardiovascular structure and function. Arterial stiffness and decreased endothelial function are caused by these anomalies. Endothelial inflammation and dysfunction are still fatal factors in cardiovascular disease.

A complete understanding of the modulatory mechanisms of the link between endothelial inflammation and destructive H₂S bioavailability is expected to promote the translation of H₂S biology to clinical management of endothelial dysfunction-related cardiovascular diseases¹¹³. People with metabolic syndrome have a fivefold increased risk of cardiovascular disease and a fivefold increased risk of type 2 diabetes. The metabolic syndrome was linked to an increased risk of CVD, as well as cardiovascular and all-cause death. Components of the metabolic syndrome were linked to identical magnitudes of elevated CVD, suggesting that the metabolic syndrome did not exceed the level described by

the presence of its individual's components¹¹⁴. Cardiovascular disease is well recognized as a leading cause of morbidity and death in the elderly. The metabolic syndrome definition's goal is to identify people who are at high risk of cardiovascular disease so that appropriate interventions can be put in place.

Metabolic syndrome is a collection of common problems that include insulin resistance, decreased glucose tolerance, abdominal obesity, low HDL cholesterol levels, increased triglycerides, and hypertension. The disorder is expected to affect one-quarter of the Western population, and its prevalence is rising in tandem with the number of individuals who are overweight or obese¹¹⁵.

Obesity, insulin resistance, T2D, dyslipidemia, and hypertension are all risk factors associated with aging, and are exacerbated by the metabolic effects of decreased muscle mass. Sarcopenia is caused by a number of reasons, including age, a lack of physical exercise, malnutrition, low-grade inflammation, insulin resistance, and hormonal changes, which result in changes in body composition (muscle mass and strength decline and fat mass increase). Furthermore, each component has independent effects on the quality and amount of muscle and fat, but their interactions have a larger influence¹¹⁶.

Muscle mass loss is induced by a drop in physical activity as well as the natural aging process. Physical exercise programmes have been shown to enhance insulin sensitivity by causing muscle contraction. Recent research add to the evidence that frequent PA decreases the risk of insulin resistance, metabolic syndrome, and type 2 diabetes, and that SI improves when people follow exercise and/or PA guidelines. Many studies show a dosage response, with larger energy expenditures and intensities of exercise, such as high intensity interval training (HIIT), yielding greater improvements on whole-body SI, albeit these findings are not universal. Aerobic exercise can enhance SI without increasing cardiorespiratory fitness as indicated by maximum or peak oxygen consumption¹¹⁷.

Insulin sensitivity is improved as a result of muscle contraction, which causes changes in insulin signaling and thus improves insulin sensitivity¹¹⁸. Physical activity has been shown to improve insulin sensitivity while also emphasizing the need of building muscle mass. Muscle mass influences insulin resistance, fatty acid metabolism, and resting metabolic rate. When someone exercises or engages in other physical activity, their activity-induced energy consumption increases. This indicates that the body may use up glucose in the blood, reducing blood glucose levels. Muscle can also be built through strength training. Even when not in use, muscle cells demand energy, therefore the more muscle a person has, the more calories they burn at rest¹¹⁹. Resistance training increases muscle mass and helps to address insulin resistance and other metabolic syndrome risk factors¹²⁰. Resistance exercise does not cause weight loss; nevertheless, it does improve lean body mass while decreasing fat mass, particularly abdominal fat.¹²¹ According to a study of severe aerobic exercise training done over 7 days, even short-term exercise can elicit significant alterations in insulin activity in T2D. Improvements included increased peripheral insulin sensitivity and responsiveness, as well as better suppression of hepatic glucose production¹²². Resistance training has the ability to improve insulin resistance and reduce hepatic glucose production by increasing body mass.

3. Physical Activity in the Treatment of Hyperglycaemia

Normal aging and decreased physical activity cause metabolic and anatomical changes, including a loss of muscle mass. Obesity, insulin resistance, T2D, dyslipidemia, and hypertension are all linked to a reduction in muscle mass¹²³. These risk factors have been linked to changes in arterial stiffness and endothelial dysfunction. Skeletal muscle is a metabolic "sink" for glucose and lipid elimination, and this system is also a key regulator of resting metabolic rate¹²⁴. Insulin resistance, as well as the ability to reduce hepatic glucose synthesis.

Several studies have found that resistance exercise lowers glycosylated hemoglobin (HbA1c) levels in diabetes men and women over the age of ¹²⁵. While cholesterol levels, BMI, and blood pressure have all been demonstrated to be predictors of overall mortality, HbA1c has been found to be the most efficient predictor.

HbA1c levels appear to be the primary mediator of the mortality risk linked with diabetes ¹²⁶. However, it appears that resistance training has the most beneficial benefits when participants exercise at 70 to 90% of 1 repetition maximum strength¹²⁷. Regardless of age, resistance training lowers HbA1c levels in diabetics. Improved glycemic control and lower HbA1c levels reduce the microvascular and macrovascular complications of diabetes ¹²⁸.

HbA1c percentage point discrepancies and health have been found in two studies. The European Prospective Investigation of Cancer and Nutrition (EPIC) Norfolk prospective population research indicated that a 1% increase in HbA1c was associated with a 28% increase in death risk, irrespective of other cardiovascular risk variables ¹²⁹. The second trial, the UK Prospective Diabetes Trial, found that each percentage point decrease in HbA1c was connected to a 35% reduction in microvascular issues ¹³⁰. Appropriate exercise, without a doubt, may greatly enhance glycemic control.

4. Physical Activity and Dyslipidemia

A single bout of physical exercise causes plasma triglyceride concentrations to drop and plasma HDL cholesterol concentrations to rise¹³¹. Lower-intensity aerobic training is the most effective strategy to lower plasma LDL levels and increase LDL particle size, although moderate-to-vigorous exercise has been shown to raise HDL cholesterol. It also reduces Apo lipoprotein B plasma levels and blood triglyceride levels ¹³². Even with small weight loss or fitness increases, the largest volume of exercise per week, rather than the most intensive, can result in broad lipoprotein profile improvements ¹³³. Improving fitness leads to positive improvements in blood pressure, lipid profiles, and waist circumference, lowering the risk

factors linked to cardiovascular disease ¹³⁴. Gaining weight, on the other hand, has the reverse impact and raises the risk of cardiovascular disease ¹³⁵.

All lipid values improved, especially during the first year of participation, in a study of 20 inactive men over the age of 20 who participated in an exercise Programme and had their plasma levels of total cholesterol, LDL cholesterol, HDL cholesterol, and triglycerides examined. These data led to the conclusion that regular exercise lowers plasma lipid levels, which lowers the risk of coronary heart disease in middle-aged and older people ¹³⁶. In a research including Greek people, the impact of adding resistance training to aerobic activities on lipoprotein profile, including HDL and LDL, triglycerides, apolipoprotein-A1, Apo lipoprotein B, and anthropometric indices, was studied. Combining aerobic and resistance-type exercises may enhance lipoprotein profile in healthy adults' more than aerobic activities alone, according to the researchers ¹³⁷.

5. Physical Activity and Blood Pressure

Improved fitness through exercise training may lower blood pressure by lowering catecholamine levels. Total peripheral resistance and changes in vasodilators and vasoconstrictors are two ways to lower blood pressure ¹³⁸. Hypertension and insulin resistance are widespread in the elderly ¹³⁹, and aging is an independent risk factor. Hypertension raises the chance of death from cardiovascular disease; both can be avoided and treated with exercise ¹⁴⁰. In healthy people, exercise lowers both systolic (8-10 mmHg) and diastolic (3-5 mmHg) blood pressure. Furthermore, in people with hypertension, a single session of exercise might result in a two-fold reduction in diastolic blood pressure¹⁴¹.

Although exercise is the cornerstone of hypertension therapy, the prescription for exercise has to be modified ¹⁴².

Numerous studies have found that aerobic exercise is linked to decreased arterial stiffness in healthy people of all ages. Resistance training's independent effects, on the other hand, are less well defined. Resistance training and aerobic exercise training both lower blood pressure, albeit through distinct processes. According to a meta-analysis of RCTs, aerobic exercise training lowers systolic (3.8 mmHg) and diastolic (2.6 mmHg) blood pressure (SBP and DBP) in individual's with normal or increased blood pressure¹⁴³. Importantly, hypertension study groups (SBP -6.9 mmHg; 95 percent CI: -9.1, -4.6 mmHg and DBP -4.9 mmHg; 95 percent CI: -6.5, -3.3 mmHg) had more dramatic blood pressure responses to aerobic exercise training than normotensive study groups (SBP -2.0 mmHg; 95 percent CI: -3.0, -0.9 mmHg). A meta-analysis by Strasser (2010) (Table 2.3) found that a weighted mean difference (WMD) change in SBP with resistance training was statistically significant (-6.19 mmHg, 95% CI -11.38, -1.00; p=0.02).

1. Physical Activity and Inflammation

Several physiological reactions are triggered by a single episode of intensive physical exertion. A rapid inflammatory release of pro-inflammatory cytokines, as well as leukocytosis and raised C-reactive protein (CRP) plasma concentrations are examples of these physiological processes¹⁴⁴. CRP is the most widely used inflammatory marker, and it represents a powerful independent risk factor for coronary heart disease events ¹⁴⁵. Many chronic disorders, including T2D, different malignancies, cardiovascular diseases, ischemic stroke, peripheral artery disease, and hypertension, have been linked to C-reactive protein.

Low-grade systemic inflammation is linked to metabolic syndrome, type 2 diabetes, endothelial dysfunction, and cardiovascular disease in overweight and obese people. Given the importance of systemic inflammation in the development and progression of atherosclerosis and cardiovascular illnesses, researchers have been looking at whether exercise has an impact on the inflammatory process.

The research on maintaining cardiorespiratory fitness (CRF) and whether it can help reduce low-grade inflammation is mixed ¹⁴⁶. Although a single bout of physical activity has been proven to raise acute pro-inflammatory markers, other research has found that it reduces low-grade inflammation. Exercise has been shown to have an inverse relationship with levels of acute phase reactants such CRP and fibrinogen in studies. Some of the possible physiological mechanisms that may interact include improved body composition through decreased body fat, decreased production of pro-inflammatory cytokines, increased production of anti-inflammatory cytokines, reduced expression of adhesion molecules, unregulated antioxidant and other increased cellular defenses, and improved dyslipidemia and endothelial function.

7. Physical Activity and Endothelial Function

Obesity, hypertension, diabetes, hypercholesterolemia, cardiovascular disease, and heart failure are all linked to endothelial dysfunction ¹⁴⁷. Endothelial dysfunction is defined as "the endothelial cells' incapacity or attenuated effect in participating in the relaxation of the neighboring smooth muscle, resulting in reduced vasodilation." Endothelial function is critical for maintaining the vessel wall's health¹⁴⁸. Nitric oxide, an autacoid, is the most important and well-studied mediator with additional anti-atherogenic properties. Its inherent vasodilator activity is frequently utilized as a proxy for endothelial function. Shear stress, or

pressure placed on the blood artery wall, increases the production of nitric oxide by endothelial cells.

This appears to be a fundamental mechanism explaining the favorable effect of exercise on endothelial function and, in turn, metabolic syndrome, since nitric oxide diffuses into and relaxes blood vessels, allowing blood to flow more freely.

Endothelial function is hampered by metabolic syndrome risk factors, which generate very precise cellular and molecular responses. Endothelial dysfunction and atherosclerosis development are linked by these molecular reactions¹⁴⁹. While the benefits of exercise training on endothelial function in healthy people appear to be contradictory, it appears that physical activity enhances endothelial function in those with metabolic syndrome. In non-diabetic groups, exercise training regularly improves endothelial function, according to other studies.¹⁵⁰ As blood pressure is exerted on the endothelium, the improvement is reflected in enhanced nitric oxide bioactivity and a reduction in oxidative stress (direct shear-stress). As a result, these systems could explain why exercise training reduces coronary events. Exercise's ability to promote endothelial function has yet to be fully understood¹⁵¹.

During exercise, changes in blood flow, and thus endothelial shear stress, are thought to cause an increase in nitric oxide bioactivity throughout the vasculature by up-regulating nitric oxide synthase gene expression (the enzyme that uses L-arginine to generate nitric oxide), which increases endothelial nitric oxide production and release. Both acute and chronic vascular function alterations are triggered by this shift in hemodynamics after acute exercise. The enhanced bioavailability of nitric oxide leads to an improvement in vascular function. Subjacent smooth muscle cells vasodilator in response to nitric oxide, which helps to homeostatically regulate wall shear stress.

2.1.5 Concept of Exercise

Exercise is defined as organized, structured, and repetitive physical activity with the goal of conditioning the body. Cardiovascular conditioning, strength and resistance training, and flexibility are all types of exercise. It is a common misconception that exercise simply entails physical activity such as walking, jogging, leaping, and swimming. Respected texts are, in fact, distinguished by their ambiguous titles¹⁵². Intentionally or unintentionally promote this assumption. Cycling, wheelchair racing, kayaking, rowing, skiing, and skating are examples of exercises that involve movement helped by machines or other technologies. In comparison to resting rates of roughly 5 kJ min⁻¹ (83 W), comparable to an oxygen intake of 0.25 liters min⁻¹, energy is expended up to and beyond 120 kJ min⁻¹ (2 kW) during these activities, equivalent to an oxygen uptake of 6 liters min⁻¹. "Planned, systematic, and repetitive body movement, "is a widely accepted definition of exercise¹⁵². However, there are some tasks that necessitate significant energy expenditures but involve little or no movement. The Crucifix and other gymnastics examples of quasi-static balance and suspension are examples. In competition, movement is actually discouraged, and stillness is rewarded. In both rugby codes, 16 or 12 players can put in maximum or near-maximum effort, such as in a scrum, but no movement occurs. In tug-of-war, the same thing happens.

Other tasks, such as rifle and pistol shooting and archery, are examples of activities in which the participants' primary goal is to avoid moving. Long periods of isometric or near isometric muscular activation in vast muscle groups occur in endurance sports such as sailing and surf surfing.' Isometric muscular action that produces and sustains streamlined body postures is crucial in ice sports like the skeleton and various forms of bob sleigh. Isometric muscular activity in fixator and stabilizing muscles contributes to performance even in dynamic exercise like running and swimming¹⁵³.

Clearly, movement is not always required or involved in exercise, thus a universal definition must admit that movement is not always an outcome. It is worth noting at this point

that the word "physical activity" is usually used as a catch-all term for exercise that covers activities of daily living arising from occupational tasks and recreational pursuits¹⁵⁴.

Competitive sport is not a primary emphasis for many people, and gym-based fitness can be frightening, with activities that are hard work, vigorous, and possibly unpleasant. As a result, the word "physical exercise" has gained popularity. This is issuer-friendly, and it pairs well with the terms "active living" and "active lifestyle." The number has made its way into the language of sport and exercise science, as well as general vocabulary¹⁵⁵. This was done in order to create messages that were more acceptable and cost-effective. It is important to evaluate the context. Physical activity is defined by the three factors listed below:

1. Skeletal muscles are responsible for the movement of the body.
2. Energy expenditure that ranges from low to high as a result.
3. There is a link between physical fitness and mental health. In terms of health consequences, exercise intensity, frequency, and duration must be such that metabolic energy expenditure is typically significantly greater than that experienced at rest ¹⁵⁶. As a result, homeostasis (i.e., the stability of physiological systems) is disrupted, and adaptations can occur at the cellular, organ, systemic, and whole-body organizational levels. Exercise is frequently used to refer to structured leisure-time physical activity, such as jogging, swimming, 'keep-fit' activities, and recreational sports, as opposed to other unstructured everyday activities, such as stair climbing and walking while performing occupational and leisure-related tasks.

A major flaw in the characteristics listed is that they overlook sorts of activities that are often practiced by specific and recognized populations, such as the elderly or infirm, for whom the phrase "physical exercise" is intended¹⁵⁷. Consider a seated workout that comprises a single or recurrent symmetrical or asymmetrical rising and lowering of the arms.

Participants flex their elbows and elevate their forearms till the tips of their fingers touch the clavicles while lying on their backs. They then drop their arms until the elbows are at right angles, maintain that posture for a few seconds, and repeat the pattern multiple times.

There are three separate phases: concentric activity when raising the forearms, eccentric activity while lowering them, and isometric activity while holding them. Despite the widespread usage of this sort of arm workout, the final phase is not included in the criterion because it does not involve movement. Furthermore, recent research has shown that standing and, as a result, the recruitment of major muscle groups in the trunk and legs, might contribute to health benefits.¹⁵⁸

Considered probable sub-components of "activity" in an attempt to distinguish between physical activity and exercise¹⁵⁹. They defined exercise as follows in 1985:

1. Skeletal muscles are responsible for movement of the body.
2. Energy expenditure ranges from low to high as a result.
3. Has a strong relationship with physical fitness.
4. Repetitive, systematic, and planned body movement
5. The goal is to keep or improve one's physical fitness.

Clearly, there is little if any practical difference between 'exercise' and 'physical activity,' according to these ideas, and Cabperson and colleagues' exclusion of isometric activity from both is a serious flaw. Exercise can also be used to improve one's health or performance. Physical activity has the same effect. Finally, none of the aforementioned "components" constitute a precise definition of exercise or physical activity¹⁶⁰.

Indeed, the distinction between the two categories is based on how the participants's desire or goal is interpreted; this might result in one person's exercise being mistaken for another's physical activity. While the terminology is fascinating to behavioral scientists, it does not aid in the evaluation of the activity.

This review will use the term exercise for consistency's sake, however the two terms are equivalent. As a result, and most critically, the use of the terms "exercise" and "physical activity" is entirely dependent on the conditions and context.

What is apparent is that exercise requires the usage of muscle, albeit there are three different forms of muscle tissue: striated, smooth, and cardiac. Although typing, playing electronic games, and controlling the television with the remote control all include muscular activity, they cannot be termed exercise due to the obvious changes in metabolism – and hence homeostasis – that occur when large muscle groups are recruited. Exercise is likely to result in increases in both breathing rate and heart rate as a result of such recruitment. However, it must be remembered that tiny or local muscle groups can be gently perturbed on a regular basis to preserve or expand functional capabilities.

It is crucial to understand the specific function of muscle, which is sometimes misconstrued before defining exercise. The intriguing historical context of muscle anatomy and physiology investigations is often disregarded, and this is a key source of current Misconceptions¹⁶¹.

Table 2.1: The American College of Sports Medicine's (ACSM) Recommendations for Exercise Terminology and Nomenclature.

| Term | Guideline for use |
|------|-------------------|
|------|-------------------|

| | |
|--------------------|--|
| Exercise | Any and any activity that causes a homeostatic state to be disrupted by generating force by the stimulated muscle(s). The muscle may shorten (concentric) contractions or be overcome by external resistance and prolong (eccentric) contractions during dynamic exercise. Isometric contractions occur when muscular power does not result in movement. |
| Exercise intensity | A precise degree of muscular activity maintenance that can be measured in terms of power (energy expenditure or work produced per unit of time), maintained isometric force, or velocity of progression. |
| Endurance | The maximum amount of time a person can maintain an isometric force or a certain power level using a combination of concentric and eccentric muscle contractions. |
| Mass | A measure of an object's inertia (note: mass ≠ weight ≠ acceleration owing to gravity; unit: gram or kilogram). |
| Weight | The force that attracts an amount of stuff towards Earth due to normal gravity acceleration. |
| Energy | The ability to generate force, do labor, or generate heat (unit: joule or kilojoule) |
| Force | Something that causes matter to alter its state of rest or motion (unit: newton). |
| Speed | Per unit of time, total distance traveled (unit: metres per second). |
| Velocity | Per unit of time, displacement. A vector number that necessitates the direction of travel to be expressed or strongly inferred (unit: metres per second or kilometres per hour). |
| Work | Force expressed over a long distance but with no temporal constraint (unit: joule or kilojoule). In addition, joules should be used to indicate quantities of energy and heat that are not related to time. The phrase "labor" should not be used interchangeably with "muscle exercise." |

| | |
|--------|---|
| Power | The product of force and velocity; the derivative of work with respect to time; the pace of doing work (unit: watt). Other associated processes, such as energy release and heat transfer, should be measured and provided in watts when stated per unit of time. |
| Torque | A force's ability to generate axial rotation (unit: Newton meter). |

Source: American College of Sports Medicines

Purpose of Exercise

Exercise is beneficial to one's general health and fitness, as well as the prevention of obesity, hypertension, and cardiovascular disease. According to the Centers for Disease Control and Prevention (CDC), 61.5 percent of people aged nine to 18 to 45 years do not engage in any organized physical activity (such as sports or dance classes), and 22.6 percent do not engage in physical activity in their spare time. Over 30 percent of children and adolescents aged six to 19 are overweight, with 15 percent being obese, according to the American Obesity Association. The key causes of this increase in overweight and obesity are a sedentary lifestyle and excessive caloric consumption; regular exercise is considered a significant factor in weight control.

Children and adolescents who are overweight or obese are more likely to acquire a variety of medical issues, including the following:

Cardiovascular disease I. Asthma ii. diabetes iii. hypertension iv. orthopedic issues, such as hip and knee discomfort and reduced range of motion cardiovascular disease v. High cholesterol levels vii. sleep apnea viii. psychosocial problems include depression, body image issues, and eating disorders

Regular exercise has been demonstrated in clinical research to provide various advantages, including the:

- i. Maintaining a healthy weight and preventing weight gain

ii. lowering blood pressure and cholesterol iii.improving coordination iv.increasing self-esteem and self-confidence v.lowering the risk of diabetes, cardiovascular disease, and some cancers vi.increasing life expectancy

Description

To develop and maintain the health of the body's heart, lungs, and muscles, exercise comprises of cardiovascular conditioning, strength and resistance training, and flexibility¹⁶².

Cardiovascular Conditioning

Cardiovascular conditioning is described as a persistent rise in heart rate caused by moderate to intense physical activity. When done on a regular basis, cardiovascular exercise improves the efficiency of the heart, lungs, and circulatory system. Adults should exercise within a target heart rate range calculated from their maximum heart rate by age. Children in excellent health should engage in cardiovascular activity that elevates their heart rate to no more than 200 beats per minute. For children and teenagers, the American Heart Association recommends at least 60 minutes of moderate to strenuous physical activity every day.

Cardiovascular conditioning exercises should be tailored to the child's age, gender, and emotional state. Bicycling, jogging, swimming, jumping rope, Brisk-walking, dancing, soccer, and basketball are examples of heart-rate-raising exercises¹⁶³.

Strength and Resistance Training

Strength and resistance exercise improves muscular mass and strength, as well as bone strength and metabolism. Strengthening exercises build muscle strength by putting a muscle under more tension than it is accustomed to. With or without special equipment, strength training can be done. Handheld dumbbells, resistance machines (Nautilus, Cybex), and elastic bands are examples of strength/resistance training equipment. Pushups, stomach crunches, and squats are examples of workouts that can be performed without the need of

equipment. Strength training with weights can be done by children as one as six years old if they are supervised by a fitness professional who is skilled in one's strength training.

Some exercise facilities may have child-sized resistance equipment. Children and adolescents should strength exercise for 20 minutes two or three times weekly on nonconsecutive days, according to one's strength training guidelines¹⁶⁴.

Flexibility

Flexibility is essential for improving and maintaining joint range of motion as well as reducing the risk of muscle strains. Most oneng children and people are inherently more flexible than older children and adults, and will do activities that enhance flexibility automatically. Children should be taught to stretch as they grow older. Flexibility is especially crucial for children and teenagers who participate in strenuous physical activity (running, competitive sports). Stretching is best done after a warm-up and/or when a workout session or sport is completed. Yoga, in the form of children's yoga courses or fitness videos is one activity that increases flexibility and is growing in popularity among onengsters¹⁶⁵.

Precautions

Before starting any fitness Programme, a doctor should examine the person to rule out any potential health issues. For children and adolescents with physical limitations or certain medical problems, exercise regimens overseen by a healthcare professional, such as a physical therapist or exercise physiologist, may be necessary. When a child develops dizziness, nausea, acute shortness of breath, or chest discomfort when exercising, the activity should be promptly stopped and a physician sought before the child restarts. Children and adolescents who utilize any type of exercise equipment should be monitored by a trained fitness specialist, such as a personal trainer¹⁶⁶.

2.1.6 Concept of Dance-exercise

Dance professionals have been concerned in dancers' physical health since ballet's journey from the ballroom to the stage. This adjustment raised the physical demands of the choreography since dance moves had to be presented in such a way that the audience could appreciate them from various places in the theatre. For example, a series of hops and jumps over the floor. Poses with a broad range of motion in external rotation of the lower limbs (turnout), sequential pirouettes, and partner lifts were among the highlights of the show. Later, the emergence of new dance genres, particularly modern (or contemporary) dance², introduced new elements of movement, such as the use of the floor, falls, weight transfers from feet to hands, dancer contact, and so on, all of which resulted in increased physical demands¹⁶⁷.

As a result, dancers must now be physically fit as well as technically proficient, and numerous studies on various aspects of dance fitness have been published in recent years, such as the fact that the cardiorespiratory demands of dance performance are greater than those of classes and rehearsals, and this is true for various dance styles. 5-10 A lack of proper rest induced by intensive dancing routines may also affect dancers' fitness levels. Another line of inquiry focuses on the various parallels that exist between sports and dance, such as the development of technical abilities based on movement efficiency, the utilization of adequate training regimens, and injury prevention concerns¹⁶⁸. Because dance is distinguished from sports by its art and expressivity, 20 developing strategies to improve dancers' physical fitness should provide a foundation for optimizing their artistic and technical skills has been particularly fruitful in terms of applying exercise science to dance, 10, 13-19. To put it another way, enhancing dancers' cardiorespiratory and neuromuscular systems would likely result in enhanced movement efficiency, delayed fatigue, and a decreased chance of injury. Dancers have been associated to a high incidence of injury due to

insufficient levels of fitness, such as aerobic conditioning and strength. Lower extremity injuries in dancers has been associated to reduce thigh strength, for example.

Similarly, it appears that exercise-induced tiredness is associated to poor limb alignment while landing from jumps, which increases the risk of severe injuries²³. Low body fat percentage is thought to be negatively related to the length of time a dancer is forced to change activities due to injury in terms of nutrition²⁴. As a result, dancers have been encouraged to participate in additional fitness training, with data linking gains in aerobic power and strength to changes in body composition and aesthetic proficiency.¹⁶⁹

1. Dance as Physical Exercise

Dance is classified as an intermittent workout because it alternates between brief bursts of rapid movement and longer adagio movements that require sustained technical precision.

Dancers attain high peaks of exercise intensity that alternate with active or passive recovery times, preventing oxygen consumption (VO₂) and heart rate (HR) from stabilizing during the activity. A practical example is the undulating shape of the HR curve during a contemporary dance instruction and performance¹⁷⁰.

Depending on the choreography's dance style, intensity, and duration, the dancer's place in the choreography, the mix of choreographies for distinct presentations, and so on, dancing performance needs energy from different metabolic systems. As a result, dancers must maintain the following levels of fitness:

1. Muscle power reserve, which allows one to undertake powerful jumps and leaps like grand jetes, which rely heavily on anaerobic-alactic energy;
2. Muscular endurance is necessary to do high-intensity exercises that must be sustained for 30 to 60 seconds, such as a sequence of little jumps (allegros), which require energy from the anaerobic-lactic system.

3. Cardiorespiratory endurance is necessary to do low-intensity exercises such as series of slow motions with a large range of motion (grand adage) or even the warm-up period of a dancing class.

Assessing energy contribution is simple when the intensity is constant throughout the performance, such as when running. On the other hand, aerobic pathways were predominantly important for fueling a grand epic sequence. 31 Furthermore, the enhanced contribution of the aerobic system after warming up demonstrates that a proper dance warm up improves aerobic pathways and may delay the onset of muscle fatigue in dancers¹⁷¹.

2. Dancers' Aerobic Capacity

Dancers' maximum aerobic capacity is influenced by their dance style, gender, technical ability, and position in the company. Ballet dancers and student contemporary dancers, for example, had a higher VO₂max than professional contemporary dancers (49.1 vs. 42.2 vs. 39.2 mlkg⁻¹min⁻¹). 2 Men jazz dancers showed a greater VO₂max than women jazz dancers (49.5 vs. 41.5 mlkg⁻¹min⁻¹)¹⁷¹. These findings imply that dancers of all genres and genders have physiological variances that might influence their performance and, as a result, the functional requirements of dance training. It has been discovered that corps of ballet dancers (44.57 mlkg⁻¹min⁻¹) had a greater VO₂max than soloists (40.5 mlkg⁻¹min⁻¹), which may be connected to choreographic demands. Soloists do intermittent, short-duration, and explosive high-intensity movement, whereas corps dancers normally perform continuous, longer-duration, and low-moderate intensity choreography. This suggests that the former mostly uses aerobic routes for energy generation, whereas the later uses anaerobic pathways¹⁷².

Despite their higher leap height, principals and artists required substantially more oxygen at their peak (VO₂peak) than solos and first artists. Dancers' aerobic capacity is an incredibly crucial aspect of their fitness requirements that is sometimes overlooked throughout training.

According to the findings of this study, it is critical for dancers to engage in additional supplemental aerobic training to prepare them for the aerobic demands of performance.

Dancers might consider using a strength and conditioning Programme designed specifically for dancers, with a focus on cardiorespiratory endurance.¹⁷³ Simply put, the first break point on a progressive exercise intensity curve corresponds to the workload at which lactate generation starts to grow, despite the fact that it is constantly digested by other tissues^{174, 175}. At this moment, the first lactate threshold (LT1) is met, which is the first increase in blood lactate concentration above resting levels.¹⁷⁶ Blood lactate builds up after LT2, which is connected to AT, as well as other metabolites such H⁺, all of which are created by anaerobic glycolysis and can cause exercise-induced fatigue¹⁷⁶.

Dancers' performance is based on rhythm, balance, and coordination, among other aspects that are impacted by muscular fatigue¹⁷⁷. Due to the involvement of several energy systems in dance, appropriate recovery times after high-intensity or long-duration choreographies should be addressed to avoid overtraining. Anaerobic exercise is a type of activity that burns glucose for energy without the need of oxygen. These exercises are often of short duration and high intensity. The concept is that a large amount of energy is released in a short period of time, and the oxygen demand exceeds the oxygen supply¹⁷⁸. During center-floor jump sequences, for example, a 1:3 work-to-rest ratio is recommended to allow the anaerobic energy system to recover adequately to avoid affecting subsequent movement quality and intensity¹⁷⁸. Another important issue to consider is glycogen utilization rate, which has an effect on neuromuscular signals (which are reduced as glycogen levels drop) and, finally, perceived muscle weariness.

Dancers, on the other hand, use less calories per day than other elite athletes who participate in predominantly aerobic sports (e.g., cyclists or runners)¹⁷⁸. As a result, dancers' energy reserves are more likely to be exhausted, leading their muscles to weary more rapidly. This, along with greater physical demands during certain dancing seasons, might raise the

risk of injury. Furthermore, because improved oxygen transport and neuromuscular function reduce exercise-induced weariness and injury rate a lower level of aerobic fitness has been identified as one probable risk factor for injury in dancers¹⁷⁸. Furthermore, after a 6-week summer vacation, professional ballerinas observed a 10% increase in VO₂max, overtraining may be to blame for dancers' high risk of injuries, which appear to occur most commonly during periods of intensive work, dance may appear to be effortless, yet it needs a great deal of strength, flexibility, and stamina. It also carries a considerable danger of injury¹⁷⁹.

2.1.7 Concept of Brisk-walking

Except for the severely crippled or the elderly, walking is the most natural activity and the only continuous dynamic aerobic exercise that everyone can do. There are no particular skills or equipment needed. Walking is convenient and may be incorporated into daily routines at work and at home. Its intensity, duration, and frequency are all self-regulated, and it has a minimal ground impact, making it intrinsically safe. Walking, unlike many other forms of physical activity, shows minimal, if any, reduction as people age. It is an appealing alternative for improving physical activity in sedentary communities since it is a year-round, easily reproducible, self-reinforcing, habit-forming exercise. Walking is a rhythmic, dynamic, aerobic activity that uses large skeletal muscles and offers a variety of health benefits with low negative effects.

Walking faster than normal and in adequate amounts into the 'training zone' of over 70% of maximum heart rate improves and maintains physical fitness. Leg, limb girdle, and lower trunk muscles are strengthened, and cardinal joint flexibility is kept; posture and carriage may improve. Walking is a very popular kind of exercise. A walking program may be adapted to any fitness level, and because it is a low-impact exercise, it is suitable for almost any age group. A regular walking routine can help with cholesterol, blood pressure, bone strength, and weight loss. Walking, in addition to its numerous health advantages, also

works a variety of muscles¹⁸⁰. Walking expends energy in any amount and at any rate, implying that walking has the ability to help people lose weight in the long run. Exercise increases the expression and activity of critical proteins known to control glucose metabolism in skeletal muscle, which affects the insulin signaling pathways. This beneficial impact of exercise on muscle insulin pathway activity is caused, at least in part, by alterations in lipid metabolism¹⁸¹. Therefore, walking, for example, stimulates a variety of biological processes that are inherent in skeletal muscle activity, such as high-density lipoprotein metabolism and insulin/glucose dynamics. Walking is also the most frequent weight-bearing activity, and there are signs of increased bone strength at all ages.

Walking is beneficial to individual's health since it raises individual's fitness and/or individual's physiological activity and energy turnover. The greater the benefits, the quicker, farther, and more frequently one walks. For example, a person may begin as an average walker and work their way up to walking quicker and completing a mile in less time than an average walker, comparable to power walkers. This can be an excellent approach to boost aerobic activity, improve heart health, and endurance while burning calories¹⁸². Walking levels are frequently low in today's society. It is possible that familiar societal inequities are visible. There are signs that children's walking is declining, but more research on their activity, fitness, and health is needed. The disadvantages include the increased number of fatal and non-fatal road accidents, particularly among children and the elderly, as well as poor air quality caused by traffic pollutants, which accumulating research links to various stages of respiratory disease¹⁸³.

Walking is an excellent gentle start for the sedentary, particularly the elderly who are inactive and immobile, and it provides an added benefit of freedom and social well-being. Mobility is a key component of health across the lifespan and is necessary for older adults to maintain independent functioning and autonomy. Mobility limitation, defined as difficulty

walking one-quarter mile or climbing one flight of stairs, is reported by 30%–40% of adults aged 65 years and older (1,2), and there is likely to be a high degree of unrecognized mobility limitation (3) because many older adults do not engage in regular volitional walking activity. On most days, a steady transition from slow to regular speed and then to 30 minutes or longer of brisk (6.4 km/h) walking is recommended. These levels should provide significant increases in exercise and health-related fitness without having any negative consequences. This type of goal might also be proposed for personal motivation, therapeutic practice, and public health.

Brisk-walking

One of the simplest and most efficient cardio workouts is a brisk stroll. And, best of all, Brisk-walking may be done without any additional equipment and can be done indoors or outdoors. To begin experiencing the many benefits of a fast-paced walk, all one need is a nice pair of sneakers. The secret to obtaining a terrific exercise from Brisk-walking is to keep a speed that is challenging for the heart and lungs but not so fast that one run out of steam. Brisk-walking, which is quicker than a stroll is around 100 steps per minute or 3.5 miles per hour on a treadmill and can promote physical, mental, and emotional well-being ⁹¹. To walk briskly, one 'll need comfortable shoes or trainers that give appropriate support and don't cause blisters. If someone is walking to work, one can dress in one's regular work clothing and put on a comfortable pair of shoes before entering the building. Water, nutritious foods, a spare shirt, sunscreen, and a sun hat in a compact bag may be required for extended treks. A person can tell whether he or she is walking quickly and can still communicate, but they are unable to sing the words to a song. Brisk-walking provides a number of physical health advantages, and 150 minutes of moderate exercise each week can assist improve overall cardiovascular health. Aerobic workouts, like Brisk-walking, are good for individual's heart. Moderate exercise can also aid in the reduction of blood pressure and cholesterol¹⁸⁴.

Being able to walk quickly is also beneficial to individual's longevity. A group of elderly persons was researched, and it was revealed that being able to walk quickly (100 or more steps per minute) might be a predictor of lower mortality¹⁸⁵. The advantages of fast walking are not only physical; they may also aid one intellectually and emotionally. In a study of healthy older persons, the effects of exercise such as Brisk-walking were examined. Individuals who took frequent brisk walks fared better on cognitive activities than adults who did not¹⁸⁶. Brisk-walking may help to mitigate the consequences of chronic illnesses. Healthcare clinicians attempting to grow and support frequent Brisk-walking in middle-aged and older people might benefit from understanding the perspectives of regular brisk walkers¹⁸⁷.

Consideration for Brisk-walking

The phrase "Brisk-walking" is a bit of a misnomer. It is both a bit quicker and a lot faster than typical. There are numerous techniques to monitor speed to ensure someone is in the "brisk" zone, which assist might clarify exactly what it implies. There are three ways to tell if someone is walking at the appropriate pace.

1. Target Heart Rate (THR)

1. Measuring heart rate is one technique to see if one walking quickly enough.
2. For most individual's, a healthy goal heart rate when exercising is 50 to 85 percent of maximal heart rate. Working out at a desired heart rate ensures that one get the most out of individual's workout¹⁸⁸.
3. During moderate-intensity exercise, individual's target heart rate should be about 50 to 70% of individual's maximal heart rate.
4. During intense activity, individual's target heart rate should be between 70 and 85 percent of individual's maximal heart rate.

Consider the following factors when determining individual's ideal heart rate range:

1. Multiply 220 bpm minus individual's age by 0.50 to find the low end of individual's ideal heart rate (50 percent). For a 40-year-old, this would be $180 \text{ bpm} \times 0.50 = 90$ bpm.
2. Multiply 220 bpm minus individual's age by 0.85 to find the top end of individual's ideal heart rate (85 percent). $180 \text{ bpm} \times 0.85 = 153$ bpm for a 40-year-old, for example.
3. While walking, this person's ideal heart rate should be between 90 to 153 beats per minute.

How to Measure Heart Rate

1. Place the tips of individual's index and middle fingers on the inside of individual's left wrist and press them together until one feel a pulse. If one want to check individual's pulse, don't use individual's thumb because it has its own pulse. This might lead to erroneous readings.
2. Count the number of beats felt with individual's fingertips for 30 seconds while looking at a clock or watch.
3. After one get that figure, divide it by two to obtain individual's bpm. Individual's heart rate would be 110 beats per minute if one counted 55 beats in 30 seconds, for example (55×2).

2. Steps per minute

Counting individual's steps is another technique to gauge individual's speed.

According to a research, if a person can walk at least 100 steps per minute, they are walking fast enough to gain significant fitness benefits¹⁸⁹.

A fitness tracker can assist one in keeping track of individual's steps and walking speed.

3. The talk test

A third option Calculating walking pace using a trusted source does not involve any math. Instead, start conversing while walking to keep track of individual's pace:

If one can chat easily while feeling a little out of breath, one probably walking at a moderate yet quick speed.

If it is difficult to speak, the pace is likely to be fast.

If one can sing out loud while walking, the speed is probably too sluggish to be termed brisk.

Benefits of Brisk-walking

1. Regular cardiac exercise, such as Brisk-walking, has several physical and mental advantages. The following are some well-researched advantages:
2. Loss of weight Walking can aid weight loss by burning more calories, increasing lean muscle mass, and improving individual's mood, making one more motivated to continue walking.
3. Better cardiovascular health: Walking five days a week can help reduce heart disease risk. Regular aerobic exercise may also aid in lowering LDL (bad) cholesterol levels in the blood.
4. Blood pressure that is lower. Regular aerobic exercise has been shown in studies to help decrease blood pressure.
5. Blood sugar levels are lower. Insulin sensitivity can be improved by going for vigorous walks on a regular basis. This implies that both before and after one exercise, the cells in individual's muscles are better equipped to utilize insulin to suck in glucose for energy.
6. Mental health has improved. Exercise has also been demonstrated to increase self-esteem, sleep quality, and mental function, among other benefits¹⁹⁰.

Walking: an Aerobic Activity

Walking is one of the most effective and injury-free ways to improve individual's health. Because it boosts individual's heart rate while having a modest impact on individual's bones and joints, taking a daily stroll is an excellent aerobic workout. Regular aerobic exercise reduces individual's chances of cardiovascular disease, type 2 diabetes, obesity, balance issues, and a slew of other chronic disorders that reduce quality of life and even shorten life expectancy. Walking works the big muscular groups in the legs and feet, resulting in healthier, stronger quadriceps, hamstrings, gluts, calves, feet, and ankles, as well as improved flexibility and circulation. After only a few minutes of walking a sedentary lifestyle may make one exhausted and lethargic¹⁹⁰.

Lack of aerobic endurance can be caused by a number of factors, all of which are related to the health and function of individual's heart. Because individual's heart has to work more to pump blood through individual's body when one overweight, individual's endurance suffers. Smokers have lower endurance because their lung capacity is diminished, and carbon monoxide replaces oxygen in their blood, which is then circulated throughout the body. Even persons who appear to be physically healthy might have low endurance if they don't exercise on a regular basis, since their hearts aren't strengthened by exercise and must work harder to pump blood during an aerobic activity, such as a fast, lengthy walk¹⁹¹.

2.2. Theoretical Model/Framework

2.2.1 Self-determination Theory

Self-determination theory as propounded by Edward Deci and Richard Ryan, in their 1985 book titled *Self-Determination and Intrinsic motivation in Human Behavior*, which states that "people tend to be driven by a need to grow and gain fulfillment". It is an important concept that refers to each person's ability to make choices and manage their own life. This ability plays an important role in psychological health and well-being. Self-determination allows people to feel that they have control over their choices and lives. This

theory was reviewed by David Susman on the 15th of March 2021 and states that, people are motivated to grow and change by three innate and universal psychological needs {Autonomy, Competence and Connection or relatedness}. {People are able to become self-determined when their needs for competence are fulfilled} ¹⁹².

This theory explains the motivation behind human behaviors and what informs their choices actions ranging from work to recreation. While some people exercise regularly for the sheer pleasure of it, others appear to exercise in order to get intrinsic or extrinsic pleasures such as weight loss, improved appearance, or acknowledgment from important others ¹⁹². Individuals who exercise for pleasure rather than for intrinsic or external benefits are more likely to stick to a prescribed exercise regimen according to previous study¹⁹³. This could have positive effect on reduction of weight and regulation of the heart, because the individual's is carrying out that particular exercise out of the pleased derived and in this case, consistence will be observed by the individual's. Because the objective of health professionals is to encourage people to maintain an active lifestyle even if they aren't currently fulfilling the current PA requirements, examining motivated cognitions has lately been at the core of a lot of research on how to encourage long-term behavior change. The self-determination theory (SDT) is a theory of human motivation that has been widely applied to the study of exercise behavior¹⁹⁴.

Despite the fact that there are several techniques to behavior modification, research has shown that without adequate behavioral intervention, nearly half of those who begin a PA Programme will drop out within the first six months ¹⁹⁴. The SDT, on the other hand, focuses on the mechanisms through which a person gains the desire to begin and maintain new health-related behaviors over time. Individuals are energetic, interested, curious, self-motivated, and eager to achieve, according to the thesis.

It also acknowledges that people may feel alienated, inactive, or dissatisfied, and it explains these differences in terms of motivational styles, which come from the interaction between people's fundamental active nature and the social surroundings that either promote or block that nature ¹⁹². According to the SDT, the degree to which a behavior is autonomous (self-determined), which involves behaving with a full sense of volition and choice, or controlling, which involves behaving with the experience of pressure and demand toward specific outcomes that comes from forces perceived to be external to the self is determined by the degree to which it is autonomous (self-determined)¹⁹³. Individuals have three primary psychological needs, according to the theory: autonomy, competence, and relatedness. Being viewed as the source or origin of one's own conduct is referred to as autonomy. Competence relates to feeling competent in one's continual interactions with the social environment and enjoying possibilities for fulfillment, whereas Relatedness refers to feeling linked to others and a sense of belonging to individual's and the community ¹⁹².

When these three essential psychological prerequisites are satisfied, an individuals' intrinsic activity is encouraged, optimum motivation is supported, and positive psychological, developmental, and behavioral outcomes are obtained ¹⁹². On the other hand, social situations that block the fulfillment of these needs result in less optimal motivation and have negative effects for a variety of well-being outcomes. To conclude, the SDT is a dialectic theory that views the environment as a source of motivation and need fulfilment.

Components of the SDT

Since its inception more than three decades ago, the SDT has showed extraordinary endurance as an explanation into the motivations behind persons engaging in, and maintaining, an active lifestyle through behavioral adjustments. The SDT has evolved in the form of mini-theories starting with the basic premise that the most useful theories of motivation would be broad in scope, encompassing a wide range of phenomena, use concepts

with phenomenological or personal meaning for people, be derived using empirical methods, and have principles that can be applied across life's domains¹⁹⁵.

In some ways, the SDT is a meta-theory made up of sub-theories that attempt to explain human motivation and behavior in terms of individual's differences. The mini theories, rather than being stand-alone theories, are easily integrated with one another since they all share organismic and dialectical assumptions, as well as the idea of fundamental psychological requirements¹⁹². As a result, they form the SDT, which covers all sorts of human behavior across all domains when coordinated. The three SDT component hypotheses will now be briefly discussed.

2.3 Review of Empirical Studies

A study was conducted on Sex Differences in Cardiorespiratory Fitness and All-Cause Mortality: The Henry Ford Exercise Testing (FIT) Project. The goal of the Sex Differences in Cardiorespiratory Fitness and All-Cause Mortality: The Henry Ford Exercise Testing (FIT) Project study was to see if sex alters the association between fitness and mortality. Between 1991 and 2009, 57,284 individuals without coronary artery disease or heart failure performed a regular treadmill exercise test. The metabolic equivalents of tasks (METs) were calculated, and patient records were connected to mortality data via the Social Security Death Index. The link between sex, fitness, and all-cause mortality was studied using multivariable Cox regression. There were 29,470 males (51.5%) and 27,814 women (48.6%), with mean ages of 53 and 54, respectively. Overall, males outperformed women by 2 METs (P.001). There were 6,402 fatalities during a median of ten years of follow-up. The mortality rate for males in each MET group was comparable to that of women, who attained 2.6 METs less on average (P=.03). In both men (HR 0.84 per 1 MET; 95% CI: 0.83, 0.85) and women (HR 0.83 per 1 MET; 95% CI: 0.81, 0.84), fitness was found to be negatively related to mortality. This association did not reach a halt at either high or low METs levels.

While males performed 2 METs better than women, their survival was comparable to women doing 2.6 METs worse. Furthermore, across the MET range, greater METs were related with decreased mortality for both men and women. These data can be used to personalize prognosis information and lifestyle recommendations to men and women who are undergoing stress testing¹⁹⁵.

A study was conducted a research on “Cognitive Benefits of Social Dancing and Walking in Old age: The Dancing Mind randomized Controlled Trial”. The goal of this study was to see if dancing, a basic and functional exercise, and improved executive function more than walking. Among community-dwelling older persons, a two-arm randomized controlled experiment was performed. Over the course of eight months (69 sessions), the intervention group got one hour of ballroom dancing twice weekly at local community dance studios. A home walking programme with a pedometer and optional biweekly group-based walking at a nearby community park to enhance interaction were given to the control group. The findings demonstrate that 115 people (mean age 69.5, SD 6.4) completed baseline and delayed baseline (3 weeks apart) before being randomly assigned to either dancing (n = 60) or walking (n = 55). Among those who were randomized, 79 participants (68 percent) completed the follow-up measures (32 weeks from baseline). Non-completers in the dance group had significantly lower baseline scores on all executive function tests than those who completed the whole programme. Intention-to-treat studies found no evidence of a group effect. In a random effects model including participants who completed all measurements, adjusted for baseline score and covariates (age, education, estimated verbal intelligence, and community), a between-group effect in favour of dance was found only for BVST total learning (Cohen's D Effect size 0.29, p = 0.07) and delayed recall (Cohen's D Effect size 0.34, p = 0.06)¹⁹⁶.

Another study was conducted a research on “Effect Of Brisk-walking On Anthropometric Indices And Physiological Characteristics Of Obese Adults” The purpose of the study was to determine the effect of Brisk-walking on anthropometric indices (body weight, body mass index, lean bodyweight, body density and percent of body fat) and physiological characteristics (systolic and diastolic blood pressure and heart rate) of obese adults in Ilorin metropolis. One group pretest-posttest experimental research design was adopted for the study, the population comprises of 70 obese adults, males and females between ages 25-49 years in Ilorin metropolis. The research instruments were standardized equipment (stadiometer, stethoscope, weighing scale, stopwatch, meter rule, skinfold caliper and sphygmomanometer). The participants were required to brisk walk 3 times a week and 70 minutes per session at an intensity of 40-70% of their respective age-predicted maximum heart rate for 8 weeks. Descriptive statistics of anthropometric and physiological parameters data form were used to collect data for the study. Percentage, mean and standard deviation were used to describe the demographic data while the two null hypotheses formulated were tested using parametric statistic of Analysis of Covariance (ANCOVA) at 0.05 level of significance.

Anthropometric indices and physiological characteristics were measured at Pretest and post. The findings revealed that there were significant effect of Brisk-walking ($P < 0.05$) in body weight, BMI, lean body weight, body density, percentage of body fat and physiological characteristics. Hence, it was concluded that Brisk-walking for 8 weeks was appropriate exercise for obese adults considering the effects on the anthropometric and physiological parameters. Based on the findings, the study concludes that there were significant effects of Brisk-walking on body weight, Body Mass Index, lean body weight, body density, percentage

of body fat, systolic blood pressure, diastolic blood pressure and heart rate of obese adults in Ilorin metropolis. It is recommended that the findings of this study should be adopted by Physical Education teachers, Health trainers and Fitness experts for prescribing the Brisk-walking Programme for the adults and by extension different age groups in Ilorin metropolis. There should also be periodic data collection on obesity and overweight to update and evaluate the obesity and overweight situation in Ilorin Metropolis¹⁹⁷.

One study was conducted a research on “Examining the Relationship between Cardiorespiratory Fitness and Body Weight Status: Empirical Evidence from a Population-Based Survey of Adults in Taiwan” This study aims to examine the extent to which cardiorespiratory fitness is associated with body mass among adult males and females in Taiwan. Materials and Methods. A nationally representative dataset consisting of 68,175 adults aged 18–60, including 31,743 males and 36,432 females, was used. Several multivariate regression models were used to investigate the relationship between cardiorespiratory fitness and body weight status, after controlling for adults’ socio demographic status. Fitness and Body Weight Status: Finding indicate that the overweight and obese adults had much lower levels of cardiorespiratory fitness as compared to their normal weight counterparts. Given the upward trend in the prevalence of overweight and obesity, it is important to help overweight and obese people to become fit and reach their healthy weight¹⁹⁸.

A study was conducted a research on “Repeated prolonged moderate-intensity walking exercise does not appear to have harmful effects on inflammatory markers in patients with inflammatory bowel disease” Because most studies focused on short or low-intensity exercise sessions and subjective results, this study on the function of exercise in the therapy of inflammatory bowel disease (IBD) is inconclusive. The benefits of repeated moderate-intensity exercise on IBD patients' objective inflammatory markers were studied. In this study,

IBD patients (IBD walkers, n1418) and a control group (non-IBD walkers, n1419) walked 30 kilometres, 40 kilometres, or 50 kilometres over four days. Blood samples were taken at baseline and every day subsequently to examine if sickness had an effect on exercise-induced changes in cytokine concentrations. The impact of exercise on faecal Cal protect in was investigated using IBD non-walkers (n1419), a second control group of IBD patients who did not engage in the exercise. Both IBD groups also filled out a clinical disease activity questionnaire. IBD walkers and non-IBD walkers observed similar changes in cytokine concentrations from baseline to post-exercise day 1 (IL-6 p14.95; IL-8 p14.07; IL-10 p14.40; IL-1b p14.28; TNF-a p14.45), with a transient significant elevation in IL-6 (p.001) and IL-10 (p14.006). Calprotectin levels in the feces were unaffected by exercise (p14.48). IBD walkers with ulcerative colitis (p14.92) had no change in clinical disease activity, while those with Crohn's disease (p14.024) did¹⁹⁹.

Elsie Hui, Bo Tsan-keung Chui, conducted a research on “Effects of dance on physical and psychological well-being in older persons” This study examine this study was aimed at determining the effects of dancing on the health status of older persons. A pool of 111 community-dwelling subjects were allocated to either an intervention group (IG), which included 23 sessions of dance over 12 weeks, or a control group (CG). All participants were assessed at baseline and 12 weeks. Finding demonstrate that dancing has physical and psychological benefits, and should be promoted as a form of leisure activity for senior citizens²⁰⁰.

The effect of a twelve-week aerobic exercise Programme on health-related physical fitness components and blood lipids in obese females was studied in Turkey. The study's goal was to see how a 12-week aerobic exercise Programme affected health-related fitness components and blood lipid levels in obese females. A total of 40 females were recruited for this study, with 20 in the exercise group and 19 in the control group. For a 12-week period,

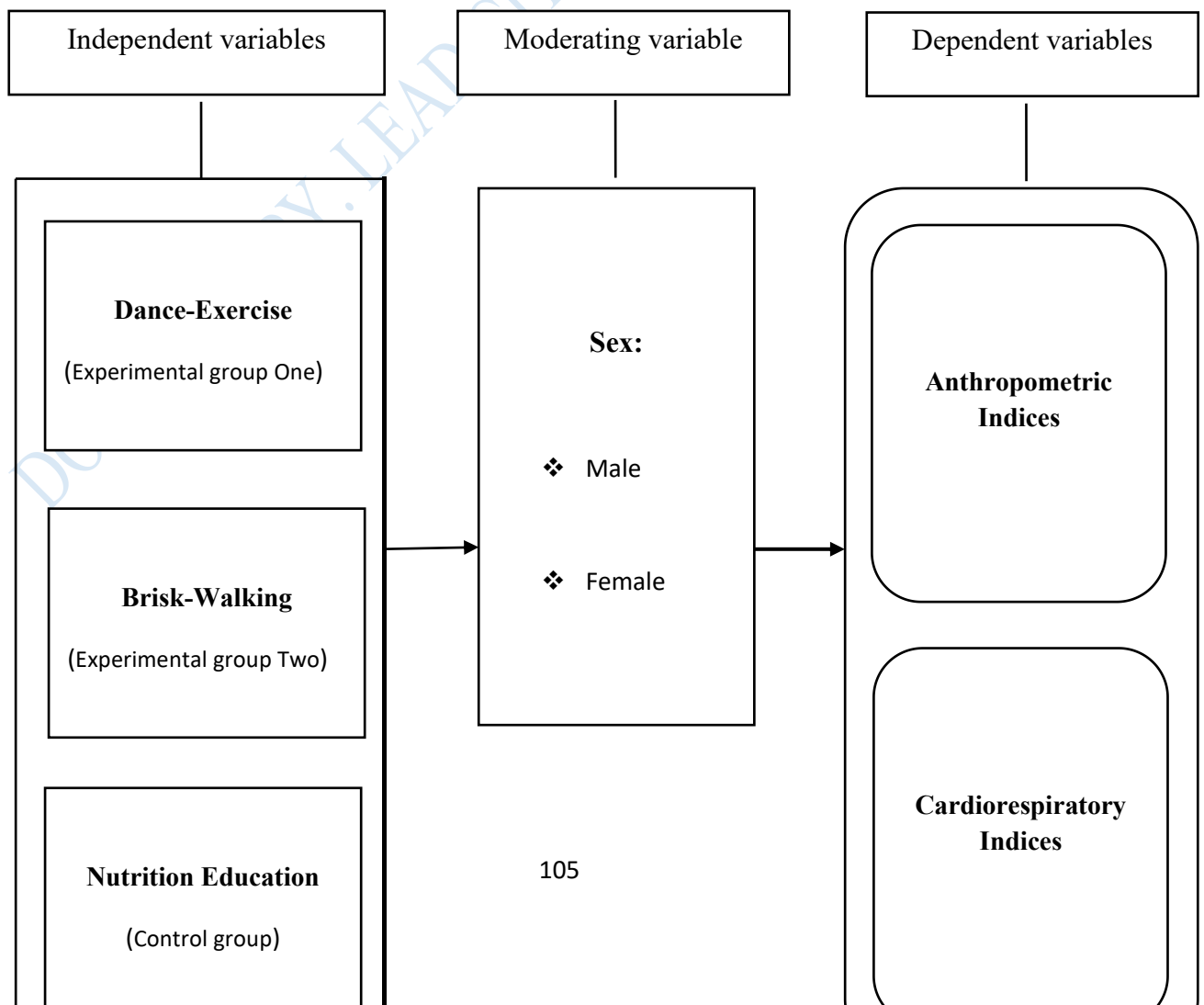
participants attended sessions that lasted 60 minutes each day, three days per week. There were significant differences in weight, body mass index (BMI), flexibility, sit-ups, hand grip for both hands, skin fold measurements (thigh, triceps, biceps, abdomen, super iliac, sub scapula, chest, body fat percent, heart rate, high density lipoproteins (HDL), low density lipoproteins (LDL), total cholesterol, and triglyceride) between Pretest and post-test scores in the exercise group. According to the findings, regular aerobic exercise may have a positive impact on health-related fitness components and blood lipids in females. Additionally, it has the ability to reduce female obesity²⁰¹.

M Neovius Y Linné S Rossner conducted a research on Body mass index (BMI, kg/m²), waist circumference (WC), and waist-hip ratio (WHR) as diagnostic tools for diagnosing fatness in teenagers were evaluated. A cross-sectional study of 474 healthy teenagers aged 17 years was conducted. Height, weight, waist circumference, hip circumference, and body fat percentage (%BF) were all measured. The diagnostic accuracy for identifying excess fatness was assessed using receiver operating characteristics (ROC) analyses using densitometry (air-displacement plethysmography) as the reference test. In both sexes, BMI and WC had a substantial positive connection ($r=0.68-0.73$; $P<0.0001$) with %BF, although WHR had a lesser correlation ($r=0.30-0.41$; $P<0.0001$). The area under the ROC curve for BMI and WC was high (0.96-0.99) for overweight and obesity in boys and obesity in girls. As a diagnostic tool for obesity in females, WHR was not substantially better than chance. Highly sensitive and specific cut-offs for obesity could be obtained for BMI and WC, however bigger trade-offs were required for diagnosing overweight in females. The cut-offs that produced equivalent sensitivity and specificity were lower than those that produced the fewest misclassifications. The latter approached internationally recommended reference values, but were still several units lower in girls for BMI and several centimetres lower in boys for WC. WHR was found to be less useful as a diagnostic test for fatness than BMI and WC. The

disparities between cut-offs that produce equal sensitivity and specificity, cut-offs that minimize the absolute number of misclassifications, and internationally recommended reference values for overweight and obesity highlight the importance of specifying classification system characteristics for different settings ²⁰².

Another study was conducted research on the impact of an eight-week step-aerobic dancing training Programme on body composition markers in middle-aged inactive obese women. This research was a randomized controlled experiment that lasted eight weeks. A total of 49 healthy sedentary obese women volunteered to take part in this study. They were separated into two groups at random: those who were participating in a step-aerobic dancing fitness Programme (n=29) and those who were not (n=20). For eight weeks, the participants participated in a step-aerobic dancing fitness Programme for one hour three days a week. Individual's BMI, weight, waist circumference, waist-hip ratio, four-site skin fold thickness, fat percentage, basal metabolic rate, and lean body mass were assessed before and after the step-aerobic Dance-exercise Programme. After eight weeks of step-aerobic dance instruction, significant changes in the experimental group's weight, BMI, body composition indices, waist-hip ratio (WHR), waist circumference (WC), fat percent, and lean body mass (LBM), and basal metabolic rate (BMR) were seen ($p < 0.05$). Following the trial, there were no significant differences in the control group on the same measures ($P > 0.05$)²⁰³.

2.4 Conceptual Framework





Source: Field survey, 2022

Figure. 2.1: Conceptual Framework of Effect of Dance-Exercise and Brisk-Walking on the Anthropometric and Cardiorespiratory Indices of Obese Undergraduates in Lead City University, Ibadan, Nigeria.

2.5 Summary of Gaps in Literature Reviewed

Exercise is an important part of preserving physical and mental health. People may keep fit and healthy by exercising three to four times a week for a minimum of 30 minutes each time, focusing on dancing and walking. Over 23.3 million people will die each year from cardiovascular disease by 2030, the majority of them will live in low- and middle-income nations. Dance, an energetic, non-competitive kind of leisure exercise, has the distinct feature of requiring all participants to do specific motions in the same rhythm, pace, and dynamics.

Dance is defined as an intermittent workout because it combines short bursts of explosive movement with prolonged adagio movement that necessitates sustained technical accuracy. In terms of metabolism, this implies that dancers reach high peaks of exercise intensity, which are alternated with active or passive recovery intervals, without allowing for oxygen consumption (VO₂) or heart rate (HR) stability throughout the activity. Dancing is not only enjoyable, but it also provides a beneficial workout for weight loss. Every day, a 30-

minute workout is required to maintain maximum health. Various styles of dancing aid in the burning of a variety of calories in the same period of time. One can burn twice as many calories in a ballet dancing class as one do in a modern dance lesson.

Walking is an aerobic activity that is rhythmic, energetic, and dynamic using big skeletal muscles that provides a wide range of health advantages with few side effects. Physical fitness is improved and maintained by walking faster than normal and in sufficient amounts into the 'training zone' of above 70% of maximal heart rate. Leg, limb girdle, and lower trunk muscles are strengthened, and cardinal joint flexibility is kept; posture and carriage may improve. Walking at any speed and for any length of time expends energy. The average middle-aged individual's should be able to walk 1.6 kilometres at 6.4 kilometres per hour on level ground and 4.8 kilometres per hour on a slope of 1 in 20. A brisk walk, which is quicker than a saunter, is around 3 miles per hour. One of the simplest and most efficient cardio workouts is a brisk stroll. One of the simplest and most efficient cardio workouts is a brisk stroll. And, best of all, Brisk-walking may be done without any additional equipment and can be done indoors or outdoors. To begin experiencing the many benefits of a fast-paced walk, all one need is a nice pair of sneakers.

The secret to obtaining a terrific exercise from brisk-walking is to keep a speed that is challenging for the heart and lungs but not so fast that one run out of steam.

On a treadmill, Brisk-walking at 100 steps per minute or 3.5 miles per hour can boost physical, mental, and emotional well-being, which is faster than a stroll²⁰⁴. To walk briskly, a shoes or trainers that are comfortable, provide adequate support and do not because blisters must be provided. Brisk-walking may be a measure for reducing impacts of chronic diseases. Understanding the perceptions of regular brisk walkers would be valuable for healthcare providers endeavoring to cultivate and promote regular Brisk-walking in middle-aged and older people²⁰⁵. Many people, however, are unable to do so due to physical inactivity.

Research has shown that the positive effects of enhanced physical fitness, and especially CRF, are comparable to or even greater than those of PA. The benefits of increased physical activity have been linked to lower risk of ischemic heart disease, stroke, diabetes, and depression, and to a reduced all-cause mortality.

Endnotes

1. [The Editors of Encyclopaedia Britannica](https://www.britannica.com/science/obesity/Causes-of-obesity), Obesity Medical Disorder: Corpulence, Fatness, Available online: <https://www.britannica.com/science/obesity/Causes-of-obesity>, 2022
2. Health risks of obesity: MedlinePlus Medical Encyclopedia, 2021, Available online: <https://medlineplus.gov/Medical-Encyclopedia>.
3. Federico Ponti, Andrea Plazzi, Giuseppe Guglielmi, Giulio Marchesini, & Alberto Bazzocchi, Body Composition, Dual-Energy X-Ray Absorptiometry And Obesity: the paradigm of fat (re)distribution, 5(3),2019. doi: [10.1259/bjrcr.20170078](https://doi.org/10.1259/bjrcr.20170078)
4. World Health Organisation. Fact on Obesity, Available online: <https://www.who.int/news-room/facts-in-pictures/detail/6-facts-on-obesity>, 2021
5. Yuetong Zhu, Zimin Wang, Hitoshi Maruyama, Ko Onoda & Qiuchen Huang, *Body Fat Percentage and Normal-Weight Obesity in the Chinese Population: Development of a Simple Evaluation Indicator Using Anthropometric Measurements*, *int. J. Environ. Res. Public Health*, 19(7), 2022, 4238.
6. A. Brian Derstine, A. Sven Holcombe, B. Brian Ross, C. Nicholas Wang, C. Stewart Wang & L. Grace Su. *Healthy Us Population Reference Values For Ct Visceral Fat Measurements And The Impact Of Iv Contrast, Hu Range, And Spinal Levels*, *Scientific Reports*. 12(2374), 2022.

7. [Soha Abd El Dayem, Sahar El-Masry, H. Elghawaby, Farid Amin & I.A. Ibrahim, *Total And Intra-Abdominal Fat Distribution In Obese Adolescents Using Different Techniques: Anthropometry, BIA and CT. Macedonian Journal of Medical Sciences*, 5\(3\), 2012, 269-274.](#)
8. [Baby Nadeem, Raham Bacha & Syed Amir Gilani, Correlation of subcutaneous fat measured on ultrasound with Body Mass Index. University Institute of Radiological Sciences and Medical Imaging Technologies, Lahore, Pakistan, 26\(4\), 2018, 205-209.](#)
9. World Health Organisation, Available online: <https://www.who.int/news/item/04-03-2022-world-obesity-day-2022-accelerating-action-to-stop-obesity>, 2022
10. [Wan Manan, Dieudonne Kuate, Rohana Jalil, Wan Suriati Wan Nik & USiti Azima Awang, *Self-perception and Quality of Life among Overweight and Obese Rural Housewives in Kelantan, Malaysia, Health and Quality of Life Outcomes*, 13\(19\), 2022,](#)
11. Food and Agriculture Organization of the United Nations (FAO) and the Pan American Health Organization (PAHO). Overweight affects almost half the population of all countries in Latin America and the Caribbean except for Haiti. 2017.
12. World Health Organisation (WHO). Over Weight and Obesity, Available Online: <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>, 2021.
13. [Waqas Sami, Tahir Ansari, Nadeem Shafique Butt, & Mohd Rashid Ab Hamid. *Effect Of Diet On Type 2 Diabetes Mellitus: A review Int J Health Sci \(Qassim\)*, 11\(2\), 2017, 6571.](#)
14. [Davies Adeloye, O. Janet Ige-Elegbede, Martinsixtus Ezejimofor, O. Eytayo Owolabi, Nnenna Ezeigwe, Chiamaka Omoyele, G. Rex Mpazanje, T. Mary Dewan, Emmanuel Agogo, A. Muktar Gadanya, Wondimagegnehu Alemu, O. Michael Harhay, Asa Auta, & Akindele O. Adebisi, *Estimating The Prevalence Of Overweight And Obesity In Nigeria In 2020: A Systematic Review And Meta-Analysis*, 53\(1\), 2021, 495–507.](#)
15. World Health Organisation (WHO), Malnutrition, Available Online: <https://www.who.int/news-room/fact-sheets/detail/malnutrition>, 2021.
16. [Adekunle Sanyaolu, Chuku Okorie, Xiaohua Qi, Jennifer Locke, & Saif Rehman. Childhood and Adolescent Obesity in the United States: A Public Health Concern, Available Online: 10.1177/2333794X19891305, 2019](#)
17. [Anna Kontsevaya , Svetlana Shalnova , Alexandr Deev , Joao Breda, Jo Jewell, Ivo Rakovac, Alexandra Conrady , Oxana Rotar, Yulia Zhernakova, Irina Chazova & Sergey Boytsov. Overweight and Obesity in the Russian Population: Prevalence in Adults and Association with Socioeconomic Parameters and Cardiovascular Risk Factors, 12\(1\), 2019, 103-114.](#)

18. The Lancet. Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: A Pooled Analysis Of 2416 Population-Based Measurement Studies In 128·9 Million Children, Adolescents, And Adults, *390(10113)*,2017, 2627-2642.
19. National Health and Nutrition Examination Survey(NHANES) Adult Obesity Facts. March, Available Online: <https://www.cdc.gov/obesity/data/adult.html>,2020
20. [Christiane L. Haase](#), [Kirsten T. Eriksen](#), [Sandra Lopes](#), [Altynai Satylganova](#), [Volker Schneck](#), & [Phil McEwan](#). Body Mass Index And Risk Of Obesity-Related Conditions In A Cohort Of 2.9 Million People: Evidence From A Uk Primary Care Database. PMID: [33841883](#),,7(2),2021, 137–147.
21. [Mweete Debra Nglazi](#) & [John Ele-Ojo Ataguba](#). Overweight And Obesity In Non-Pregnant Women Of Childbearing Age In South Africa: Subgroup Regression Analyses Of Survey Data from1998to2017.22(395),2022.
22. Par Fannie Lajeunesse-Trempe, association between anthropometric features, metabolic syndrome (ms) and other cardio-metabolic risk factors in a population from kenya. March, Available Online: <https://dam-oclc.bac-lac.gc.ca>,2018
23. [Mohsen Mazidi](#), [Maciej Banach](#) & [Andre Pascal Kengne](#), *lipid and Blood Pressure Meta-Analysis Collaboration. Prevalence of Childhood and Adolescent Overweight and Obesity in Asian Countries: A Systematic Review and Meta-Analysis*, 14(6), 2018 1185–1203.
24. World Health Organisation (WHO), Overweight and Obesity, Available Online: <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>2021
25. [Davies Adeloye](#), [Janet O. Ige-Elegbede](#), [Martinsixtus Ezejimofor](#), [Eyitayo O. Owolabi](#), [Nnenna Ezeigwe](#), [Chiamaka Omoyele](#), [Rex G. Mpazanje](#), [Mary T. Dewan](#), [Emmanuel Agogo](#), [Muktar A. Gadanya](#), [Wondimagegnehu Alemu](#), [Michael O. Harhay](#), [Asa Auta](#), & [Akindele O. Adebisi](#). *Estimating The Prevalence Of Overweight and Obesity in Nigeria in 2020: A Systematic Review and Meta-Analysis*, 53(1), 2021, 495507.
26. [Heather M. Francis](#), [Richard J. Stevenson](#), [Megan J. Oaten](#), [Mehmet K. Mahmut](#) & [Martin R. Yeomans](#). The Immediate and Delayed Effects of TV: Impacts of Gender and Processed-Food Intake History, Available Online: <https://doi.org/10.3389/fpsyg.2017.01616>
27. [Paul Adepoju](#) , Key To Addressing Obesity in Africa Lies In Education, Food Systems, Available Online: <https://www.devex.com/news/key-to-addressing-obesity-in-africa-lies-in-education-food-systems-99644a>, 2021

28. Alan Chait & J. Laura. den Hartigh, Adipose Tissue Distribution, Inflammation and Its Metabolic Consequences, Including Diabetes and Cardiovascular Disease,25, Available Online: <https://doi.org/10.3389/fcvm.2020.00022>
29. [Anna Fenton](#). Weight, Shape, and Body Composition Changes at Menopause, *12(3)*,187–192, Available Online:[10.4103/jmh.jmh_123_21,2021](https://doi.org/10.4103/jmh.jmh_123_21,2021)
30. Jonathan Q Purnell, Definitions, Classification, and Epidemiology of Obesity, Available Online: <https://www.ncbi.nlm.nih.gov/books/NBK279167/,2018>
31. [Michele Longo](#), [Federica Zatterale](#), [Jamal Naderi](#), [Luca Parrillo](#), [Pietro Formisano](#), [Gregory Alexander Raciti](#), [Francesco Beguinot](#), & [Claudia Miele](#), Adipose Tissue Dysfunction as Determinant of Obesity-Associated Metabolic Complications,*20(9)*, 2019,2358.
32. Srđan Pandurević, Djuro Macut, Flaminia Fanelli, Uberto Pagotto & Alessandra Gambineri. Biomediators in Polycystic Ovary Syndrome and Cardiovascular Risk. 2021.
33. [Pimjai Anthanont](#), [Paola Ramos](#), [Michael D Jensen](#), & [Kazanna C. Hames](#). Family History of Type 2 Diabetes, Abdominal Adipocyte Size and Markers of the Metabolic Syndrome. *PMC5818259*, 41(11),2018, 1621–1626.
34. Nicole D. Ford, Shivani , A. Patel, & K.M. Venkat Narayan, *Obesity in Low- and Middle-Income Countries: Burden, Drivers, and Emerging Challenges: Annual Review of Public Health*, 38, 2017, 145-164.
35. [Valentina Salvestrini](#), [Christian Sell](#) & [Antonello Lorenzini](#), Obesity May Accelerate the Aging Process, Available Online: <https://doi.org/10.3389/fendo.2019.002662019>.
36. [Francesco Weiss](#), [Margherita Barbuti](#), [Giulia Carignani](#), [Alba Calderone](#), [Ferruccio Santini](#), [Icro Maremmani](#) & [Giulio Perugi](#), Psychiatric Aspects of Obesity: A Narrative Review of Pathophysiology and Psychopathology, *9(8)*,2020, 2344.
37. Nahla Hwalla, Lara Nasreddine, & Sibelle El Labban, Cultural determinants of obesity in low- and middle-income countries in the Eastern Mediterranean Region,10, Available Online: <https://www.ncbi.nlm.nih.gov/books/NBK565803/2017>.
38. [Beatrice Ragnoli](#), [Patrizia Pochetti](#), [Mariangela Barbieri](#), [Lucrezia Mondini](#), [Luca Ruggero](#), [Liliana Trotta](#), [Paolo Montuschi](#) & [Mario Malerba](#), Sleep Deprivation, Immune Suppression and SARS-CoV-2 Infection,*19(2)*,2022, 904.
39. Benioff Children’s Hospital Oakland, Obesity 2002 - 2022. The Regents of the University of California, Available Online: <https://www.ucsfbenioffchildrens.org/conditions/obesity>
40. [Adda Bjarnadottir, MS, RDN \(Ice\)](#), 9 Reasons Why Obesity is Not Just a Choice, Available Online:https://www.healthline.com/nutrition/9reasonsobesityisnotachoice#toc_title_hdr_9,2022.

41. [Su Jin Kim](#), [Sung Yoon Cho](#), & [Dong-Kyu Jin](#), Prader-Willi Syndrome: an update on Obesity And Endocrine Problems, 26(4), 2021 Dec 31, 227–236.
42. [Matthew sherman](#), [ming-mei liu](#), [shari birnbaum](#), [steven e. Wolf](#), [joseph p. Minei](#) & [joshua w. Gatson](#), Adult Obese Mice Suffer From Chronic Secondary Brain Injury After Mild ,vo. 13, 2016, 171.
43. NationalCancerInstitute,ObesityandCancer,AvailableOnline:<https://www.cancer.gov/about-cancer/causes-prevention/risk/obesity/obesity-fact-sheet2022>
44. [Yan lu](#), [e wang](#), [ying chen](#), [bing zhou](#), [jiejie zhao](#), [liping xiang](#), [yiling qian](#), [jingjing jiang](#), [lin zhao](#), [xuelian xiong](#), [zhiqiang lu](#), [duojiao wu](#), [bin liu](#), [jing yan](#), [rong zhang](#), [huijie zhang](#), [cheng hu](#), & [xiaoying li](#), Obesity-Induced Excess Of 17-Hydroxyprogesterone Promotes Hyperglycemia Through Activation of Glucocorticoid Receptor, 130(7), 2020 , 3791–3804. D
45. [Huaizhu wu](#) & [christie m. Ballantyne](#), Metabolic Inflammation And Insulin Resistance In Obesity,126, 2020, 1549–1564. <https://doi.org/10.1161/circresaha.119.315896>.
46. Michael .P Czech, Insulin action and resistance in obesity and type 2 diabetes, 23(7),Jul 11, 804–814, Available Online:[10.1038/nm.4350](https://doi.org/10.1038/nm.4350),2017
47. M. [Sharon Fruh](#), Obesity: Risk Factors, Complications, and Strategies for Sustainable Long-Term Weight Management,29(1),2017,S3–S14. doi: [10.1002/2327-6924.12510](https://doi.org/10.1002/2327-6924.12510).
48. L.Burrows., & J. Wright. The good life: New Zealand Children's Perspectives On Health and Self Sport, Education and Society, 2004. 9(2), 193-205. doi:10.1080/1357332042000233930.
49. [Danielle Tholey](#) & Sidney Kimmel, Fatty Liver, Medical College at Thomas Jefferson University,2021.<https://www.msmanuals.com/home/liver-and-gallbladder-disorders/manifestations-of-liver-disease/fatty-liver>.
50. [Motonari Ri](#), [Susumu Aikou](#), & [Yasuyuki Seto](#). Obesity As A Surgical Risk Factor, 2(1), 2018 Jan. 13–21. doi: [10.1002/ags3.12049](https://doi.org/10.1002/ags3.12049)
51. Cleveland Clinic, Class III Obesity (Formerly Known as Morbid Obesity), Available Online:<https://my.clevelandclinic.org/health/diseases/21989-class-iii-obesity-formerly-known-as-morbid-obesity2022>.
52. [Gavin Van De Walle](#) & MS, RD. What Is a Calorie Deficit, and How Much of One Is Healthy, medically reviewed by [Jillian Kubala](#),Available Online: <https://www.healthline.com/nutrition/calorie-deficit2019>.
53. OsamaHamdy,Obesity Treatment&Management,AvailableOnline:<https://emedicine.medscape.com/article/123702-treatment?reg=1>,2022

54. Liang Shen , Xiangmin Meng , Zhongrong Zhang & Tianhui Wang. Physical Exercise for Muscle Atrophy.1088; 2018: 529-545.
55. T. Rowan Chlebowski, Juhua Luo, Garnet L. Anderson, Wendy Barrington, Kerry Reding, Michael S. Simon, JoAnn E. Manson, Thomas E. Rohan, Jean Wactawski-Wende, Dorothy Lane, Howard Strickler, Yasmin Mosaver-Rahmani, Jo L. Freudenheim, Nazmus Saquib, & Marcia L. Stefanick. Weight Loss and Breast Cancer Incidence in Postmenopausal Women, 125(2),2019, 205–212.
56. Asia Zierle-Ghosh & Arif Jan. Physiology, Body Mass Index, Available Online: <https://www.ncbi.nlm.nih.gov/books/NBK535456/2021>.
57. Henry-unaeze, & e.k. Ngwu, *Eating habits and dietary practices among outpatient type 2 diabetic adults in enugu, Nigeria*, **Journal of dietitians association of Nigeria (jdan)**, 11(2), 2020 print issn: 2141-8209; eissn:2635-3326.www.jdan.org.ng.
58. Dhandevi pem & rajesh jeewon, Fruit And Vegetable Intake: Benefits And Progress Of Nutrition Education Interventions- Narrative Review Article.4 (10): 2015, 1309–1321. <https://www.ncbi.nlm.nih.gov/pmc/articles/pmc4644575/>.
59. Henrik Holm Thomsen, Nikolaj Rittig, Mogens Johannsen, Andreas Buch Møller, Jens Otto Lunde Jorgensen, Niels Jessen & Niels Moller, Effects Of 3-Hydroxybutyrate And Free Fatty Acids on Muscle Protein Kinetics And Signaling During Lps-Induced Inflammation in Humans: Anticatabolic Impact Of Ketone Bodies. 108(4),2018.
60. Adda Bjarnadottir, MS, RDN (Ice) & Jillian Kubala, MS, RD, Alternate-Day Fasting: A Comprehensive Beginner's Guide. — Medically reviewed.2020.
61. Miguel A. Montoro-Huguet, Blanca Belloc, & Manuel Domínguez-Cajal, Small and Large Intestine (I): Malabsorption of Nutrients, 13(4), 2021, 1254.
62. K.Vinay.Kapoor.StomachAnatomy,AvailableOnline:<https://emedicine.medscape.com/article/1899301-overview>
63. Dimitrios I. Athanasiadis, Sara Monfared, Jennifer N. Choi, Don Selzer, Ambar Banerjee & Dimitrios Stefanidis, Vertical Banded Gastroplasty Revision to Gastric Bypass Leads to Effective Weight Loss and Comorbidity and Dysphagia Symptom Resolution, 30, 2020, 3453–3458.
64. mayo clinic q and a:transplant options for patients who are obese. gastric bypass (roux-en-y) .2022.<https://www.mayoclinic.org/tests-procedures/gastric-bypass-surgery/about/pac-20385189>.
65. Aetna,ObesityandSurgery.2022.https://www.aetna.com/cpb/medical/data/100_199/0157.html.

66. [Alana Biggers, & Natalie Silver](https://www.healthline.com/health/jaw-wired-shut2019). What to Know about Jaw Wiring, Available Online: <https://www.healthline.com/health/jaw-wired-shut2019>.
67. American Society of Plastic Surgeons Liposuction, 10 things to know and 10 questions to ask, Available Online: <https://www.plasticsurgery.org/news/blog/liposuction-10-things-to-know-and-10-questions-to-ask,2018>
68. Colette Gallagher. Science Saturday: Researchers Explore Personalized Approach to Anti-Obesity medications, Available Online: <https://newsnetwork.mayoclinic.org/discussion/science-saturday-researchers-explore-personalized-approach-to-anti-obesity-medications/2021>
69. T. Cuff, [Historical Anthropometrics](#). The EHS Annual Conference 2022, Available Online: <https://eh.net/encyclopedia/historical-anthropometrics/2022>.
70. K. Casadei & J. Kiel. Anthropometric Measurement, Available Online: <https://www.ncbi.nlm.nih.gov/books/NBK537315/2021>.
71. J. Frost. Percentile: Interpretations and Calculation, Available Online: <https://statisticsbyjim.com/basics/percentiles/2019>.
72. Z score and Percentile. E-resource, Available Online: <https://anthro.du.ac.in/e-resources2020/shivani/z%20score%20and%20percentile.pdf2020>.
73. World Health Organisation (WHO). World Health Statistics 2019: Monitoring Health for the Sustainable Development Goals (SDGs).
74. Medline Plus. Aging changes in the bones - muscles – joints, Available Online: <https://medlineplus.gov/ency/article/004015.htm2020>.
75. [Rebecca Kuriyan](#), Body Composition Techniques, Indian, 148(5), 2018, 648–658.
76. [Magnus Borga](#), [Janne West](#), [Jimmy D Bell](#), [Nicholas C Harvey](#), [Thobias Romu](#), [Steven B Heymsfield](#), & [Olof Dahlqvist Leinhard](#), Advanced Body Composition Assessment: From Body Mass Index to Body Composition Profiling, 66(5), 2018.
77. [Biskup M](#), [Macek P](#), [Król H](#), [Nogajczyk M](#), [Terek-Derszniak M](#), [Skowronek T](#), et al. Predictions Of The Incidence Of Gastrointestinal Cancers In The Swietokrzyskie Region In The Year 2025. *Med Stud./Stud Med.* 2019; 32–40. [Google Scholar](#).
78. [Melissa Chambers](#), [Stephanie K. Tanamas](#), [Elena J. Clark](#), [Diana L. Dunnigan](#), [Chirag R. Kapadia](#), [Robert L. Hanson](#), [Robert G. Nelson](#), [William C. Knowler](#), & [Madhumita Sinha](#), Growth Tracking in Severely Obese or Underweight Children, 140(6), 2017, e20172248.

79. Frank W. Booth, Christian K. Roberts, John P. Thyfault, Gregory N. Ruegsegger, & Ryan G. Toedebusch, Role of Inactivity in Chronic Diseases: Evolutionary Insight and Pathophysiological Mechanisms, Available Online: <https://doi.org/10.1152/physrev.00019.20162017>
80. Jordan King & David R. Lowery. Physiology, Cardiac Output, Available Online: <https://www.ncbi.nlm.nih.gov/books/NBK470455/2022>.
81. Amer Suleman, & Craig C Oneng, Exercise Physiology, Available Online: <https://emedicine.medscape.com/article/88484-overview#a42020>.
82. Riddhi Ramanlal & Vikas Gupta, Physiology, Vasodilation, Available Online: <https://www.ncbi.nlm.nih.gov/books/NBK557562/2022>
83. Joshua. E Brinkman, Fadi Toro & Sandeep Sharma, Physiology, Respiratory Drive, <https://www.ncbi.nlm.nih.gov/books/NBK482414/2022>.
84. James Beckerman. Individual's Heart Rate, Available Online: <https://www.webmd.com/heart-disease/heart-failure/watching-rate-monitor,2020>.
85. Debra Sullivan & Jon Johnson. What to Know about low blood pressure with high pulse, Available Online: <https://www.medicalnewstoday.com/articles/low-blood-pressure-high-pulse2021>.
86. Mayo Clinic. Exercise intensity: How to measure it, Available Online: <https://www.mayoclinic.org/healthy-lifestyle/fitness/in-depth/exercise-intensity/art-20046887/2022>.
87. Jake Tipane, CPT & Sarah Kester, Science Based Training Scheme, Available Online: <https://www.healthline.com/health/fitt-principle2020>
88. Sagar Patel; Alvin Jose & Shamim S. Mohiuddin, Physiology, Oxygen Transport and Carbon Dioxide Dissociation Curve, 2022.
89. Danielle Hildreth, RN, CPT & Jane Chertoff . 10 Aerobic Exercise Examples: How to, Benefits, and More, Available Online: <https://www.healthline.com/health/fitness-exercise/aerobic-exercise-examples2022>
90. Micky Lal, Tamera Clifton, & Nicole Davis. 5 Fat-Burning Low Impact Exercises That Won't Kill Individual's Knees, Available Online: <https://www.healthline.com/health/fitness-exercise/low-impact-exercises2022>.
91. Lawrence Robinson, Jeanne Segal, & Melinda Smith. The Mental Health Benefits of Exercise, Available Online: <https://www.helpguide.org/articles/healthy-living/the-mental-health-benefits-of-exercise.htm2022>

92. Health & Fitness, 10 Best Cardio Workouts for Weight Loss, Available Online: <https://www.mensjournal.com/health-fitness/best-types-cardio-workouts-weight-loss/2022>.
93. David Zelman, Exercise to Treat Arthritis; Available Online: <https://www.webmd.com/arthritis/exercise-treat-arthritis2021>
94. Cleveland Clinic medical professional. Aerobic Exercise, Available Online: <https://my.clevelandclinic.org/health/articles/7050-aerobic-exercise2019>.
95. Daniel Bubnis & Emily Cronkleton, 6 Warm-up Exercises to Help Boost Individual's Workout, Available Online: <https://www.healthline.com/health/fitness-exercise/warm-up-exercises#benefits2019>
96. Basim wadood, What Is A Structured Physical Activity, Available Online: <https://www.readersfact.com/what-is-a-structured-physical-activity/2022>.
97. Public Health Agency of Canada, A Common Vision for Increasing Physical Activity and Reducing Sedentary Living in Canada: Let's Get Moving, 12-08. ISBN: 978-0-660-08860-0, Available Online: <https://www.canada.ca/en/publichealth/services/publications/healthy-living/lets-get-moving.html2020>
98. Lauren Sharkey & Paula Field, Exercise Levels Predict Lifespan Better than Smoking, Medical History, 2019. <https://www.medicalnewstoday.com/articles/326958>.
99. Amer Suleman & Sherwin SW. Exercise Prescription. Updated, Available Online: <https://emedicine.medscape.com/article/88648-overview2021>.
100. Ikechi G. Okpechi¹, Vinash Kumar Hariramani¹, Naima Sultana¹, Anukul Ghimire¹, Deenaz Zaidi¹, Shezel Muneer¹, Mohammed M. Tinwala¹, Feng Ye¹, Megan Sebastianski¹, Abdullah Abdulrahman¹, Branko Braam¹, Kailash Jindal¹, Maryam Khan¹, Scott Klarenbach¹, Soroush Shojail¹, Stephanie Thompson¹, Aminu K. Bello¹. The Impact Of Community-Based Non-Pharmacological Interventions On Cardiovascular And Kidney Disease Outcomes In Remote Dwelling Indigenous Communities, A Scoping Review Protocol, Available Online: <https://doi.org/10.1371/Journal.Pone.02698392022>.
101. Jillian Kubala & Adda Bjarnadottir, 9 Reasons One May Be Gaining Weight Unintentionally; Medically reviewed. 2019.
102. María Mendoza-Muñoz, José Carmelo Adsuar, Jorge Pérez-Gómez, Laura Muñoz-Bermejo, Miguel Ángel Garcia-Gordillo & Jorge Carlos-Vivas, Influence of Body Composition on Physical Fitness in Adolescents, 56(7), 2020, 328.

103. Holly Blake, Kathryn Watkins, Matthew Middleton, & Natalia Stanulewicz, Obesity and Diet Predict Attitudes towards Health Promotion in Pretest Registered Nurses and Midwives, 18(24), 2021,13419.
104. W. H. M. Saris , S. N. Blair , M. A. van Baak1 , S. B. Eaton, P. S. W. Davies , L. Di Pietr , M. Fogelholm ,A. Rissanen , D. Schoeller , B. Swinburn , A. Tremblay , K. R. Westerterp & H. Wyatt, *How Much Physical Activity is Enough to Prevent Unhealthy Weight Gain? Outcome of the 1st Stock Conference and Consensus Statement: The International Association for the Study of Obesity. Obesity reviews*, 4, 2003, 101–114.
105. Anne McTiernan, Bess Sorensen, Melinda L Irwin, Angela, Exercise Effect on Weight and Body Fat in Men and Women. 15(6), 2007. 1496-512.
106. Chih-Hui Chiu, Ming-Chen Ko, Long-Shan Wu, Ding-Peng Yeh, Nai-Wen Kan, Po-Fu Lee, Jenn-Woei Hsieh, Ching-Yu Tseng & Chien-Chang Ho, *Benefits Of Different Intensity Of Aerobic Exercise in Modulating Body Composition Among Obese Women Adults: a pilot randomized controlled trial: Health and Quality of Life Outcomes*,15(168)2017.
107. Deep Shukla & Alexandra Sanfins, Obesity: Exercising, not dieting, may be key to avoidinghealthrisks,AvailableOnline:<https://www.medicalnewstoday.com/articles/obesity-exercising-not-dieting-may-be-key-to-avoiding-health-risks#Body-mass-index-and-mortality-risk2021>.
108. Alice Bellicha, Marleen A. van Baak, Francesca Battista, Kristine Beaulieu, John E. Blundell, Luca Busetto, Eliana V. Carraça, Dror Dicker, Jorge Encantado, Andrea Ermolao, Nathalie Farpour-Lambert, Adriyan Pramono, Euan Woodward, Jean-Michel Oppert, *Effect of Exercise Training On Weight Loss, Body Composition Changes, and Weight Maintenance in Adults With Overweight Or Obesity: An overview of 12 systematic reviews and 149 studies*.2021.
109. University of Copenhagen, Researchers Find the Secret behind Maintaining Healthy WeightLoss,AvailableOnline:<https://scitechdaily.com/researchers-find-the-secret-behindmaintaining-healthy-weight-loss/amp/2021>.
110. Grazyna Sypniewska, Pro-Inflammatory and Prothrombotic Factors and Metabolic Syndrome.PMID:29632466,18(1),2007,3946.
111. ClevelandClinic.InsulinResistance,AvailableOnline:<https://my.clevelandclinic.org/health/diseases/22206-insulin-resistance2022>.
112. ShekharCapoor,ManishRajPahadia,M.L.Tank,PuneetRijhwani&ShatakshiSingh,*Prevalence of Metabolic Syndrome, Its Co-Morbidities and Effect of Treatment and Lifestyle Modification in Rural Females: International Journal of Research and Review*, 7(2),2020, 273. ISSN: 2454-2237

113. Hai-Jian Sun, Zhi-Yuan Wu, Xiao-Wei Nie & Jin-Song Bian, Role of Endothelial Dysfunction in Cardiovascular Diseases: The Link between Inflammation and Hydrogen Sulfide.2020. <https://doi.org/10.3389/fphar.2019.01568>
114. María J. Guembe, Cesar I. Fernandez-Lazaro, Carmen Sayon-Orea, Estefanía Toledo & Conchi Moreno-Iribas, Risk For Cardiovascular Disease Associated With Metabolic Syndrome and its Components: A 13-Year Prospective Study In The Rivana Cohort, 2020. <https://cardiab.biomedcentral.com/articles/10.1186/s12933-020-01166-6>.
115. BMJ Best Practice, Metabolic syndrome, 2022. <https://bestpractice.bmj.com/topics/en-us/212>.
116. Mina Wang, Yan Tan, Yifan Shi, Xu Wang, Zehuan Liao & Peng Wei, Diabetes and Sarcopenic Obesity: Pathogenesis, Diagnosis, and Treatments, Available Online: <https://doi.org/10.3389/fendo.2020.005682020>
117. Stephen R Bird & John A Hawley, Update on the Effects of Physical Activity on Insulinsensitivity in humans, Available Online: <https://bmjopensem.bmj.com/content/2/1/e0001432017>.
118. Kohei Kido, Kohei Sase, Takumi Yokokawa, & Satoshi Fujita. Enhanced Skeletal Muscle Insulin Sensitivity After Acute Resistance-Type Exercise Is Up Regulated By Rapamycin-Sensitive Mtor Complex 1 Inhibition, 10: 2020, 8509.
119. Kelly Wood, MD & Lauren Martin, Diabetes and metabolism: What to know, Available Online: <https://www.medicalnewstoday.com/articles/diabetes-and-metabolism2021>.
120. Dominik H. Pesta, Renata L. S. Goncalves, Anila K. Madiraju, Barbara Strasser & Lauren M. Sparks, Resistance Training To Improve Type 2 Diabetes: Working Toward a Prescription For the future, 14(24), 2017.
121. Brown, J.C., Cespedes Feliciano, E.M. & Caan, B.J. *The Evolution of Body Composition In Oncology—Epidemiology, Clinical Trials, and The Future Of Patient Care: Facts And Numbers*. **Journal of cachexia, sarcopenia and muscle**. 2018 9(7), pp.1200-1208.
122. J.B. Gillen, S. Estafanos & A. Govette, *Exercise-nutrient Interactions for Improved Postprandial Glycemic Control and Insulin Sensitivity*. **Applied Physiology, Nutrition, and Metabolism**, 46(8), 2021, 856-865.
123. M.A. Said, N.Y. Nafeh, & H.A. Abdallah, Spexin Alleviates Hypertension, Hyperuricaemia, Dyslipidemia And Insulin Resistance in High Fructose Diet Induced Metabolic Syndrome in Rats Via Enhancing Ppar- γ And Ampk And Inhibiting IL-6 and TNF- α . *Archives of Physiology and Biochemistry*. 2021, 1-6.

124. Yin, X., Chen, Y., Ruze, R., Xu, R., Song, J., Wang, C. & Xu, Q, *The evolving view of thermogenic fat and its implications in cancer and metabolic diseases*. **Signal Transduction and Targeted Therapy**, 7(1), 2022, 1-21.
125. I. Yun, H.J. Joo, Y.S. Park & E.C. Park, *Association between Physical Exercise and Glycated Hemoglobin Levels in Korean Patients Diagnosed with Diabetes*. **International Journal of Environmental Research and Public Health**, 19(6), 2022, 3280.
126. Müller-Wieland, D., Brandts, J., Verket, M., Marx, N. & K. Schütt, *Glycaemic Control in Diabetes. Prevention and Treatment of Atherosclerosis*. 2021,47.
127. P. Androulakis-Korakakis, J.P. Fisher & J. Steele, *The Minimum Effective Training Dose Required to Increase 1rm Strength In Resistance-Trained Men: a systematic review and meta-analysis*. **Sports Medicine**, 50(4), 2020, 751-765.
128. H. Chehregosha, M.E. Khamseh, M. Malek, F. Hosseinpanah & F. Ismail-Beigi, *A view beyond HbA1c: Role of Continuous Glucose Monitoring*. **Diabetes Therapy**, 10(3), 2019, 853-863.
129. S. Raghavan, J.L. Vassy, Ho, Y.L., R.J Song, D.R. Gagnon, K. Cho, P.W. Wilson & L.S, Phillips. *Diabetes Mellitus–Related All-Cause and Cardiovascular Mortality in a National Cohort Of Adults*. **Journal of the American Heart Association**, 8(4), 2019, p.e011295.
130. T. W. Levensgood, Y. Peng, K.Z. Xiong, Z. Song, R. Elder, M.K. Ali, M.H. Chin, P. Allweiss, C.M. Hunter & A. Becenti, *Community Preventive Services Task Force. Team-Based Care To Improve Diabetes Management: a community guide meta-analysis*. **American journal of preventive medicine**.2019, 57(1), pp.e17-e26.
131. Bülbül, a., özsoy, ş., ocakli, s. & b. Olcucu, *The Effect of Heavy Exercise on Plasma Lipid Levels in Elite Volleyball Male Athletes*, **Akdeniz Spor Bilimleri Dergisi**, 5(3),2022,604-612.
132. Henson, J., Edwardson, C.L., Davies, M.J., Gill, J.M., Heaney, L.M., Khunti, K., Ng, L., Sattar, N., Zaccardi, F. & T. Yates, *Physical Activity and Lipidomics in a Population At High Risk Of Type 2 Diabetes Mellitus*. **Journal of Sports Sciences**, 38(10), 2020, 1150-1160.
133. A. Kasiakogias & S. Sharma, *Exercise: The Ultimate Treatment to All Ailments*. **Clinical Cardiology**, 43(8), 2020, 817-826.
134. J.K. Cooney, Y.A. Ahmad, J.P. Moore, A. Sandoo & J.M. Thom, *The Impact of Cardiorespiratory Fitness on Classical Cardiovascular Disease Risk Factors in*

- Rheumatoid Arthritis: A Cross-Sectional and Longitudinal Study. *Rheumatology International*, 39(10), 2019,1759-1766.
135. A.V Mattioli, S. Sciomer, C. Cocchi, S. Maffei & S. Gallina, *Quarantine during COVID-19 outbreak: Changes in Diet and Physical Activity Increase the Risk of Cardiovascular Disease*. **Nutrition, Metabolism and Cardiovascular Diseases**, 30(9), 2020, 1409-1417.
 136. A. Muscella, E. Stefano & S. Marsigliante, *Effects of Exercise Training On Lipid Metabolism and Coronary Heart Disease*. **American Journal of Physiology-Heart and Circulatory Physiology**, 319(1), 2020, H76-H88.
 137. B. Kirk, K. Mooney, S. Vogrin, M. Jackson, G. Duque, O. Khaiya & F. Amirabdollahian, *Leucine-enriched Whey Protein Supplementation, Resistance-Based Exercise, and Cardiometabolic Health in Older Adults: A Randomized Controlled Trial*. **Journal of cachexia, sarcopenia and muscle**, 12(6), 2021, 2022-2033.
 138. J.N. Barnes & N. Charkoudian, *Integrative Cardiovascular Control in Women: Regulation of Blood Pressure, Body Temperature, and Cerebrovascular Responsiveness*, **The FASEB Journal**, 35(2), 2021, e21143.
 139. A. Rajpal, L. Rahimi & F. Ismail-Beigi, *Factors Leading To High Morbidity and Mortality of Covid-19 in Patients with Type 2 Diabetes*. **Journal of diabetes**, 12(12), 2020, 895-908.
 140. D. Tian & Meng. *Exercise for Prevention And Relief Of Cardiovascular Disease: Prognoses, Mechanisms, and Approaches*. *Oxidative Medicine and Cellular Longevity*, 2019.
 141. S. Dhaliwal, T. Colletti, S. Wijesinghe & C. Rheaume, *Effect of Physical Activity on Systemic Hypertension: A Review & Recommendations*, **Journal of Family Medicine and Health Care**, 8(3), 2022, 71-75.
 142. J.E. Sharman, N.A. Smart, J.S. Coombes & M. Stowasser, *Exercise and Sport Science Australia Position Stand Update on Exercise and Hypertension*, **Journal of human hypertension**, 33(12), 2019, 837-843.
 143. M. Esmailian, A. Amerizadeh, S. Vahdat, M. Ghodsi, R.I. Doewes & Y. Sundram, *Effect of Different Types of Aerobic Exercise on Individual's with and without Hypertension: An updated systematic review*. **Current problems in cardiology**, 2021, p.101034.

144. T. Speelman, L. Dale, A. Louw & N.J. Verhoog, the Association of Acute Phase Proteins in Stress and Inflammation-Induced t2d. *Cells*, 11(14), 2022, 2163.
145. O. Stirbu, F. Gadalean, I.V. Pitea, G. Ciobanu, A. Schiller, I. Grosu, A. Nes, R. Bratescu, N. Olariu, B. Timar & M.C. Tandrau, *C-reactive protein as a Prognostic Risk Factor for Loss of Arteriovenous Fistula Patency in Hemodialyzed Patients*, **Journal of Vascular Surgery** ,70(1),2019,208-215.
146. Agostinis-Sobrinho, C., Ramirez-Vélez, R., García-Hermoso, A., Rosário, R., Moreira, C., Lopes, L., Martinkenas, A., Mota, J. & Santos, R. *The Combined Association of Adherence To Mediterranean Diet, Muscular and Cardiorespiratory Fitness on Low-Grade Inflammation in Adolescents: A Pooled Analysis*. **European journal of nutrition**, 58(7), 2019, 2649-2656.
147. Nik Ibrahim, N.N.I., Abdul Rahman, R., Azlan, M., Abd Aziz, & A. H. Ghulam Rasool, Endothelial Microparticles as Potential Biomarkers in the Assessment of Endothelial Dysfunction in Hypercholesterolemia. *Medicina*, 58(6), 2022,824.
148. Xu, S., Ilyas, I., Little, P.J., Li, H., Kamato, D., Zheng, X., Luo, S., Li, Z., Liu, P., Han, J. & I.C. Harding, *Endothelial Dysfunction in Atherosclerotic Cardiovascular Diseases and Beyond: From Mechanism to Pharmacotherapies*. **Pharmacological Reviews**, 73(3), 2021, 924-967.
149. R. Esse, M. Barroso, I. Tavares de Almeida & R. Castro, *The Contribution of Homocysteine Metabolism Disruption to Endothelial Dysfunction: State-Of-The-Art*, **International journal of molecular sciences**, 20(4), 2019,867.
150. A. Thorp & J.G. Stine, Exercise as medicine: the impact of exercise training on nonalcoholic fatty liver disease, *Current hepatology reports*, 19(4), 2020, 402-411.
151. J. Gao, Pan, X., G. Li, E. Chatterjee & J. Xiao, *Physical exercise protects against endothelial dysfunction in cardiovascular and metabolic diseases*, **Journal of Cardiovascular Translational Research**.2021, 1-17.
152. J. Qian, D.J. McDonough & Z. Gao.VFG, *The Effectiveness of Virtual Reality Exercise on Individual's Physiological, Psychological and Rehabilitative Outcomes: A systematic review*, **International journal of environmental research and public health**, 17(11), 2020, 4133.
153. L.J .Gamble. Physical Rehabilitation for Small Animals. *Veterinary Clinics: Small Animal Practice*.2022.

154. H.S. Schaefer, N.H. Gist, K. Bigelman, J.D. Coelho, E.S. Proctor & R.M. Lerner. *Tough teams and optimistic individuals: The Intersecting Roles of Group and Individual's Attributes in Helping to Predict Physical Performance*. **The Journal of Psychology**, 155(1), 2021, 1-25.
155. S.H. Kim, M. Kim, Y.B. Ahn, H.K. Lim, S.G. Kang, & J. H. Cho, *Effect of Dance-exercise on cognitive function in elderly patients with metabolic syndrome: a pilot study*. **J. Sports Sci. Med**, 10, 2011, 671–678.
156. A.C. Veronda, C.E. Kline & L.A. Irish, *The Impact Of Circadian Timing on Energy Balance: An Extension of The Energy Balance Model*. *Health Psychology Review*, 16(2), 2022, 161-203.
157. R.M. Creighton, K.F. Paradis, N.E. Blackburn & M.A. Tully, *Group-Based Physical Activity Interventions Targeting Enjoyment in Older Adults: A Systematic Review*. **Journal of Ageing and Longevity**, 2(2), 2022, 113-129.
158. M.C. Haas, B.B. Sommer, S. Karrer, M. Jörger, E.S. Graf, M. Huber, D. Baumgartner, J. Bansi, J. Kool & C.M. Bauer, *Surface Electromyography Activity of Trunk Muscles During Trunk Control Exercises for People After Stroke; Effect of a Mobile and Stable Seat for Rehabilitation*, 17(7), 2022, e0272382.
159. W. Hollman, H.K. Strüder, C.V.M. Tagarakis, and G. King, *Physical activity and the elderly*. *Eur. J. Cardiovasc. Prev. Rehabil*, 14, 2007, 730–739.
160. A.C. Jeffries, S.M. Marcora, A.J. Coutts, L. Wallace, A. McCall & F.M. Impellizzeri. *Development of a Revised Conceptual Framework of Physical Training for Use in Research and Practice*. **Sports Medicine**, 2021, 1-16.
161. O. Laitano, M.A. King & L.R. Leon, *Common Misconceptions in Classic and Exceptional Heat Stroke*. In *heat stress in sport and exercise*, 2019. 91-112.
162. Y.S. Bhati & J.N. Saini, *A Comparative Study of Cardiovascular Fitness of Bodybuilders and Athletes during 50's Age*. **Central Asian Journal of Medical and Natural Science**, 3(5), 2022, 124-132.
163. K.D. Tambalis & L.S. Sidossis. *Physical Activity and Cardio metabolic Health*. *Cardiorespiratory Fitness in Cardio metabolic Diseases: Prevention and Management in Clinical Practice*, 2019, 405.
164. L.D. Méndez-Hernández, E. Ramírez-Moreno, R. Barrera-Gálvez, M.D.C. Cabrera-Morales, J. Reynoso-Vázquez, O.R. Flores-Chávez, L. Morales-Castillejos, N.D.S. Cruz-

- Cansino, R.C. Jiménez-Sánchez & J. Arias-Rico, *Effects of Strength Training on Body Fat in Children and Adolescents with Overweight and Obesity: A Systematic Review with Meta-Analysis*, 9(7),2022, 995.
165. R.P. Mullerpatan. Enhancing Physical Activity for Overall Development of Children using Traditional Indian Movement Science. *Holistic Development of One*, 87.
166. P.R. Stricker, A.D. Faigenbaum, T.M. McCambridge, C.R. LaBella, M.A. Brooks, G. Canty, A.B. Diamond, W. Hennrikus, K. Logan, K. Moffatt & B.A. Nemeth, Resistance Training for Children and Adolescents. *Pediatrics*, 145(6), 2020.
167. S. Burrige. Platforms for Change: Cambodia and Contemporary Dance from the Asia—Pacific Region. In *Beyond the Apsara*, 2022, 121-139.
168. D. Ellison, T. Wynard, J.L. Walton-Fisette & S. Benes, *Preparing the Next Generation of Health And Physical Educators Through Trauma-Informed Programmes*. **Journal of Physical Education, Recreation & Dance**, 91(9), 2020, 30-40.
169. P.E. Rice, K. Nishikawa & S. Nimphius, Isolated Joint Block Progression Training Improves Leaping Performance in Dancers. *Frontiers in Sports and Active Living*, 2021, 3.
170. Burrige, S. Platforms for Change: Cambodia and Contemporary Dance from the Asia—Pacific Region. In *Beyond the Apsara* , 2020, 121-139.
171. J. Rodrigues-Krause, G.C. dos Santos, M. Krause & A. Reischak-oliveira, *Dancing at Home during Quarantine: Considerations For Session Structure, Aerobic Fitness, and Safety*. **Journal of Physical Education, Recreation & Dance**, 92(4), 2021, 22-32.
172. C. Attwell, C. Dugan, A.K. McKay, J. Nicholas, L. Hopper & P. Peeling, Dietary Iron and the Elite Dancer. *Nutrients*, 14(9), 2022, 1936.
173. Nylander-French, Mikela. Oxygen Consumption during Rehearsal and Performance in Collegiate Dancers,2022. Thesis. <http://hdl.handle.net/20.500.12648/6702>.
174. Shannon S. D. Bredin, Kai L. Kaufman, Maddison I. Chow, Donna J. Lang, Nana Wu, David D. Kim, & Darren E. R. Warburton. Effects of Aerobic, Resistance, and Combined Exercise Training on Psychiatric Symptom Severity and Related Health Measures in Adults Living With Schizophrenia: A Systematic Review and Meta-Analysis, 2021, 8, 753117.

175. B. K. Pedersen & B. Salti, Evidence for prescribing exercise as therapy in 26 different chronic diseases. *Scand J. Med Sci Sports*, 2015.
176. David W. Hill, Brian K. McFarlin & Jakob L. Vingren, Exercise Above The Maximal Lactate Steady State Does Not Elicit A $\dot{V}O_2$ Slow Component That Leads To Attainment of $\dot{V}O_{2max}$, 46(2), 2021. <https://doi.org/10.1139/apnm-2020-026>
177. Styliani Douka, Vasiliki I. Zilidou, Olympia Lilou, & Vasiliki Manou, Traditional Dance Improves the Physical Fitness and Well-Being of the Elderly, 11(75), 2019. doi: 10.3389/fnagi.2019.00075.
178. Physiopedia, Anaerobic Exercise, Available Online: https://www.physiopedia.com/Anaerobic_Exercise2022
179. Amanda Greene & Andrea Lasner, Common Dance Injuries and Prevention Tips, Available Online: <https://www.hopkinsmedicine.org/health/conditions-and-diseases/sports-injuries/common-dance-injuries-and-prevention-tips2022>
180. AZCentral, What muscles are used in walking, Available Online: <https://healthyliving.azcentral.com/muscles-walking-exercise-1837.html2021>.
181. Monika Imierska, Adam Kurianiuk & Agnieszka Błachnio-Zabielska, The Influence of Physical Activity on the Bioactive Lipids Metabolism in Obesity-Induced Muscle Insulin Resistance, 10(12), 2020, 1665.
182. Mayo Clinic Staff, Walking: Trim your waistline, improve your health, Available Online: <https://www.mayoclinic.org/healthy-lifestyle/fitness/in-depth/walking/art-200462612021>.
183. R. Berman, Walking 8,200 Steps A Day May Lower Your Risk Of Chronic Disease, Available Online: <https://www.medicalnewstoday.com/articles/walking-8200-steps-a-day-may-lower-your-risk-of-chronic-disease-study-finds2022>
184. American Heart Association, Recommendation for Physical Activity, 2018, https://www.heart.org/HEARTORG/HealthyLiving/PhysicalActivity/StartWalking/American-Heart-Association-Guidelines-for-Physical-Activity_UCM_307976_Article.jsp.
185. Astrid Bergland, Lone Jørgensen, Nina Emaus & Bjørn Heine Strand, Mobility as a Predictor Of All-Cause Mortality in Older Men And Women: 11.8 year follow-up in the Tromsø study, 17(22), 2017.
186. Suh-Jung Kang, Byung-Hoon Kim, Hyo Lee & Jinsung Wang. The Beneficial Effects of Cognitive Walking Program on Improving Cognitive Function and Physical Fitness in Older Adults, 9(4), 2021, 419. 10.3390/healthcare9040419

187. Pi-Hsia Lee, RN, EdD , Yeu-Hui Chuang, RN, PhD, Su-Ru Chen, RN, PhD ,Chin-Lung Fang, PhD, Hsiang-Ru Lai, PhD , Pei-I Lee, RN , Perspectives of brisk walking among middle-aged and older persons in community: A qualitative study,24(2), 2017,147-153.
188. Mariam. E. Nelson, W. Jack. Rejeski, Stephen N. Blair, Pamela. W. Duncan, Abby. C. King, Carol.A. Macera, Carmen Castaneda-sceppa, James. O. Judge, *Physical activity and public Health in Older Adult*, **American Heart Association: British Journal of Sports Medicine**, 116(9), 2007.
189. S.M. Haffner. Abdominal adiposity and cardiometabolic risk: Do We Have All the Answers? *The American Journal of Medicine*, 120(9A), 2007, S10 - 17.
190. M. Hagstromer,P. Oja, &M. Sjostrom, The International Physical Activity Questionnaire (IPAQ): a study of concurrent and construct validity. *Public Health Nutrition*, 9(6),2006, 755-762.
191. J.G.Z. Uffelen van, M.J.M. Chinapaw, W. Mechelen van, & M. Hopman-Rock, *Walking or Vitamin B for Cognition in Older Adults with Mild Cognitive Impairment? A randomised controlled trial.* **Br. J. Sports Med**, 42,2008, 344–351. doi:10.1136/bjism.2007.044735.
192. E. L. Deci and R. M. Ryan, “Facilitating Optimal Motivation And Psychological Well-Being Across Life's Domains,” *Canadian Psychology*,49(1),2008,14–23, 2008. Google Scholar.
193. E. L. Deci and R. M. Ryan, *Intrinsic Motivation and Self-Determination in Human Behavior*, Plenum Press, New York, NY, USA, 1985.
194. R. K. Dishman and J. Buckworth, “Increasing Physical Activity: A Quantitative Synthesis,” *Medicine and Science in Sports and Exercise*, 28(6), 706–719, 1996. Google Scholar
195. Mouaz H. Al-Mallah, Stephen P. Juraschek, Seamus Whelton, Zeina A. Dardari, Jonathan K. Ehrman, Erin D. Michos, Roger S. Blumenthal, Khurram Nasir, Waqas T. Qureshi, Clinton A. Brawner, Steven J. Keteyian, & Michael J. Blaha, Sex Differences in Cardiorespiratory Fitness and All-Cause Mortality: The Henry Ford Exercise Testing , 91(6),2017,755–762.
196. Dafna Merom, Anne Grunseit, Ranmalee Eramudugolla , Barbara Jefferis, Cognitive Benefits of Social Dancing and Walking in Old age: The Dancing Mind Randomized Controlled Trial. Trial Registration: Australian and New Zealand Clinical Trials Register, 2016.
197. Ismail-Orire, Halimat I'ya. Effect Of Brisk-walking On Anthropometric Indices And Physiological Characteristics Of Obese Adults In Ilorin Metropolis, Kwara State University (Nigeria) ProQuest Dissertations Publishing, 2021. 28542722.<https://www.proquest.com/openview/4d0ad5c42ea2afba741f39ac1d4393b4/1?pq-origsite=gscholar&cbl=2026366&diss=y>

198. Tai-Hsiung Hung, 1 Pei-A Liao, 2 Hung-Hao Chang, *Examining the Relationship between Cardiorespiratory Fitness and Body Weight Status: Empirical Evidence from Population-Based Survey of Adults in Taiwan*. **The Scientific World Journal**, 2014, 7. Article ID 463736,
199. R. Carlijn Lamers, Repeated Prolonged Moderate-Intensity Walking Exercise Does Not Appear to have Harmful Effects on Inflammatory Markers in Patients with Inflammatory Bowel Disease, -py7k nigeria. *Scandinavian Journal of Gastroenterology*, 56(1),2021, 30–37.
200. Elsie Hui a,* , Bo Tsan-keung Chui b, Jean Wooa, Effects of Dance on Physical And Psychological Well-Being in Older Persons, *East J Med*, 23(2),20118.
201. Özcan Saygın and Mehmet Ali Öztürk, *Effect of a Twelve-Week Aerobic Exercise Programme On Health-Related Physical Fitness Components And Blood Lipids In Obese Females*. **African Journal of Pharmacy and Pharmacology** Vol. 5(12), 2011, 1441-1445.
202. M Neovius, Y Linné, & S Rossner. *BMI, Waist-Circumference And Waist-Hip-Ratio As Diagnostic Tests For Fatness in Adolescents*. **International Journal of Obesity**, 29(2), 2005, 163-9.
203. Arslan, “Impact of an Eight-Week Step-Aerobic Dancing Training Programme On Body Composition Markers In Middle-Aged Inactive Obese Women”. *International Federation of Sports Medicine Aksaray*, Available Online: <https://journals.co.za/doi/pdf/10.10520/EJC484192011>
204. https://www.heart.org/HEARTORG/HealthyLiving/PhysicalActivity/StartWalking/American-Heart-Association-Guidelines-for-Physical-Activity_UCM_307976_Article.jsp
205. American Heart Association, <https://www.heart.org/en/health-topics/high-blood-pressure/understanding-blood-pressure-readings>

Chapter Three

Methodology

This chapter describes the procedures and strategies for data collection. It is organized to cover the following services:

3.1 Research Design

Randomised experimental Pretest-posttest control group design was adopted for this study. This design was chosen because the study used random assignment of participants to control and experimental groups. The investigation was carried out using 3x2 factorial matrices, which were used for this study. The participants were divided into three groups: experimental group 1, experimental group 2, and control group. The experimental group 1 received the dance-exercise intervention programme, while the experimental group 2 received the brisk-walking intervention programme. The control group was given a placebo (Nutrition education) with no awareness of the experimental groups' intervention Programme.

Table 3.1: Pretest-posttest Design out line

| | | | | |
|-----------------------------|----------|----------------------|----------------------|----------------------|
| Experimental Group 1 | R | O₁ | X₁ | O₂ |
| Experimental Group 2 | R | O₃ | X₂ | O₄ |
| Control Group | R | O₅ | X₃ | O₆ |

Source: Researcher

O₁, O₃ and O₅= Pretest of the experimental 1, experimental 2 and control groups respectively.

r = Randomization

X₁= Treatment Dance-exercise

X₂= Brisk-walking

X₃= Placebo (Health Talk on Nutrition Education)

O₂, O₄ and O₆=Posttest of the experimental 1, experimental 2 and control groups respectively.

| Independent Variables | Moderating Variables |
|---------------------------------|-----------------------------|
| 1. Treatment 1 (Dance-exercise) | Sex |
| 2. Treatment 2(Brisk-walking) | (10 Male) |

| | | |
|---|--------------------------|--|
| | (10 Female) | Table 3.2: Breakdown of the Factorial |
| 3. Control Group (Health Talk on Nutrition Education) | Sex | |
| | (10 Male) (10 Female) | |

Matrix (3 X 2 factorial matrix)

Source: Researcher

3.2 Population of the Study

The population for this study consisted of all male and female undergraduates of Lead City University, Ibadan, Nigeria categorized as obese.

3.3 Sample and Sampling Techniques

The sample size for this study was sixty students who were categorized as obese after screening utilizing body mass index and waist-hip-ratio categorization by World Health Organisation (WHO). The participants were chosen using a multistage sampling technique.

The following are the phases involved in the procedure:

Stage 1: Purposive sampling technique was used to select sixty undergraduates categorized as obese in Lead City University.

Stage 2: Simple random sampling technique was used to randomly assign participants to the three groups of two experimental and a control. This was accomplished through the use of the

ballot system. The treatment and control groups were assigned through balloting, with the researcher labeling the intervention and control programmes.

Inclusion and Exclusion Criteria

Obese undergraduates at Lead City University were included. All individuals who completed the readiness questionnaire and found eligible were permitted to engage in the exercise programme. The exercise programme was open to all individuals who are medically fit. Participants who do not fall into the obese category or have a low waist-to-hip ratio, or who have medical records indicating that they are not qualified to participate in an exercise programme, were not permitted to participate.

3.4 Description of the Research Instruments

A stopwatch was used in timing the participants during Dance-exercise and Brisk-walking session¹.

Weighing scale: Hanna portable weight measuring scale (RA9012) made in England was used to measure total body weight of the participants in kilogram (kg). The accuracy of these instruments is within 50g. Calibration of all scale is critical. This was done using calibration weights, certified by a government department of weights and easers and totaling at least 150kg². Portable speaker, acoustic pro, model: AP 121, power input: 110v-220v/50-60Hz, output: 800w (P.M.P.O) made in china, was used to amplify and adjust the sound quality, To play music for Dance-exercise.

Floor mats was used for floor exercises. Stadiometer is an instruments used for measuring stature and height. It is usually attached to a wall so that the participant can be aligned vertically in the appropriate manner. It had minimum range of measurement of 60cm to 220cm and the accuracy of measurement was used to measure participant's height to the nearest 0.1centimer³.

Sphygmomanometer, N4 1PS, made by Accosson, vale road, London, was also used to measure blood pressure. Stethoscope, No NP22 5XD, made by Tytan Medical in U.K, used for measuring heart rate. The exercise programmes were carried out on the track and gymnasium.

3.5 Validity of Research Instruments

Validity is the ability of a test results to reflect the accuracy of the parameters being measured. The test must be valid for an accurate score to be obtained. For this research, standardized scientific tests and instruments were used for this study to ensure validity. The researcher, supervisor and research assistants in the field of exercise physiology endeavored to cross-check the workability of the instruments before use. Calibration of all scale is critical, therefore, the researcher re-calibrated the stadiometer using calibration weights, certified by a government department of weights and easers and totaling at least 150kg². Also, sygmomanometers was subjected to test-re-test to validate the instrument.

3.6 Reliability of the Research Instrument:

Reliability of an instrument is the consistence of an instrument to measure what it is purported to measure. All the instruments that were used by the researcher for testing have been utilized by other researchers to test the various physical fitness components and have been found to be reliable.

3.7 Data Collection

In order to investigate the effect of dance-exercise and brisk-walking on the anthropometric and Cardiorespiratory indices of obese undergraduates in Lead City University, Ibadan, Nigeria, standardized instruments were used. These are explained as follows:

The training programme was continuous low-moderate impact dance-exercise and brisk-walking performed by experimental group 1 and 2 respectively, while the control group was placed on placebo (Health talk – Nutrition Education) for 8 week.

Anthropometric Indices

In determining anthropometric measures, Body Mass Index (BMI) was calculated using the following equation: $\text{Weight (in kilograms)}/\text{Height (in meters)} \times \text{height (in meters)} = \text{BMI}$. For instance, $60\text{kilograms} / (1.65\text{meters} \times 1.65\text{meters}) = 22.03$. Note:

Healthy weight: BMI of 19 to 24.9

Overweight: BMI of 25 to 29.9

Obese: BMI of 30 and above

| Health Risk | Women | Men |
|-------------|----------------|---------------|
| Low | 0.80 or lower | 0.89 or lower |
| Moderate | 0.81-0.85 | 0.9-0.99 |
| High | 0.86 or higher | 1.0 or higher |

Table 3.3: Table showing Measures for, Waist-to-hip-ratio (WHR)

Source: <https://eh.net/encyclopedia/historical-anthropometrics/2022>.

WHR measures the ratio of waist circumference to hip circumference. According to WHO, a healthy WHR is: 0.9 or less for men, 0.85 or less for women. How to measure: (W/H), For example, a person with a 30'' (76cm) waist and 38'' (97cm) hips has a waist-hip-ratio of about 0.78.

Cardiorespiratory Indices

In determining cardiorespiratory indices, heart rate as an indices and was calculated as follows:

- i. At the wrist, lightly press the index and middle fingers of my hand just below the base of the thumb. At the neck, lightly press the side of the neck, just below the jawbone.

- ii. Then Count the number of beats in 15 seconds, and multiply by four. That's the heart rate.

A normal resting heart rate for adults ranges from 60 to 100 beats per minute. Generally, a lower heart rate at rest implies more efficient heart function and better cardiovascular fitness.

Sphygmomanometer was also be used to cross check the heart rate, so as to ensure accurate measure of the heart rate.

Blood Pressure: This was measured using Sphygmomanometer and Stethoscope, with the help of qualified medical personnel (Nurse), the blood pressure of the respondents was taken.

| | |
|------------------------------------|--|
| Normal | systolic: less than 120 mm Hg diastolic: less than 80 mm Hg |
| Elevated | systolic: 120–129 mm Hg diastolic: less than 80 mm Hg |
| High Blood Pressure (Hypertension) | systolic: 130 mm Hg or higher diastolic: 80 mm Hg or higher |

Table 3.4: Table showing Measures for, Blood Pressure

Source: The American College of Cardiology/American Heart Association ⁴.

The training programme lasted for eight week, three sessions per week. Dance-exercise was carried out by playing afro music with the temp at 100BP – 120BPM using VLC on a sound system, Brisk-walking was carried out outdoor on the track using sound system to make the walking interesting at the same tempo with Dance-exercise to equate the intensity and frequency. The placement day was Tuesday, Thursdays and Saturdays for experimental group 1, Mondays, Wednesdays and Fridays for experimental group 2, while Mondays and Wednesdays was for control group. Each training session had segment of warm up, followed by main activity and ended with cool down exercises. The researcher with the help of five (5) research assistants undertook the administration, measurement and recording of data. Body Mass Index and Waist-to-Hip-Ratio measurement was taken.

Treatment Group: There was pretest measures taken of the selected dependent variables on the participants in the groups before they were made to go through an eight weeks Dance-

exercise and Brisk-walking session using moderate intensity impact pace. After the intervention programme, the variables were tested again as the post-test measures.

Control Group: There was pretest of the selected dependent variables on the participants in the control group before they were placed on placebo (Health Talk on Nutrition Education) for eight weeks. The posttest measures took place after the 8 week of Nutrition Education.

3.8 Data Analysis

Descriptive statistics of frequency and percentages, were used to analyze the demographic data of the participants, mean and standard deviation were used to determine the anthropometric compositions of the participants, while Analysis of Co-variance (ANCOVA) and T-test were used to test the hypotheses formulated at 0.05 level of significance.

3.9 Ethical Consideration

Ethical approval was obtained by the researcher from Lead City University Health Research Ethics Committee (LCU- HREC). After approval, the undergraduates of Lead City University categorized as obese were approached as a group by the researcher in order to inform them about the aim and benefits amass to them on the research and make them see reasons to participate in it. Participation was however made voluntary as no participants was forced to participate against their personal wish. Please, turn over to appendix (IV) for the approved ethical consideration letter.

Informed consent form was given out to each volunteers to affirm their willingness to participate in the study. The template of the informed consent form can be seen in appendix (II & III). The information gathered from the participants was treated with uttermost confidentiality while the facilities and equipment for training and measurement was put in

good shape throughout the study to protect the participants. Also, participants who experienced some unpleasant signs like muscle soreness (counter shock) and pains at the beginning of the training that made them wanted to quit the study, were admonished not to pull out and assured them that the pains were only some of the early effects of the training which will reduce as sufficient oxygen is released through regular participation in the exercise programmes. Fruits were given to the participants at the end of every training session, also there was water break for anyone that wished to take during the exercise session.

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Endnotes

1. V. Mathiowetz, K. Weber, G. Volland, & N. Kashman, *Reliability and Validity of Grip and Pinch Strength Evaluations*. **Journal of Hand Surgery**, 9(2), 1984, 222-226.
2. J. Hans de Ridder, International Society for the Advancement of Ki Anthropometry (ISAK). International Standard for Anthropometric Assessment 2001.8.
3. J. Hans de Ridder, International Society for the Advancement of Ki Anthropometry (ISAK). International Standard for Anthropometric Assessment 2001. 7.
4. The American College of Cardiology/American Heart Association, Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults, 2017.

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Chapter Four

Results and Discussion of Findings

This chapter presents results of the analyses and discussion of findings. The results and discussion of findings are organized to cover the following: demographic characteristics of the participants, research question and hypotheses testing and discussion of findings.

4.1 Demographic Data Analysis

The analysis of demographic characteristics of the participants is presented in table 4.1.

Table 4.1.1: Distribution of Participants by Sex

| Gender | Frequency | Percent |
|--------|-----------|---------|
| Male | 15 | 37.5 |
| Female | 25 | 62.5 |
| Total | 40 | 100.0 |

Source: Field Survey, 2022. Researcher.

Table 4.1.1 reveals that 15 (37.5%) of the participants are males, while 25 (62.5%) were females. Most of the participants are females.

The analysis of socio-demographic characteristics of the participants is presented in table 4.2.

Table 4.1.2: Distribution of Participants by Age

| Age (Range) | Frequency | Percent |
|--------------------|-----------|---------|
| 18-23 years | 32 | 80.0 |
| 24-29 years | 6 | 15.0 |
| 30 years and above | 2 | 5.0 |
| Total | 40 | 100.0 |

Source: Field Survey, 2022. Researcher.

Table 4.1.2 reveals that 32 (80.0%) of the participants were in the age range of 18-23 years, 6 (15.0%) were between 24-29 years, while 2 (5.0%) were 30 years and above. This means that, most of the participants were in the age range of 18-23 years, while the participants who were over 30 years were the least.

Table 4.1.3: Distribution of the Participants by Group

| Treatment Group | Frequency | Percent |
|---------------------------------------|-----------|---------|
| Dance-exercise (Experimental Group 1) | 17 | 42.5 |
| Brisk-Walking (Experimental Group 2) | 13 | 32.5 |
| Control group | 10 | 25.0 |
| Total | 40 | 100.0 |

Source: Field Survey, 2022

Table 4.1.3 reveals that 17 (42.5%) of the participants involved in Dance-exercise, 13 (32.5%) participated in brisk-walking, while 10 (25.0%) participants were used as control group.

4.2 Presentation of Data

Research Question

The research question was answered:

Research Question 1: What is the common class of obesity among obese undergraduates in Lead City University, Ibadan, Nigeria?

Table 4.2.1: Summary of Result on Common Class of Obesity

| Class | BMI (Range) | Frequency | Percent |
|---------------|--------------|-----------|---------|
| Normal weight | 18-24.9 | 2 | 5.0 |
| Overweight | 25-29.9 | 16 | 40.0 |
| Obese class 1 | 30-34.9 | 17 | 42.5 |
| Obese class 2 | 35-39.9 | 2 | 5.0 |
| Obese class 3 | 40 and above | 3 | 7.5 |
| Total | | 40 | 100.0 |

Source: Field Survey, 2022

As indicated in table 4.2.1, 2 (5.0%) participants had normal weight, while 16 (40.0%) were overweight. In addition, 17 (42.5%) participants were in the obese class 1, 2 (5.0%) were in obese class 2, while 3 (7.5%) were in obese class 3. This means that most of the respondents belonged to obese class 1. It implied that obese class 1 was the most common class of obesity among obese undergraduates in Lead City University, Ibadan, Nigeria.

Hypotheses

The following hypotheses were tested in this study.

H01: There was no significant effect of treatments (Dance-exercise and Brisk-walking) on the anthropometric indices (BMI and WHR) of obese undergraduates in Lead City University, Ibadan, Nigeria.

Table 4.2.2: Summary of Analysis of Covariance of Effect of Treatments on Anthropometric Indices

| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. | Partial Eta Squared |
|-----------------|-------------------------|----|-------------|---------|------|---------------------|
| Corrected Model | 1280.818 | 3 | 426.939 | 114.894 | .000 | .905 |
| Intercept | 4.975 | 1 | 4.975 | 1.339 | .255 | .036 |
| Pretest | 1249.991 | 1 | 1249.991 | 336.386 | .000 | .903 |
| Treatments | 9.361 | 2 | 4.680 | 1.260 | .296 | .065 |
| Error | 133.774 | 36 | 3.716 | | | |
| Total | 48868.779 | 40 | | | | |
| Corrected Total | 1414.592 | 39 | | | | |

Source: Field Survey, 2022. Researcher.

Table 4.2.2 shows that there was no significant effect of treatments on the anthropometric indices ($F_{(2,36)} = 1.260$, $p < 0.05$, $\eta^2 = 0.296$) of obese undergraduates in Lead City University, Ibadan, Nigeria. The null hypothesis was therefore considered tenable. This implied that the combined treatment (Dance-exercise and Brisk-walking) was not effective in reducing the anthropometric indices of obese undergraduates in the study. The eta square value of 0.065 shows the treatment effect size of 6.5%.

Table 4.2.3: Estimated Marginal Means of Treatments on Anthropometric Indices

| Treatment groups | Mean | Std. Error | 95% Confidence Interval | |
|----------------------|--------|------------|-------------------------|-------------|
| | | | Lower Bound | Upper Bound |
| Experimental group 1 | 34.997 | .468 | 34.049 | 35.945 |
| Experimental group 2 | 33.934 | .536 | 32.847 | 35.022 |
| Control group | 34.164 | .613 | 32.922 | 35.407 |

Source: Field Survey, 2022. Researcher.

The table reveals that after controlling for initial difference on anthropometric indices, the participants exposed to Dance-exercise had the highest mean score (mean=34.997), followed

by those in the control group(mean= 34.164), while the brisk-walking had a mean score of 33.934. This implies that Dance-exercise with the highest mean score may be more effective in relation to anthropometric indices of obese undergraduates in Lead City University, Ibadan, Nigeria.

Table 4.2.4: Pretest-posttest Mean Scores for Experimental Groups on Anthropometric Indices (BMI)

| Mean and Standard Deviation | Body Mass Index(Pre) | Body Mass Index(Post) |
|-----------------------------|----------------------|-----------------------|
| Mean | 33.6218 | 27.000 |
| Std. Deviation | 5.99185 | .93918 |

Source: Field Survey, 2022. Researcher.

The result in table 4.2.4 shows that the mean score for the pretest stage was 33.6218, and at the posttest stage 27.000. It was revealed that there was treatments effect on Body Mass Index as the posttest score was lower than the pretest score. Standard deviation showed that at pretest, the BMI of participants were more spread while at posttest BMI of participants were closely packed around the mean value. This indicate a treatment effect. To ascertain this, a t-test was carried out on mean scores.

Table 4.2.5 present the Analysis of t-test between Pre and Posttest measures of Body Mass Index (BMI) of obese undergraduates in Lead City University, Ibadan, Nigeria.

Table 4.2.5 Summary of Analysis of t-test between Pretest-posttest measures of Body Mass Index(BMI)

| Body Mass Index (BMI) | T | DF | Sig. (2-tailed) | Mean Difference | 95% Confidence Interval of the Difference | |
|-----------------------|--------|----|-----------------|-----------------|---|---------|
| | | | | | Lower | Upper |
| BMI pretest | 35.489 | 39 | .000 | 33.6218 | 31.7055 | 35.5380 |
| BMI posttest | 18.182 | 39 | .000 | 27.0000 | 23.9960 | 30.0040 |

Source: Field Survey, 2022. Researcher.

Table 4.2.5 shows that that there was a significant treatment effect on the anthropometric indices (BMI) (≤ 0.005) of obese undergraduates in Lead City University, Ibadan, Nigeria. This implied that the combined treatment (Dance-exercise and Brisk-walking) was effective in reducing the anthropometric indices (BMI) of obese undergraduates in the study.

Table 4.2.6: Pretest-posttest Means Score for Experimental Groups on Anthropometric Indices (Waist-Hip-Ratio)

| Mean and Standard Deviation | WHR pre | WHR post |
|-----------------------------|---------|----------|
| Mean | 0.8218 | 0.8260 |
| Std. Deviation | 0.07193 | 0.07264 |

Source: Field Survey, 2022. Researcher.

The result shows the mean score for the pretest stage was 0.8218, and at the posttest stage 0.8260. There was little or no difference between Waist-Hip-Ratio measures at Pretest-posttest stage.

Ho2: There was significant effect of treatments (Dance-exercise and Brisk-walking) on the cardiorespiratory indices (heart rate and blood pressure) of obese undergraduates in Lead City University, Ibadan, Nigeria.

Table 4.2.7: Summary of Analysis of Covariance of Effect of Treatments on Cardiorespiratory Indices

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. | Partial Eta Squared |
|-----------------|-------------------------|----|-------------|--------|------|---------------------|
| Corrected Model | 10989.041 | 3 | 3663.014 | 11.889 | .000 | .498 |
| Intercept | 9225.710 | 1 | 9225.710 | 29.945 | .000 | .454 |
| Pretest | 7989.756 | 1 | 7989.756 | 25.933 | .000 | .419 |
| Treatments | 2120.786 | 2 | 1060.393 | 3.442 | .043 | .161 |
| Error | 11091.334 | 36 | 308.093 | | | |
| Total | 3071881.000 | 40 | | | | |
| Corrected Total | 22080.375 | 39 | | | | |

Source: Field Survey, 2022. Researcher.

Table 4.2.7 shows that there was a significant effect of treatments ($F_{(2,36)}=3.442$, $p<0.05$, $\eta^2=0.043$) on the Cardiorespiratory indices of obese undergraduates in Lead City University, Ibadan, Nigeria. The null hypothesis was therefore rejected. This implied that the combined treatment (Dance-exercise and Brisk-walking) was effective in reducing the heart rate and blood pressure of obese undergraduates in the study. The eta square value of 0.161 shows the contributing effect size of treatment was 16.1%.

Table 4.2.8: Estimated Marginal Means of Treatments on Cardiorespiratory Indices

| Treatment groups | Mean | Std. Error | 95% Confidence Interval | |
|----------------------|--------|------------|-------------------------|-------------|
| | | | Lower Bound | Upper Bound |
| Experimental group 1 | 67.184 | 4.274 | 260.069 | 277.404 |
| Experimental group 2 | 69.366 | 4.995 | 267.333 | 287.593 |
| Control group | 71.737 | 5.610 | 275.568 | 298.324 |

Source: Field Survey, 2022. Researcher.

Table 4.2.8 shows that the control group had the highest mean score (mean=71.737), followed by those in the brisk-walking group (mean=69.366), while dance-exercise group had the least mean score of 67.184. This implies that Experimental group 1- Dance-exercise had the least mean score in relating to cardiorespiratory indices of obese undergraduates in Lead City University, Ibadan, Nigeria.

Table 4.2.9: Pretest-posttest Means Scores for Experimental Groups on Cardiorespiratory Indices(Heart Rate)

| Mean and Standard Deviation | Heart Rate(Pre) | Heart Rate (Post) |
|-----------------------------|-----------------|-------------------|
| Mean | 80.9750 | 78.5250 |
| Std. Deviation | 10.45991 | 8.22438 |

Source: Field Survey, 2022. Researcher.

The result shows that the mean score for the pretest stage was 80.9750, and at the posttest stage 78.5250. It was revealed that there was treatments effect on Heart Rate as the posttest score was lower than the pretest score. Standard deviation showed that at pretest, the Heart Rate of participants was more spread while at posttest Heart Rate of participants was closely packed around the mean value. This indicate a treatment effect.

Table 4.2.10: Pretest-posttest Means Scores for Experimental Groups on Cardiorespiratory Indices (Blood Pressure)

| Mean and Std. Deviation | Systolic Pre | Systolic Post | Diastolic Pre | Diastolic Post |
|-------------------------|--------------|---------------|---------------|----------------|
| Mean | 127.5250 | 125.6000 | 74.1000 | 72.0000 |
| Std. Deviation | 15.35559 | 10.72452 | 13.48085 | 13.01872 |

Source: Field Survey, 2022. Researcher.

The result shows that the Systolic mean score for the pretest stage was 127.5250, and at the post test stage 125.6000. Also, the Diastolic mean score for the pretest stage was 74.1000,

and at the post test stage 72.0000. The result revealed that there was treatments effect on Blood Pressure as the posttest score was lower than the pretest score. This indicate a treatment effect on Blood Pressure.

Ho3: There was no significant effect of sex on the anthropometric indices of obese undergraduates in Lead City University, Ibadan, Nigeria.

Table 4.2.11: Summary of Analysis of Covariance of Effect of Sex on Anthropometric Indices

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. | Partial Eta Squared |
|-----------------|-------------------------|----|-------------|---------|------|---------------------|
| Corrected Model | 1182.053 | 2 | 591.027 | 178.775 | .000 | .906 |
| Intercept | .611 | 1 | .611 | .185 | .670 | .005 |
| Pretest | 1148.261 | 1 | 1148.261 | 347.329 | .000 | .904 |
| Sex | 9.661 | 1 | 9.661 | 2.922 | .096 | .073 |
| Error | 122.321 | 37 | 3.306 | | | |
| Total | 44147.290 | 40 | | | | |
| Corrected Total | 1304.374 | 39 | | | | |

Source: Field Survey, 2022. Researcher.

Table 4.2.11 shows that there was no significant effect of sex ($F_{(1,37)}=2.922, p>0.05, \eta^2=0.073$) on the anthropometric indices of obese undergraduates in Lead City University, Ibadan, Nigeria. The null hypothesis was therefore considered tenable. This implied that sex had no significant impact on the anthropometric indices of obese undergraduates in the study area. The eta square value of 0.073 shows the treatment effect size of 7.3%.

Table 4.2.12: Estimated Marginal Means of Anthropometric Indices by Sex

| Sex | Mean | Std. Error | 95% Confidence Interval | |
|--------|--------|------------|-------------------------|-------------|
| | | | Lower Bound | Upper Bound |
| Male | 32.333 | .368 | 31.587 | 33.080 |
| Female | 33.384 | .480 | 32.412 | 34.356 |

Source: Field Survey, 2022. Researcher.

Table 4.2.12 shows that female participants had a higher posttest mean score (33.384) than their male (32.333) counterpart. This implied that the female gender had a higher anthropometric indices than the male.

Ho4: There was no significant effect of sex on the cardiorespiratory indices of obese undergraduates in Lead City University, Ibadan, Nigeria.

Table 4.2.13: ANCOVA Analysis of Effect of Sex on Cardiorespiratory Indices

| | Type III Sum of Squares | Df | Mean Square | F | Sig. | Partial Eta Squared |
|-----------------|-------------------------|----|-------------|--------|------|---------------------|
| Corrected Model | 9078.568 | 2 | 4539.284 | 12.918 | .000 | .411 |
| Intercept | 9235.813 | 1 | 9235.813 | 26.283 | .000 | .415 |
| Pretest | 9065.366 | 1 | 9065.366 | 25.798 | .000 | .411 |
| Sex | 210.312 | 1 | 210.312 | .598 | .444 | .016 |
| Error | 13001.807 | 37 | 351.400 | | | |
| Total | 3071881.000 | 40 | | | | |
| Corrected Total | 22080.375 | 39 | | | | |

Source: Field Survey, 2022. Researcher.

Table 4.2.13 shows that there was no significant effect of sex ($F_{(1,37)}=0.598, p>0.05, \eta^2=0.016$) on the Cardiorespiratory indices of obese undergraduates in Lead City University, Ibadan, Nigeria. The null hypothesis was therefore considered tenable. This implied that sex was not of any consequence on the cardiorespiratory indices of obese undergraduates in this study. The eta square value of 0.016 shows the contribution of treatment effect size of 1.6%.

Table 4.2.14: Estimated Marginal Means of Sex on Cardiorespiratory Indices

| Sex | Mean | Std. Error | 95% Confidence Interval | |
|--------|---------|------------|-------------------------|-------------|
| | | | Lower Bound | Upper Bound |
| Male | 274.337 | 3.758 | 266.722 | 281.952 |
| Female | 279.105 | 4.860 | 269.257 | 288.952 |

Source: Field Survey, 2022. Researcher.

Table 4.2.14 shows that female participants had a higher cardiorespiratory mean score (279.105) than their male (274.337) counterpart.

Ho5: There was no significant interaction effect of treatments (Dance-exercise, Brisk-walking and control) and sex on the anthropometric indices (BMI and WHR) of obese undergraduates in Lead City University, Ibadan, Nigeria.

Table 4.2.15: ANCOVA Analysis of Interaction Effect of Treatments and Sex on the Anthropometric Indices

| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. | Partial Eta Squared |
|-----------------|-------------------------|----|-------------|---------|------|---------------------|
| Corrected Model | 1193.174 | 6 | 198.862 | 59.015 | .000 | .915 |
| Intercept | 3.145 | 1 | 3.145 | .933 | .341 | .028 |
| Pretest | 876.024 | 1 | 876.024 | 259.970 | .000 | .887 |
| Treatments | 2.537 | 2 | 1.269 | .376 | .689 | .022 |
| Sex | 1.700 | 1 | 1.700 | .505 | .482 | .015 |
| Treatmts & Sex | 9.469 | 2 | 4.735 | 1.405 | .260 | .078 |
| Error | 111.200 | 33 | 3.370 | | | |
| Total | 44147.290 | 40 | | | | |
| Corrected Total | 1304.374 | 39 | | | | |

Source: Field Survey, 2022. Researcher.

Table 4.2.15 shows that there was no significant interaction effect of treatments and sex on the anthropometric indices ($F_{(2,33)}=1.405$, $p>0.05$, $\eta^2=0.078$) of obese undergraduates in Lead City University, Ibadan, Nigeria. The null hypothesis was therefore considered tenable. This implied that treatment and sex had no perceptible impact on the anthropometric indices of obese undergraduates in the study area. The eta square value of 0.078 shows the contribution of treatment effect size of 7.8%.

Table 4.2.16: Estimated Marginal Means of Treatments by Sex on the Anthropometric Indices

| Treatment groups | Sex | Mean | Std. Error | 95% Confidence Interval | |
|----------------------|--------|--------|------------|-------------------------|-------------|
| | | | | Lower Bound | Upper Bound |
| Experimental group 1 | Male | 32.211 | .459 | 31.276 | 33.145 |
| | Female | 32.351 | 1.839 | 28.608 | 36.093 |
| Experimental group 2 | Male | 33.504 | .973 | 31.524 | 35.485 |
| | female | 32.919 | .659 | 31.579 | 34.260 |
| Control group | Male | 31.994 | .821 | 30.324 | 33.664 |
| | female | 34.221 | .825 | 32.542 | 35.901 |

Source: Field Survey, 2022. Researcher.

Table 4.2.16 shows that male participants in the Experimental Group 1 had a lower mean score (32.211) compared to their female (32.351) counterpart. The difference between males and females in Experimental Group 1 in the estimated marginal means for anthropometric

indices is 0.140 with females having a higher value. Table 4.9.2 further reveals that male participants in the Experimental Group 2 had a higher mean score (33.504) than their female (33.919) counterpart. The mean difference between male and female participants in their marginal means for anthropometric indices is 0.585 in favor of females.

In the control group, the female participants had a higher marginal mean score (34.221) than their male (31.994) counterpart. The difference between their marginal means in anthropometric indices is 2.227. This value is much higher than those for the two experimental groups.

Ho6: There was no significant interaction effect of treatments (Dance-exercise and Brisk-walking) and sex on cardiorespiratory indices (heart rate and blood pressure) of obese undergraduates in Lead City University, Ibadan, Nigeria.

Table 4.2.17: ANCOVA Analysis of Interaction Effect of Treatments by Sex on the Cardiorespiratory Indices

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. | Partial Eta Squared |
|-----------------|-------------------------|----|-------------|--------|------|---------------------|
| Corrected Model | 11067.948 | 6 | 1844.658 | 5.528 | .000 | .501 |
| Intercept | 9035.020 | 1 | 9035.020 | 27.074 | .000 | .451 |
| Pretest | 7627.311 | 1 | 7627.311 | 22.856 | .000 | .409 |
| Treatments | 1344.299 | 2 | 672.150 | 2.014 | .150 | .109 |
| Sex | 65.745 | 1 | 65.745 | .197 | .660 | .006 |
| Treatmts & Sex | 42.370 | 2 | 21.185 | .063 | .939 | .004 |
| Error | 11012.427 | 33 | 333.710 | | | |
| Total | 3071881.000 | 40 | | | | |
| Corrected Total | 22080.375 | 39 | | | | |

Source: Field Survey, 2022. Researcher.

Table 4.2.17 shows that there was no significant interaction effect of treatments by sex ($F_{(2,33)}=0.063, p>0.05, \eta^2=0.004$) on the Cardiorespiratory indices of obese undergraduates in Lead City University, Ibadan, Nigeria. The null hypothesis was therefore considered tenable. This implied that treatment and sex had no perceptible impact on the cardiorespiratory

indices of obese undergraduates in this study. The eta square value of 0.004 shows the contribution of treatment effect size of 0.04%.

Table 4.2.18: Estimated Marginal Means of Treatments by Sex on the Cardio-respiratory Indices

| Treatment groups | Sex | Mean | Std. Error | 95% Confidence Interval | |
|----------------------|--------|-------|------------|-------------------------|-------------|
| | | | | Lower Bound | Upper Bound |
| Experimental group 1 | Male | 67.31 | 4.593 | 259.900 | 278.587 |
| | Female | 65.24 | 18.297 | 223.727 | 298.179 |
| Experimental group 2 | Male | 69.75 | 9.149 | 260.386 | 297.613 |
| | female | 69.17 | 6.264 | 263.952 | 289.441 |
| Control group | Male | 71.79 | 8.172 | 270.545 | 303.799 |
| | female | 71.70 | 8.307 | 269.903 | 303.705 |

Source: Field Survey, 2022. Researcher.

Table 4.2.18 shows that male participants in the experimental group 1 had a higher mean score (67.31) compared to their female (65.24) counterpart. The mean difference in experimental Group 1 between male and female participants in their marginal means for cardiorespiratory indices is 2.07 with male having a higher mean score.

Table 4.2.18 further reveals that male participants in the experimental group 2 had a higher mean score (69.75) than their female (69.17) counterpart. The mean difference in experimental group 2 between male and female participants in their marginal means for cardio respiratory indices is 0.58 with male having a higher mean score.

In the control group, the male participants had a higher mean score (71.79) than their female (71.70) counterpart. The difference between their marginal means in cardiorespiratory indices is 0.09. This implied that the interaction of treatment and sex had little effect on cardiorespiratory indices of obese female undergraduates in the control group than their female counterparts. The overall comparison shows that female participants in experimental group 1 had the lowest mean score.

4.3 Discussion of Findings

The result in this study revealed that there was a significant main effect of treatments on the cardiorespiratory indices of obese undergraduates in Lead City University, Ibadan, Nigeria. This is pertinent with objective number three of this study. This means that the combined treatment (Dance-exercise and Brisk-walking) was effective on the cardiorespiratory indices of obese undergraduates in this study. Decreased vascular resistance and organ adaptation to exercise could be the reason for the reduction of cardiorespiratory indices of obese undergraduates in the study. The findings of this study is in agreement with a previous study, which found significant training effect on physiological characteristics (systolic and diastolic blood pressure and heart rate) in obese adults ¹. Additionally, the findings of this study agreed with those of a prior study which showed that Brisk-walking and square dancing are effective in lowering blood pressure and heart rate². In another study on the effect of a twelve-week aerobic exercise Programme on health-related physical fitness components and blood lipids in obese females involving a total of 40 females with 20 in the exercise group and 20 in the control group, participants attended sessions that lasted 60 minutes each day, three days per week³. Result showed there were significant differences in heart rate, and other parameters measured between pre and posttest scores in the exercise group. According to the findings, regular aerobic exercise may have a positive impact on health-related fitness components and blood lipids in females.

The estimated marginal means of treatment on cardiorespiratory indices of obese undergraduates in Lead City University, Ibadan, Nigeria revealed that the control group had the highest mean score, followed by those in the brisk-walking, while dance-exercise group had a least mean score. This outcome corroborate the assertion that Dancing requires a lot of energy since it requires "movement in all directions," and that "there is a lot of accelerating and decelerating in dancing, which the body is less capable of doing in an energy effective

way." If running is like driving on a highway, dancing is like driving through a city. Even if one is not traveling much territory, all of the starting, stopping, and changing directions consumes a lot of gasoline⁴.

With regards to Body Mass Index of obese undergraduates in Lead City University, the result showed that the mean score for the posttest was lower than that of pretest. It was revealed that there was treatments effect on Body Mass Index at the posttest stage. This may be attributed to the treatments for the two groups (Dance-exercise and Brisk-walking). This study is in line with a study conducted on impact of an eight-week step-aerobic dancing training Programme on body composition parameters in middle-aged inactive obese women⁵. After eight weeks of participation in a step-aerobic dancing fitness Programme for one hour three days a week, it was revealed that there was significant changes in the experimental group's Body Mass Index BMI.

In addition, after controlling for the initial difference on anthropometric indices, the participants exposed to Dance-exercise had the highest mean score, followed by those in the control group, while the brisk-walking had a lower mean score. Brisk-walking has the lowest mean score in relation to anthropometric indices of obese undergraduates in Lead City University, Ibadan, Nigeria. This implied that Brisk-walking is more effective in reduction of Body Mass Index (BMI) compared to Dance-exercise. This corroborate a study conducted on effect of Brisk-walking on anthropometric indices and physiological characteristics of obese adults Ilorin metropolis. The findings revealed that there was significant effect of brisk on Body Mass Index (BMI) ¹.

However, the means score for pretest and protest for Waist-Hip-Ratio revealed that there was little difference in the variable. It may be that WHR techniques is not as sensitive in detecting improvement as Body Mass Index. This study corroborate a study on BMI, Waist-circumference and waist-hip-ratio as diagnostic tests for fatness in adolescents⁶. It was

revealed that BMI and WC were found to perform well as diagnostic tests for fatness, while WHR was less useful. The result in this study further revealed that there was no significant main effect of treatments on the anthropometric indices of obese undergraduates in Lead City University, Ibadan, Nigeria. This result is in contrast with a study conducted on effect of Brisk-walking on anthropometric indices and physiological characteristics of obese adults in Ilorin metropolis in which Brisk-walking was found significant¹. One group pretest-posttest experimental research design was adopted for the study, the population comprised 70 obese adults, males and females between ages 25-49 years in Ilorin metropolis. The participants were required to brisk walk 3 times a week and 70minutes per session at an intensity of 40-70% of their respective age-predicted maximum heart rate for 8 weeks.

The reason behind the outcome of the non-significance of treatment effect on anthropometric indices in this current study could be as a result of time allotted for the exercise, intensity, and structure. A 50 minutes per session was allotted for the exercise Programme at 3times per week, and at 100 -120 BPM intensity was designed for the Programme. It takes about 7700 calories to loose 1kg per week, which could be achieved when more time and days are allotted for moderate –high intensity exercise. The intensity of 100-120 BPM seems low to bring about the desired effect. Therefore, in other for an exercise Programme to have significant treatment effect on anthropometric indices, it has to be conducted within the minimum of 1hour and at moderate to high intensity.

Another findings of this study was that there was no significant main effect of sex on the anthropometric indices of obese undergraduates in Lead City University, Ibadan, Nigeria. This implies that sex was not a significant determinant of anthropometric indices of obese undergraduates in this study. Female participants had a higher posttest mean score than their male counterpart. Female normally have higher level of adipose tissues than males as early in adolescence to adulthood. Furthermore, it is commonly claimed that females lose less body

weight in response to exercise than males. These differences are thought to be due to females having a better defense of body fat and a larger compensatory hunger response to exercise than males. This is in line with a study conducted on Effect of sex/gender on obesity traits in Canadian first year university students⁷.

A comparison of the magnitude of change over time between the two sexes, on the other hand, found no significant difference for any of the examined anthropometric attributes. Weight, waist and hip circumferences, BMI, and waist to hip ratio are usually evaluated as obesity parameters. In addition, it was found that there was no significant main effect of sex on the cardiorespiratory indices of obese undergraduates in this study. This implies that sex was not an important factor in the cardiorespiratory indices of obese undergraduates in this study. However, after controlling for initial difference, the main effect of treatment by sex on cardiorespiratory indices of obese undergraduates, female participants had a higher posttest mean score than their male counterpart. It can be inferred that the male participants had a better training effect in cardiorespiratory indices than their female counterpart. This validates a study conducted on Sex Differences in Cardiorespiratory Fitness and All-Cause Mortality: The Henry Ford Exercise Testing (FIT) Project⁸. This is one of the landmark long-term research on the relationship between fitness and mortality in men and women. It was discovered that men have higher cardiorespiratory fitness than women in this population of intermediate and high risk adults.

It was further indicated in this study that, there was no significant interaction effect of treatments and sex on the anthropometric indices of obese undergraduates in Lead City University, Ibadan, Nigeria. This study corroborates a study conducted on “No sex difference in body fat in response to supervised and measured exercise”⁹. There are no gender differences in the assessed compensatory response to exercise when exercise programmes were observed and energy expenditure regulated. Another study conducted on No Sex

Differences in Body Weight Response to Exercise corroborates the findings of this study¹⁰. It was revealed that, there is little indication of sex differences in body weight response to exercise in the majority of studies, particularly when exercise is matched across men and women. Furthermore, there does not appear to be any strong evidence that women adjust for exercise-induced energy expenditure more than males. However, male participants in the experimental group 1 had a lower mean score than their female counterpart. This implies that being of male gender and participation in Dance-exercise had a better effect on anthropometric indices of obese male undergraduates than their female counterparts. This same trend was found for female participants in the treatment group 2 (Brisk-walking) had a lower mean score than their male counterpart. Being of female gender and participation in Brisk-walking enhances the anthropometric indices of obese female undergraduates than being of the male gender.

Finally, the study found that, there was no significant interaction effect of treatments and sex on the cardiorespiratory indices of the participants. Based on gender at the treatment level, it was found that male participants in the treatment group 1 had a higher mean score than their female counterparts. This implied that the interaction of treatment and sex had a better effect on cardiorespiratory indices of obese female undergraduates who were exposed to Dance-exercise than their male counterparts. Furthermore, male participants in the treatment group 2 had a higher mean score than their female counterparts. This implied that the interaction of treatment and sex had a better effect on cardiorespiratory indices of obese female undergraduates who were exposed to brisk-walking than their male counterparts.

The overall comparison shows that female participants in treatment group 1 had the lowest mean score, followed by female participants in treatment group 2, while the male participants in control group had the highest mean score. It implied that the interaction of treatment and sex had a better effect on cardiorespiratory indices of obese female

undergraduates who were exposed to Dance-exercise than their male counterparts in the same group and other participants in treatment group 2 and control group respectively.

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Endnotes

1. Ismail-Orire, Halimat I'ya. Effect Of Brisk-walking On Anthropometric Indices And Physiological Characteristics of Obese Adults in Ilorin Metropolis, Kwara State University (Nigeria), ProQuest Dissertations Publishing, 2021. 28542722.
2. Liu, Hui, Kim, Jung & Kim, Ok-ja, *Effect of Brisk-walking And Square Dancing On Blood Pressure Reduction And Blood Lipid In Middle-Aged Female Patients with Hypertension*. **Journal of korean physical, Therapy Science**, 28(3), 2021, 76-87.
3. Özcan Saygın & Mehmet Ali Öztürk, *.Effect of a Twelve-Week Aerobic Exercise Programme On Health-Related Physical Fitness Components and Blood Lipids in Obese Females*; **African Journal of Pharmacy and Pharmacology**. 5(12), 2011, 1441-1445.
4. Nick Smeeton, A Principal Lecturer at the University of Brighton and Coauthor of that report. Why Dancing Is the Best Thing One Can Do For Individual's Body: <https://time.com/4828793/dancing-dance-aerobic-exercise/>, 2017.
5. A. Arslan, "Impact of an Eight-Week Step-Aerobic Dancing Training Programme on Body Composition Markers In Middle-Aged Inactive Obese Women". International Federation Of Sports Medicine: <https://journals.co.za/doi/pdf/10.10520/EJC48419,2011>.
6. M Neovius, Y Linné, & S Rossner, *Body Mass Index, Waist-Circumference and Waist-Hip-Ratio As Diagnostic Tests For Fatness In Adolescents*. **International Journal of Obesity**,29(2), 2005, 163-9.
7. Tanmay Sharma, Rita E. Morassut, Christine Langlois & David Meyre. *Effect of Sex/Gender on Obesity Traits in Canadian First Year University Students*, **The Geneius study**: <https://doi.org/10.1371/journal.pone.0247113>,2021.
8. Mouaz H. Al-Mallah, Stephen P. Juraschek, Seamus Whelton, Zeina A. Dardari, Jonathan K. Ehrman, Erin D. Michos, Roger S. Blumenthal, Khurram Nasir, Waqas T. Qureshi, Clinton A. Brawner, Steven J. Keteyian, & Michael J. Blaha, Sex Differences in Cardiorespiratory Fitness and All-Cause Mortality: The Henry Ford Exercise Testing (FIT) Project., 91(6), 2017, 755–762.
9. Caudwell, Phillipa, Gibbons, Catherine, Hopkins, Mark, King, Neil, Finlayson, Graham, & Blundell, *No sex Difference In Body Fat In Response To Supervised and Measured Exercise*, **Medicine and Science in Sports and Exercise**,45(2),2013, 351-358.
10. Caudwell, Phillipa, Gibbons, Catherine, Finlayson, Graham, Näslund, Erik, Blundell & John, *No Sex Differences in Body Weight Response to Exercise*, **Exercise and Sport Sciences Reviews**, 42(3),2014,92-101.

Chapter Five

Conclusion

This chapter presents the conclusion of the study.

5.1 Summary of Findings

The aim of this study was to ascertain the effectiveness of dance-exercise and brisk-walking on the anthropometric and cardiorespiratory indices of obese Undergraduates in Lead City University, Ibadan, Nigeria. Other objectives determined the prevalence of obesity among obese undergraduates, assessed the effect of Dance-exercise and Brisk-walking on the anthropometric indices (BMI and WHR,) of obese undergraduates, as well as determined the effect of Dance-exercises and Brisk-walking on the cardiorespiratory indices (heart rate and blood pressure) of obese undergraduates. The study furthermore examined the main effect of sex on the anthropometric indices as well as the main effect of sex on the cardiorespiratory indices of obese undergraduates. This were with a view to determining which of the training modes (Dance-Exercise, Brisk-walking and their interactions) can better affect anthropometric and cardiorespiratory indices of obese undergraduates in Lead City University, Ibadan, Nigeria.

Sixty undergraduates categorized as obese were identified through screening using BMI and WHR grouping by WHO. The participants were selected using multistage sampling procedure. The stages involved in the procedure were, purposive and simple random sampling technique. Descriptive statistics of frequency count, percentages, were used to analyze the demographic data of the participants; mean and standard deviation were used to determine the anthropometric compositions of the participants, while Analysis of Co-variance (ANCOVA) and T-test were used to test the hypotheses formulated at 0.05 level of significance.

The findings of this study on socio-demographic characteristics revealed that, most of the participants are female. Similarly, it was shown that, most of the participants were in the age range of 18-23 years. The study revealed that most of the respondents belonged to obese class1. This study also revealed that there was significant main effect of treatments on the anthropometric indices (BMI) of obese undergraduates in Lead City University, Ibadan, Nigeria. The estimated marginal means of treatment on anthropometric indices (BMI) revealed that participants exposed to Dance-exercise had the highest mean score, followed by those in the brisk-walking, while the control group had the least mean score.

Moreover, the findings of this study reveals that, there was a significant main effect of treatments on the cardiorespiratory indices of obese undergraduates in Lead City University, Ibadan, Nigeria. The estimated marginal means of treatment on cardiorespiratory indices of obese undergraduates in Lead City University, Ibadan, Nigeria was revealed that participants exposed to Dance-exercise had the highest training effect, followed by those in the brisk-walking, while the control group had the least.

Furthermore, the study revealed that there was no significant main effect of sex on the anthropometric indices of obese undergraduates in Lead City University, Ibadan, Nigeria. Additionally, it was found that there was no significant main effect of sex on the cardiorespiratory indices of obese undergraduates. Finally, the study established that, there was no significant interaction effect of treatments and sex on the anthropometric and cardiorespiratory indices of obese undergraduates in Lead City University, Ibadan, Nigeria.

5.2 Conclusion

Based on the findings of this study, it was concluded that Dance-exercise and Brisk-walking are exercise modes that can bring positive changes in the anthropometric indices of obese participants. Similarly, Dance-exercise and Brisk-walking also positively affected the cardiorespiratory indices of obese undergraduates in this study. Exercise training involving

Dance and Brisk-walking nature tends to influence the anthropometric and Cardiorespiratory indices of male more than female participants. It was further concluded that sex was not a determinant of the outcome of Dance-exercise and Brisk-walking exercise modes on anthropometric as well as cardiorespiratory indices of obese undergraduate in this study.

5.3 Recommendations

Based on the findings of this study, the following recommendations were made:

The school authority should organize periodic sensitization programme on different exercises including Dance-exercise and Brisk-walking as means of improving fitness of obese students. This is important as Dance-exercise and Brisk-walking positively influence anthropometric and cardiorespiratory indices of obese individuals. Also, fitness trainers, coaches, sports agencies, should adopt Dance-exercise and Brisk-walking alternative types of exercises that can be utilized to meet the preferences of individuals averse to typical routine exercise in the quest for improving anthropometric and cardiorespiratory indices.

Dance-exercise along with other forms of exercise can be incorporated in fitness programmes as they affect both anthropometric and cardiorespiratory indices especially of obese individual's since Dance-exercise and Brisk-walking are not cost intensive and can be performed at any place and time. Relevant government, non-governmental organizations and agencies should adopt Dance and Brisk-walking exercise programmes for promotion of fitness and well-being of stakeholders.

5.4 Contributions to Knowledge

This study contributed to knowledge in the following ways:

1. This study confirmed that Dance-exercise and Brisk-walking are effective in bringing about desired change in anthropometric indices of obese undergraduates in Lead City University, Ibadan, Nigeria.

2. It was also affirmed that both Dance-exercise and Brisk-walking are exercise modes that can influence positively the cardiorespiratory indices of obese participants.
3. It was confirmed that irrespective of sex, Dance-exercise and Brisk-walking can bring about training effect on anthropometric indices of obese participants, though males tend to benefit more than females.
4. It was further confirmed that irrespective of sex, Dance-exercise and Brisk-walking can bring about training effect on cardiorespiratory indices of obese participants, though males tend to benefit more than females.

5.5 Suggested Areas of Further Research

The following suggestions were made for further research based on the findings of the study.

1. The study of this nature can be replicated among obese undergraduates of other tertiary institutions in Nigeria.
2. Also, the study of this nature can be carried out among adolescents with issues relating to overweight and obesity.
3. Some other Health-related fitness components that were not examined in this study can be worked on by other researchers in the subsequent studies.
4. Duration, frequency and intensity of exercise that are different from the one utilized in this study can be adopted to determine their effects on obesity.

Bibliography

Journals

- Abubakar, Dominic & Adeoye, *Making Weight for Sports Performance: Implications for Health of Combat Sports*, **Ghana Journal of Health, Physical Education, Recreation, Sports and Dance. (GJOHPERSD)**, 10(1)2018,90-112.
- Agostinis-Sobrinho, Ramírez-Vélez, García-Hermoso, Rosário, Moreira, C., Lopes, L., Martinkenas, A., Mota, J. & Santos, R. *The Combined Association of Adherence to Mediterranean Diet, Muscular and Cardiorespiratory Fitness on Low-Grade Inflammation in Adolescents: A Pooled Analysis*. **European journal of nutrition**, 58(7), 2019, 2649-2656.
- Aleisha Fetters, Dose-Response Effects of Exercise on Glucose-Lowering Medications for Type 2 Diabetes: A Secondary Analysis of a Randomized Clinical Trial. **Medically Reviewed**, 2020.
- Alice Bellicha, Marleen A. van Baak, Francesca Battista, Kristine Beaulieu, John E. Blundell, Luca Busetto, Eliana V. Carraça, Dror Dicker, Jorge Encantado, Andrea Ermolao, Nathalie Farpour-Lambert, Adriyan Pramono, Euan Woodward & Jean-Michel Oppert, *Effect Of Exercise Training On Weight Loss, Body Composition Changes, and Weight Maintenance In Adults With Overweight or Obesity: An overview of 12 systematic reviews and 149 studies*.2021.
- Androulakis-Korakakis. P, Fisher. J.P & Steele. J, *The Minimum Effective Training Dose Required To Increase 1rm Strength In Resistance-Trained Men: a systematic review and meta-analysis*. **Sports medicine**, 50(4), 2020, 751-765.
- Ann Med, ‘*Estimating the Prevalence of Overweight and Obesity In Nigeria In 2020: A Systematic Review and Meta-Analysis*’, 53(1), 2021 495–507.Doi; 10.1080/07853890.2021.1897665.
- Anne McTiernan, Bess Sorensen, Melinda L Irwin & Morgan Angela, *Exercise, Effect on Weight and Body Fat in Men and Women*. 15(6), 2007. 1496-512.
- Astrid Bergland, Lone Jørgensen, Nina Emaus & Bjørn Heine Strand , *Mobility as a predictor of all-cause mortality in older men and women: 11.8 year follow-up in the Tromsø study*,17(22), 2017.
- Atividade física, aptidão cardiorrespiratória e síndrome metabólica em adolescentes. *Physical Activity, Cardiorespiratory Fitness and Metabolic Syndrome in Adolescents*, 24 (4),2018, <https://doi.org/10.1590/1517-869220182404174502>.

- Attwell. C, Dugan. C, McKay.AK, Nicholas.J, Hopper. L & Peeling. P, Dietary Iron and the Elite Dancer. *Nutrients*, 14(9), 2022, 1936.
- Barnes. J.N & Charkoudian. N, *Integrative Cardiovascular Control In Women: Regulation Of Blood Pressure, Body Temperature, And Cerebrovascular Responsiveness*, **The FASEB Journal**, 35(2), 2021, e21143.
- Baten, Joerg & Komlos, John. "Looking Backward and Looking Forward: Anthropometric Research and the Development of Social Science History". *Social Science History*, via **Elsevier Science Direct**, (28): 2004, 191–210.
- Beatrice Ragnoli, Patrizia Pochetti, Mariangela Barbieri, Lucrezia Mondini, Luca Ruggero, Lillian TrotaPaolo Montuschi & Mario Malerba, Sleep Deprivation, Immune Suppression and SARS- CoV-2 Infection,19(2),2022, 904.
- Bhati. Y.S & Saini.J.N, *A Comparative Study of Cardiovascular Fitness of Bodybuilders and Athletes during 50's Age*. **Central Asian Journal of Medical and Natural Science**, 3(5), 2022, 124-132.
- Biskup M, Macek P, Król H, Nogajczyk M, Terek-Derszniak M & Skowronek T, *Predictions Of The Incidence Of Gastrointestinal Cancers In The Swietokrzyskie Region By The Year 2025*. **Med Stud./Stud Med**.2019; 32–40. Google Scholar.
- Brian Derstine, Sven Holcombe, Brian Ross, Nicholas Wang, Stewart Wang & GraceSu. *Healthy US population reference values for CT Visceral Fat Measurements and the Impact of IV Contrast, Hu Range, And Spinal Levels*, **Scientific Reports**. 12(2374), 2022. <https://www.nature.com/articles/s41598-022-06232-5>.
- Brosse.A.L, Sheets.E. , Lett.H.S , & Blumenthal.J.A, *Exercise and the Treatment of Clinical Depression in Adults*, **Recent Findings and Future Directions. Sports Med**,32(12),2022,741760.https://www.researchgate.net/publication/11151794_Exercise_and_the_Treatment_of_Clinical_Depression_in_Adults.
- Brown, J.C., Cespedes Feliciano, E.M. and Caan, B.J. *The Evolution of Body Composition In Oncology—Epidemiology, Clinical Trials, And The Future Of Patient Care: Facts And Numbers*. **Journal of cachexia, sarcopenia and muscle**. 2018 9(7), pp.1200-1208.
- Bülbul, a., özsoy, ş., ocakli, s. And b. Olcucu, *The Effect of Heavy Exercise on Plasma Lipid Levels in Elite Volleyball Male Athletes*, **Akdeniz Spor Bilimleri Dergisi**, 5(3),2022,604-612.
- Burridge, S. *Platforms for Change: Cambodia and Contemporary Dance from the Asia—Pacific Region*. In **Beyond the Apsara** , 2020, 121-139.
- Burrows. J , & Wright.J *The Good Life: New Zealand Children's Perspectives On Health And Self.Sport, Education And Society*, 2004. 9(2), 193-205. doi:10.1080/1357332042000233930.

- Carlijn Lamers. R, *Repeated Prolonged Moderate-Intensity Walking Exercise does not Appear to Have Harmful Effects on Inflammatory Markers in Patients with Inflammatory Bowel Disease*, -py7k Nigeria. **Scandinavian journal of gastroenterology**, 56(1),2021, 30–37
<https://doi.org/10.1080/00365521.2020.1845791>.
- Caudwell, Phillipa, Gibbons, Catherine, Finlayson, Graham, Näslund, Erik, Blundell & John, *No Sex Differences in Body Weight Response to Exercise*, **Exercise and Sport Sciences Reviews**, 42(3),2014,92-101. doi: 10.1249/JES.0000000000000019.
- Chehregosha. H, Khamseh.M.E, Malek.M. , Hosseinpanah. F & Ismail-Beigi. F, *A view beyond hba1c: Role of Continuous Glucose Monitoring*. **Journal of Diabetes therapy**, 10(3), 2019, 853-863.
- Chih-Hui Chiu, Ming-Chen Ko, Long-Shan Wu, Ding-Peng Yeh, Nai-Wen Kan, Po-Fu Lee, Jenn-Woei Hsieh, Ching-Yu Tseng & Chien-Chang Ho, *Benefits of Different Intensity Of Aerobic Exercise In Modulating Body Composition Among Obese Oneng Adults: A Pilot Randomized Controlled Trial: Health and Quality of Life Outcomes*,15(168)2017. <https://hqlo.biomedcentral.com/articles/10.1186/s12955-017-0743-4>.
- Chinmoy Sarkar, Chris J. Webster & Pablo Monsivais, *Examining the Interaction of Fast-Food Outlet Exposure and Income on Diet and Obesity: Evidence From 51,361 Uk Biobank Participants*. **International Journal of Behavioral Nutrition and Physical Activity**, (15)71, 2018. <https://ijbnpa.biomedcentral.com/articles/10.1186/s12966-018-0699-8>.
- Christiane L. Haase, Kirsten T. Eriksen, Sandra Lopes, Altynai Satylganova, Volker Schnecke, & Phil McEwan. *Body Mass Index and Risk Of Obesity-Related Conditions In A Cohort Of 2.9 Million People: Evidence From A Uk Primary Care Database*. PMID: 33841883. 2021,7(2), 137–147.
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8019280/>.
- Colin. D, Mathers. History of Global Burden of Disease Assessment At The World Health
- Cooney. J.K, Ahmad. Y.A, Moore. J.P, Sandoo. A & Thom. J.M, *The Impact Of Cardiorespiratory Fitness On Classical Cardiovascular Disease Risk Factors in Rheumatoid Arthritis: A Cross-Sectional And Longitudinal Study*. **Rheumatology International**, 39(10), 2019, 1759-1766.
- Creighton. R.M , Paradis.K.F , Blackburn. N. E & Tully.M.A, *Group-Based Physical Activity Interventions Targeting Enjoyment in Older Adults: A Systematic Review*. **Journal of Ageing and Longevity**, 2(2), 2022, 113-129.
- Dania Al-Hamad & Vandana Raman. *Defining the Metabolic Syndrome In Children Andadolescents*:Translpediatr.2017,6(4),397407.<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5682379/>.
- Danielle Tholey & Sidney Kimmel, *Fatty Liver*, Medical College at Thomas Jefferson

- David W. Hill, Brian K. McFarlin & Jakob L. Vingren, Exercise above the Maximal Lactate Steady State Does Not Elicit A $\dot{V}O_2$ Slow Component That Leads to Attainment of $\dot{V}O_{2max}$, 46(2), 2021. <https://doi.org/10.1139/apnm-2020-026>.
- Deci. E.L. & Ryan. R.M. , “Facilitating Optimal Motivation And Psychological Well-Being Across Life's Domains,” *Canadian Psychology*,49(1),2008,14–23, 2008. Google Scholar.
- Dhaliwal.S, Colletti.T , Wijesinghe.S & Rheume.C, *Effect of Physical Activity on Systemic Hypertension: A Review & Recommendations*, **Journal of Family Medicine and Health Care**, 8(3), 2022, 71-75.
- Dhandevi Pem & Rajesh Jeewon, Fruit and Vegetable Intake: *Benefits and Progress of Nutrition Education Interventions- Narrative Review Article*, 4 (10): 2015, 1309–1321. <https://www.ncbi.nlm.nih.gov/pmc/articles/pmc4644575/>.
- Dimitrios I. Athanasiadis, Sara Monfared, Jennifer N. Choi, Don Selzer, Ambar Banerjee, & Dimitrios Stefanidis, Vertical Banded Gastroplasty Revision to Gastric Bypass Leads to Effective Weight Loss and Comorbidity and Dysphagia Symptom Resolution, 30, 2020, 3453–3458. https://www.researchgate.net/publication/340674443_.
- Dishman. R.K & Buckworth. J, “Increasing Physical Activity: A Quantitative Synthesis,” *Medicine and Science in Sports and Exercise*, 28(6), 706–719, 1996. Google Scholar
- Dominik H. Pesta, Renata L. S. Goncalves, Anila K. Madiraju, Barbara Strasser & Lauren M. Sparks, Resistance Training To Improve Type 2 Diabetes: Working Toward a Prescriptionforthefuture,14(24),2017.<https://nutritionandmetabolism.biomedcentral.com/articles/10.1186/s12986-017-0173-7>.
- Eduardo Rossato de Victo., Gerson Luis de Moraes Ferrari., João Pedro da Silva Junior., Timóteo Leandro Araújo & Victor Keihan Rodrigues Matsudo, Lifestyle Indicators and Cardiorespiratory Fitness in Adolescents,35(01),2017. <https://doi.org/10.1590/1984-0462/;2017;35;1;00016>.
- Ellison. D, Wynard.T , Walton-Fisette. J.L. & Benes. S, *Preparing The Next Generation Of Health And Physical Educators Through Trauma-Informed Programmes*. **Journal of Physical Education, Recreation & Dance**, 91(9), 2020, 30-40.
- Elsie Hui a,* , Bo Tsan-keung Chui b, Jean Wooo, Effects of Dance On Physical And Psychological Well-Being In Older Persons, *East J Med*, 23(2),20118.
- Esmailiyan. M, Amerizadeh. A , Vahdat.S , Ghodsi.M , Doewes . R.I & Sundram.Y, *Effect of Different Types of Aerobic Exercise On Individual's With and Without Hypertension: An updated systematic review*. **Current problems in cardiology**, 2021, p.101034.
- Esse. R, Barroso. M, Tavares de Almeida & R. Castro, *The contribution of homocysteine*

- Federico Ponti, Andrea Plazzi, Giuseppe Guglielmi, Giulio Marchesini, & Alberto Bazzocchi, Body composition, dual-energy X-ray absorptiometry and obesity: the paradigm of fat (re)distribution, 5(3),2019. doi: 10.1259/bjrcr.20170078.
- Ferrari. G.L , Bracco.M.M , Matsudo. V.K ,Fisberg. M, *Cardiorespiratory Fitness and Nutritional Status of Schoolchildren: 30-Year Evolution*, **J Pediatr (Rio J)**. 2013; 89, 366–373.
- Ford and Swaine, *Effects of a 15-week accumulated Brisk-walking programme on the body composition of primary school children*. **Journal of Sports Sciences**, 31(2), 2012. DOI:10.1080/02640414.2012.723816. Source PubMed.
- Francesco Weiss, Margherita Barbuti, Giulia Carignani, Alba Calderone, Ferruccio Santini, IcroMaremmanni & Giulio Perugi, Psychiatric Aspects of Obesity: A Narrative Review of Pathophysiology and Psychopathology, 9(8),2020, 2344.
- Frank W. Booth, Christian K. Roberts, John P. Thyfault, Gregory N. Ruegsegger, & Gamble.L.J Physical Rehabilitation for Small Animals. *Veterinary Clinics: Small Animal Practice*.2022.
- Gao.J, Pan, X., G. Li, E. Chatterjee & J. Xiao, *Physical Exercise Protects against Endothelial Dysfunction in Cardiovascular and Metabolic Diseases*, **Journal of Cardiovascular Translational Research**.2021,1-17.
- Geetha Raghuveer, Jacob Hartz, David R. Lubans, Timothy Takken, Jennifer L. Wiltz, Michele Mietus-Snyder, Amanda M. Perak, Carissa Baker-Smith, Nicholas Pietris,Edwards, *Cardiorespiratory Fitness in Oneth: An Important Marker of Health: A Scientific Statement From the American Heart Association*, 142(7), 2020. <https://doi.org/10.1161/CIR.0000000000000866>.
- Gen.J Intern Med. Walking Cadence and Mortality among Community Dwelling Older Adult, 29(9), 2014, 1263-9. doi: 10.1007/s11606-014-2926-6. Epub.
- Gillen. J.B, Estafanos. S & Govette. A, *Exercise-nutrient Interactions for Improved Postprandial Glycemic Control and Insulin Sensitivity*. **Applied Physiology, Nutrition, and Metabolism**,46(8),2021,856-865.
- Grazyna Sypniewska, Pro-Inflammatory & Prothrombotic Factors and Metabolic Syndrome.PMID:29632466,18(1),2007,3946.<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5875080/>.
- Haas.M.C , Sommer.B.B , Karrer.S , Jörger. M, Graf, M. Huber, D. Baumgartner, J. Bansi, J. Kool & C.M. Bauer, *Surface Electromyography Activity Of Trunk Muscles During Trunk Control Exercises for People After Stroke; Effect of A Mobile And Stable Seat For Rehabilitation*, 17(7),2022,e0272382.
- Haffner.S.M , *Abdominal Adiposity and Cardiometabolic Risk: Do We Have All The Answers?* **The American Journal Of Medicine**, 120(9A),2007, S10 - 17.

- Hagstromer. M, Oja.P & Sjostrom.M , *The International Physical Activity Questionnaire (IPAQ): a study of concurrent and construct validity*. **Public Health Nutrition**, 9(6),2006, 755-762.
- Henrik Holm Thomsen, Nikolaj Rittig, Mogens Johannsen, Andreas Buch Møller, Jens Otto Lunde Jorgensen, Niels Jessen & Niels Moller, Effects of 3-hydroxybutyrate and Free Fatty Acids On Muscle Protein Kinetics And Signaling During Lps-Induced Inflammation In Humans: Anticatabolic Impact Of Ketone Bodies. 108(4),2018.
- Henry-unaeze, & e.k. Ngwu, *Eating Habits And Dietary Practices Among Outpatient Type 2 Diabetic Adults In Enugu, Nigeria*, **Journal Of Dietitians Association Of Nigeria (jdan)**, 11(2), 2020 print issn: 2141-8209; eissn:2635-3326.www.jdan.org.ng.
- Henson, J., Edwardson, C.L., Davies, M.J., Gill, J.M., Heaney, L.M., Khunti, K., Ng, L., Sattar, N., Zaccardi, F. and T. Yates, *Physical Activity And Lipidomics In A Population At High Risk Of Type 2 Diabetes Mellitus*. **Journal of sports sciences**, 38(10), 2020, 1150-1160.
- Hollman.W, Strüder,H.K , Tagarakis. C.V.M & King.G , *Physical Activity And The Elderly*. **Eur. J. Cardiovasc. Prev. Rehabil**, 14, 2007, 730–739.
- Holly Blake, Kathryn Watkins, Matthew Middleton, & Natalia Stanulewicz, Obesity and Diet Predict Attitudes towards Health Promotion in Pretest Registered Nurses and Midwives, 18(24), 2021,13419. doi: 10.3390/ijerph182413419
- Huaizhu wu & christie m. Ballantyne, Metabolic Inflammation and Insulin Resistance in Obesity,126, 2020, 1549–1564. <https://doi.org/10.1161/circresaha.119.315896>.
- Isabelle Romieu, Laure Dossus, Simón Barquera, Hervé M. Blottière, Paul W. Franks, Marc Gunter, Nahla Hwalla, Stephen D. Hursting, Michael Leitzmann, Barrie Margetts, Chizuru Nishida, Nancy Potischman, Jacob Seidell, Magdalena Stepien, Onefa Wang, Klaas Westerterp, Pattanee Winichagoon, Martin Wiseman & Walter C. Willett, Energy balance and obesity: what are the main drivers,28(3),2017, 247–258.doi: 10.1007/s10552-017-0869-z
- Jeffries. A.C, Marcora. S.M, Coutts, A.J, Wallace. L, McCall. A & Impellizzeri.F.M, *Development of a revised conceptual framework of physical training for use in research and practice*. **Sports Medicine**, 2021, 1-16.
- Johannes Zeiher, J. Katherine, Ombrellaro, Nita Perumal, Thomas Keil, B. Gert, M. Mensink, & Jonas D. Finger, *Correlates and Determinants of Cardiorespiratory Fitness in Adults: a Systematic Review*. **Sports Med Open**, 5(39). doi: 10.1186/s40798-019-0211-2.
- Kasiakogias.A & Sharma.S, Exercise: *The Ultimate Treatment to All Ailments?* **Clinical Cardiology Journal**, 43(8), 2020,817-826.

- Kim.S.H, Kim.M , Ahn.Y.B , Lim.H.K , Kang.S.G , & Cho.J.H, *Effect of Dance-exercise on Cognitive Function In Elderly Patients With Metabolic Syndrome: A Pilot Study*. **J. Sports Sci. Med**, 10, 2011, 671–678.
- Kirk.B, Mooney.K, Vogrin.S, Jackson.M, Duque.G, Khaiya.O & Amirabdollahian.F, *Leucine-Enriched Whey Protein Supplementation, Resistance-Based Exercise, and Cardiometabolic Health In Older Adults: A Randomized Controlled Trial*. **Journal of cachexia, sarcopenia and muscle**, 12(6), 2021, 2022-2033.
- Laitano. O, King. M.A & Leon. L.R, *Common Misconceptions in Classic and Exceptional heat Stroke in Heat Stress in Sport and Exercise*, 2019. 91-112.
- Levengood.T.W. , Peng.Y, Xiong. K.Z, Song. Z, Elder.R , Ali.M.K, M.H. Chin, P. Allweiss, C.M. Hunter & A. Becenti, *Community Preventive Services Task Force. Team-based Care To Improve Diabetes Management: A Community Guide Meta-Analysis*. **American Journal of Preventive Medicine**.2019, 57(1), pp.e17-e26.
- Liu, Hui, Kim, Jung & Kim, Ok-ja, *Effect of Brisk-walking and Square Dancing On Blood Pressure Reduction And Blood Lipid In Middle-Aged Female Patients With Hypertension*, **Journal of korean physical, Therapy Science**, 28(3), 2021, 76-87. <https://doi.org/10.26862/jkpts.2021.12.28.3.76>.
- Maedeh Amini, Farid Zayeri & Masoud Salehi. *Trend Analysis of Cardiovascular Disease Mortality, Incidence, And Mortality-To-Incidence Ratio: Results From Global Burden of Disease Study*, **BMC Public Health**, 2017, 21(401), 2021. <https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-021-10429-0#citeas>.
- Magnus Borga, Janne West, Jimmy D Bell, Nicholas C Harvey, Thobias Romu, Steven B Heymsfield, & Olof Dahlqvist Leinhard, *Advanced Body Composition Assessment: From Body Mass Index to Body Composition Profiling*, 66(5),2018, doi: 10.1136/jim-2018-000722.
- Manuela Angi ,George S Metsios, Yiannis Koutedakis & Matthew Wyon, *Fitness in Contemporary Dance A Systematic Review*.**International Journal of Sports Medicine**. 2022. <https://www.researchgate.net/publication/44392562>.
- María Mendoza-Muñoz, José Carmelo Adsuar, Jorge Pérez-Gómez, Laura Muñoz-Bermejo, Miguel Ángel Garcia-Gordillo & Jorge Carlos-Vivas, *Influence of Body Composition on Physical Fitness in Adolescents*, **Journal of Sports medicine**, 56(7),2020,328. doi:, 10.3390/medicina56070328.
- Mariam. E. Nelson, W. Jack. Rejeski, Stephen N. Blair, Pamela. W. Dunkan, Abby. C. King, Carol.A. Macera, Carmen Castaneda-sceppa & James. O. Judge, *Physical activity and public Health in Older Adult*, **American Heart Association: British Journal of Sports Medicine**, 116(9), 2007.

- Mathiowetz. V. , Weber,K, Volland. G & Kashman.N, *Reliability and validity of grip and pinchstrength evaluations. Journal of Hand Surgery*, 9(2),1984, 222-226. [https://doi.org/10.1016/S0363-5023\(84\)80146-X](https://doi.org/10.1016/S0363-5023(84)80146-X).
- Matthew Sherman, Ming-mei liu, Shari Birnbaum & Steven E. Wolf, joseph p, Minei & joshua w. Gatson, Adult obese mice suffer from chronic secondary brain injury after mild ,vo. 13, 2016, 171.
- Mattioli.A.V, Sciomer.S, Cocchi.C, Maffei. S & Gallina.S , *Quarantine during COVID-19 outbreak: Changes in diet and physical activity increase the risk of cardiovascular disease. Nutrition, Metabolism and Cardiovascular Diseases*,30(9),2020,1409-1417.
- Melissa Chambers, Stephanie K. Tanamas, Elena J. Clark, Diana L. Dunnigan, Chirag R. Kapadia, Robert L. Hanson, Robert G. Nelson, William C. Knowler, & Madhumita Sinha, *Growth Tracking in Severely Obese or Underweight Children, Medline Journal*,140(6),2017, e20172248. doi: 10.1542/peds.2017-2248.
- Méndez-Hernández, E. Ramírez-Moreno, R. Barrera-Gálvez, M.D.C. Cabrera-Morales, J. Reynoso-Vázquez, O.R.Flores-Chávez, L. Morales-Castillejos, N.D.S.Cruz-Cansino, R.C. Jiménez-Sánchez & J. Arias-Rico, *Effects of Strength Training on Body Fat in Children and Adolescents with Overweight and Obesity: A Systematic Review with Meta-Analysis*, 9(7),2022, 995.
- Metabolism disruption to endothelial dysfunction: state-of-the-art, International journal of molecular sciences*, 20(4),2019,867.
- Michael .P Czech, Insulin action and resistance in obesity and type 2 diabetes, 23(7), 2017 Jul 11, 804–814. doi: 10.1038/nm.4350.
- Michele Longo, Federica Zatterale, Jamal Naderi, Luca Parrillo, Pietro Formisano, Gregory Alexander Raciti, Francesco Beguinot, & Claudia Miele, *Adipose Tissue Dysfunction as Determinant of Obesity-Associated Metabolic Complications*,20(9), 2019,2358.
- Miguel A. Montoro-Huguet, Blanca Belloc, & Manuel Domínguez-Cajal, *Small and Large Intestine (I): Malabsorption of Nutrients*, 13(4), 2021, 1254. doi: 10.3390/nu13041254.
- Mohsen Mazidi, Maciej Banach, Andre Pascal Kengne, *Lipid and Blood Pressure Meta-analysis Collaboration. Prevalence of Childhood and Adolescent Overweight and Obesity in Asian Countries: A Systematic Review and Meta-Analysis*, 14(6), 2018 1185–1203.
- Monika Imierska, Adam Kurianiuk & Agnieszka Błachnio-Zabielska, *The Influence of Physical Activity on the Bioactive Lipids Metabolism in Obesity-Induced Muscle Insulin Resistance, (J.Med)*10(12), 2020, 1665. <https://doi.org/10.3390/biom10121665>.

- Motonari Ri, Susumu Aikou, & Yasuyuki Seto. Obesity as a surgical risk factor, 2(1), 2018 Jan. 13–21. doi: 10.1002/ags3.12049.
- Mouaz H. Al-Mallah, Stephen P. Juraschek, Seamus Whelton, Zeina A. Dardari, Jonathan K. Ehrman, Erin D. Michos, Roger S. Blumenthal, Khurram Nasir, Waqas T. Qureshi, Clinton A. Brawner, Steven J. Keteyian, & Michael J. Blaha, *Sex Differences in Cardiorespiratory Fitness and All-Cause Mortality: The Henry Ford Exercise Testing*, 91(6), 2017, 755–762. doi: 10.1016/j.mayocp.2016.04.002.
- Mouaz H. Al-Mallah, Stephen P. Juraschek, Seamus Whelton, Zeina A. Dardari, Jonathan K. Ehrman, Erin D. Michos, Roger S. Blumenthal, Khurram Nasir, Waqas T. Qureshi, Clinton A. Brawner, Steven J. Keteyian, & Michael J. Blaha. *Sex Differences in Cardiorespiratory Fitness and All-Cause Mortality: The Henry Ford Exercise Testing (FIT) Project.*, 91(6), 2017, 755–762. doi: 10.1016/j.mayocp.2016.04.002.
- Müller-Wieland, D., Brandts, J., Verket, M., Marx, N. & K. Schütt, **Glycaemic Control in Diabetes. Prevention and Treatment of Atherosclerosis.** 2021,47.
- Murad. M, Rahman. N.A.A, NIA Rahman, M Haque. “*Knowledge, attitude and practice regarding exercise among people exercising in gymnasium and recreational parks around Kuantan, Malaysia*”. **J App Pharm Sci**, 6 (06), 2016, 047-054.
- Muscella. A , Stefano . E & Marsigliante . S, *The effects of exercise training on lipid metabolism and coronary heart disease.* **American Journal of Physiology-Heart and Circulatory Physiology**, 319(1),2020,H76-H88.
- Mweete Debra Nglazi & John Ele-Ojo Ataguba, *Overweight and Obesity In Non-Pregnant Women Of Childbearing Age In South Africa: Subgroup Regression Analyses of surveydafrom1998to2017.*22(395),2022.<https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-022-12601-6>.
- Nadeem Baby, Raham Bacha & Syed Amir Gilani, *Correlation of subcutaneous fat measured on ultrasound with Body Mass Index.* *University Institute of Radiological Sciences and Medical Imaging Technologies, Lahore, Pakistan*, 26(4),2018,205-209. <https://www.jmuonline.org/article.asp?issn=09296441;year=2018;volume=26;issue=4;spage=205;epage=209;aulast=Nadeem>.
- Nahla Hwalla, Lara Nasreddine, & Sibelle El Labban, *Cultural Determinants of obesity in low- and Middle-income Countries in the Eastern Mediterranean Region, Eastern Mediterranean Region Journal*,10, 2017,
- Neovius.M, Y Linné, & S Rossner. *BMI, waist-circumference and Waist-Hip-Ratio as Diagnostic Tests for Fatness in Adolescents.* **International Journal of Obesity**, 29(2), 2005, 163-9. DOI:10.1038/sj.ijo.0802867.
- Nicole D. Ford, Shivani , A. Patel, & K.M. Venkat Narayan, *Obesity in Low- and Middle-Income Countries: Burden, Drivers, and Emerging Challenges: Annual Review of Public Health*, Vol. 38, 2017, 145-164. <https://doi.org/10.1146/annurev-publhealth-031816-044604>.

- Nik Ibrahim, N.N.I., Abdul Rahman, R., Azlan, M., Abd Aziz, A. H. Ghulam Rasool, Endothelial Microparticles as Potential Biomarkers in the Assessment of Endothelial Dysfunction in Hypercholesterolemia. *Medicina*, 58(6), 2022,824.
- Nnenna Ezeigwe, Chiamaka Omoyele, Rex G. Mpazanje, Mary T. Dewan, Emmanuel Agogo, Muktar A. Gadanya, Wondimagegnehu Alemu, Michael O. Harhay, Asa Auta, & Akindele O. Adebisi. *Estimating the prevalence of Overweight and Obesity in Nigeria in 2020: a systematic Meta-analysis*, 53(1), 2021, 495507.
- Organization Mathers Archives of Public Health, Journal of Public Health*, 2020.78:77 <https://doi.org/10.1186/s13690-020-00458-3> .
- Özcan Saygın and Mehmet Ali Öztürk, *.Effect of a Twelve-Week Aerobic Exercise Programme on health-related physical fitness components and blood lipids in obese females; African Journal of Pharmacy and Pharmacology*. 5(12), 2011, 1441-1445. <http://www.academicjournals.org/AJPP>.
- Pedersen.B.K & Salti. B, *Evidence for prescribing exercise as therapy in 26 different chronic diseases. Scand J.Med Sci Sports*, 2015.
- Pi-Hsia Lee, RN, EdD , Yeu-Hui Chuang, RN, PhD, Su-Ru Chen, RN, PhD ,Chin-Lung Fang, PhD, Hsiang-Ru Lai, PhD & Pei-I Lee, RN , *Perspectives Of Brisk Walking Among Middle-Aged And Older Persons In Community: A qualitative study*,24(2), 2017,147-153.
- Pimjai Anthanont, Paola Ramos, Michael D Jensen, & Kazanna C. Hames. *Family History of Type 2 Diabetes, Abdominal Adipocyte Size and Markers of the Metabolic Syndrome*. PMC5818259, 41(11),2018, 1621–1626.
- Qian. J, McDonough. D.J & Gao . Z.VFG, *The Effectiveness of virtual reality exercise on individual's physiological, psychological and rehabilitative outcomes: A systematic review*,**International journal of environmental research and public health**, 17(11),2020,4133.
- Raghavan. S, Vassy.J.L , Ho, Y.L., R.J Song, D.R. Gagnon, K. Cho, P.W. Wilson & L.S, Phillips. *Diabetes mellitus–related all-cause and cardiovascular mortality in a national cohort of adults. Journal of the American Heart Association*, 8(4), 2019, p.e011295.
- Rajpal A. , Rahimi. L, & Ismail-Beigi. F, *Factors leading to high morbidity and mortality of COVID-19 in patients with type 2 diabetes. Journal of diabetes*, 12(12), 2020, 895-908.
- Rebecca Kuriyan, *Body Composition Techniques, Indian*, 148(5), 2018, 648–658. doi: 10.4103/ijmr.IJMR_1777_18 .
- Rice.P.E , Nishikawa.K & Nimphius. S, *Isolated Joint Block Progression Training Improves Leaping Performance in Dancers. Frontiers in Sports and Active Living*, 2021, 3.

- Rodrigues-Krause, G.C. dos Santos, M. Krause & A. Reischak-Oliveira, *Dancing at Home during Quarantine: Considerations For Session Structure, Aerobic Fitness, and Safety*. **Journal of Physical Education, Recreation & Dance**, 92(4), 2021, 22-32.
- Rowan T. Chlebowski, Juhua Luo, Garnet L. Anderson, Wendy Barrington, Kerryn Reding, Michael S. Simon, JoAnn E. Manson, Thomas E. Rohan, Jean Wactawski-Wende, Dorothy Lane, Howard Strickler, Yasmin Mosaver-Rahmani, Jo L. Freudenheim, Nazmus Saquib, & Marcia L. Stefanick. *Weight Loss and Breast Cancer Incidence in Postmenopausal Women*, 125(2), 2019, 205–212. doi: 10.1002/cncr.31687
- Ryan G. Toedebusch, *Role of Inactivity in Chronic Diseases: Evolutionary Insight and Pathophysiological Mechanisms*, 2017. <https://doi.org/10.1152/physrev.00019.2016>.
- Said.M.A, Nafeh.N.Y & Abdallah, *Spexin Alleviates Hypertension, Hyperuricaemia, Dyslipidemia and Insulin Resistance in High Fructose Diet Induced Metabolic Syndrome in Rats Via Enhancing PPAR-γ and AMPK and inhibiting IL-6 and TNF-α*. **Archives of Physiology and Biochemistry**.2021,1-6.
- Saris. W.H.M , Blair.S.N , Van Baak1.M.A , S. B. Eaton, P. S. W. Davies , L. Di Pietr , M. Fogelholm ,A. Rissanen , D. Schoeller , B. Swinburn , A. Tremblay , K. R. Westerterp & H. Wyatt, *How much physical activity is enough to prevent unhealthy weight gain? Outcome of the IASO 1st Stock Conference and consensus statement: **The International Association for the Study of Obesity***. **Obesity reviews**,4, 2003, 101–114.
- Schaefer. H.S, Gist, K. Bigelman, J.D. Coelho, E.S. Proctor & R.M. Lerner. *Tough Teams and Optimistic Individuals: The Intersecting Roles of Group and Individual's Attributes In Helping To Predict Physical Performance*. **The Journal of Psychology**, 155(1), 2021, 1-25.
- Shannon S. D. Bredin, Kai L. Kaufman, Maddison I. Chow, Donna J. Lang, Nana Wu, David D. Kim, & Darren E. R. Warburton. *Effects of Aerobic, Resistance, and Combined Exercise Training on Psychiatric Symptom Severity and Related Health Measures in Adults Living With Schizophrenia: A Systematic Review and Meta-Analysis*, 2021, 8, 753117.
- Sharman. J. E, Smart.N.A, Coombes. J.S & Stowasser. M, *Exercise and sport science australia position stand update on exercise and hypertension*, **Journal of human hypertension**, 33(12), 2019,837-843.
- Sharon M. Fruh, *Obesity: Risk factors, complications, and strategies for sustainable long-term weight management*,29(1),2017,S3–S14. doi: 10.1002/2327-6924.12510.
- ShekharCapoor,ManishRajPahadia,M.L.Tank,PuneetRijhwani&ShatakshiSingh,*Prevalence of Metabolic Syndrome, Its Co-Morbidities and Effect of Treatment and Lifestyle Modification in Rural Females: **International Journal of Research and Review***, 7(2),2020, 273. ISSN: 2454-2237.

- Soha Abd El Dayem, Sahar El-Masry, H. Elghawaby, Farid Amin, I.A. Ibrahim, *Total and intra-abdominal fat distribution in obese adolescents using different techniques: Anthropometry, BIA and CT*. **Macedonian Journal of Medical Sciences**, 5(3), 2012, 269-274. DOI:10.3889/MJMS.1857-5773.2012.0237.
- Speelman.T, Dale. L, Louw.A & Verhoog. N.J , *The Association Of Acute Phase Proteins In Stress And Inflammation-Induced T2d (AAPPSI-T2D) Cells*, 11(14), 2022, 2163.
- Stirbu.O , Gadalean. F, Pitea.I.V , G. Ciobanu, A. Schiller, I. Grosu, A. Nes, R. Bratescu, N. Olariu, B. Timar & M.C. Tandrau, *C-reactive protein as a prognostic risk factor for loss of arteriovenous fistula patency in hemodialyzed patients*, **Journal of Vascular Surgery** ,70(1),2019,208-215.
- Stricker. P.R, Faigenbaum. A.D, McCambridge. T.M , LaBella. C.R,Brooks. M.A, Canty.G , A.B. Diamond, W. Hennrikus, K. Logan, K. Moffatt & B.A. Nemeth, Resistance training for children and adolescents. *Pediatrics*, 145(6), 2020.
- Su Jin Kim, Sung Yoon Cho, & Dong-Kyu Jin, Prader-Willi, *An Update On Obesity And Endocrine Problems*, **Journal on Obesity Syndrom** 26(4), 2021 Dec 31, 227–236.
- Suh-Jung Kang, Byung-Hoon Kim, Hyo Lee & Jinsung Wang. *The Beneficial Effects of Cognitive Walking Program on Improving Cognitive Function and Physical Fitness in Older Adults*, **Health Care Journal**, 9(4),2021,419. 10.3390/healthcare9040419
- Tai-Hsiung Hung, 1 Pei-An Liao, 2 Hung-Hao Chang, *Examining the Relationship between Cardiorespiratory Fitness and Body Weight Status: Empirical Evidence from Population-Based Survey of Adults in Taiwan*. **The Scientific World Journal**. 2014, 7.
- Tambalis. K.D & Sidossis. L.S . *Physical Activity and Cardio metabolic Health. Cardiorespiratory Fitness in Cardio metabolic Diseases: Prevention and Management in Clinical Practice*, 2019, 405.
- The Lancet. *Worldwide Trends in Body-Mass Index, Underweight, Overweight, And Obesity From 1975 To 2016: A Pooled Analysis Of 2416 Population-Based Measurement Studies In 128·9 Million Children, Adolescents, And Adults*.2017, 390(10113), 2627-2642.
- Thorp. A , & Stine. J.G , *Exercise As Medicine: The Impact Of Exercise Training On Nonalcoholic Fatty Liver Disease*, **Current Hepatology Reports**, 19(4), 2020, 402-411.
- Uffelen van, M.J.M. Chinapaw, W. Mechelen van, & M. Hopman-Rock, *Walking or vitamin B for cognition in older adults with mild cognitive impairment? A randomised controlled trial*. **Br. J. Sports Med**, 42,2008, 344–351. doi:10.1136/bjism.2007.044735.
- University,2021.<https://www.msmanuals.com/home/liver-and-gallbladder-disorders/manifestations-of-liver-disease/fatty-liver>.

- Veronda. A.C, Kline.C.E & Irish.L.A, *The Impact Of Circadian Timing On Energy Balance: An Extension Of The Energy Balance Model*. **Health Psychology Review**, 16(2), 2022, 161-203.
- Wan Manan, Dieudonne Kuate, Rohana Jalil, Wan Suriati Wan Nik & USiti Azima Awang, *Self-Perception And Quality Of Life Among Overweight And Obese Rural Housewives In Kelantan, Malaysia*, **Health and Quality of Life Outcomes**,13(19),2022.
- Waqas Sami, Tahir Ansari, Nadeem Shafique Butt, & Mohd Rashid Ab Hamid, *Effect Of Diet on Type 2 Diabetes Mellitus: A review* **Int J Health Sci (Qassim)**, 11(2), 2017, 6571.
- Xu, S., Ilyas, I., Little, P.J., Li, H., Kamato, D., Zheng, X., Luo, S., Li, Z., Liu, P., Han, J. & I.C. Harding, *Endothelial Dysfunction In Atherosclerotic Cardiovascular Diseases And Beyond: From Mechanism to Pharmacotherapies*. **Pharmacological Reviews**, 73(3), 2021, 924-967.
- Yan lu, e wang, ying chen, bing zhou, jiejie zhao, liping xiang, yiling qian, jingjing jiang, lin zhao, xuelian xiong, zhiqiang lu, duojiao wu, bin liu, jing yan, rong zhang, huijie zhang, cheng hu, & xiaoying li, *Obesity-induced excess of 17-hydroxyprogesterone promotes hyperglycemia through activation of glucocorticoid receptor*, 130(7), 2020 , 3791–3804. D
- Yin, X., Chen, Y., Ruze, R., Xu, R., Song, J., Wang, C. and Xu, Q,*The Evolving View Of Thermogenic Fat And Its Implications In Cancer And Metabolic Diseases*. **Signal Transduction and Targeted Therapy**, 7(1), 2022, 1-21.
- Yuetong Zhu, Zimin Wang, Hitoshi Maruyama, Ko Onoda & Qiuchen Huang, *Body Fat Percentage and Normal-Weight Obesity in the Chinese Population: Development of a Simple Evaluation Indicator Using Anthropometric Measurements*, **int. J. Environ. Res. Public Health**, 19(7), 2022, 4238; <https://doi.org/10.3390/ijerph19074238>.
- Yun.I, Joo.H.J , Y.S. Park and E.C. Park, *Association between Physical Exercise and Glycated Hemoglobin Levels in Korean Patients Diagnosed with Diabetes*. **International Journal of Environmental Research and Public Health**, 19(6), 2022, 3280.

Periodical Articles

- Arslan.A , *Impact of an eight-week step-aerobic dancing training programme on body composition markers in middle-aged inactive obese women*”. **International Federation of Sports Medicine**, 2011. <https://journals.co.za/doi/pdf/10.10520/EJC48419>.
- Adda Bjarnadottir, MS, RDN (Ice) & Jillian Kubala, MS, RD, *Alternate-Day Fasting: A Comprehensive Beginner's Guide*. — Medically reviewed.2020.

- Amanda Greene, Andrea Lasner, Common Dance Injuries and Prevention Tips, 2022. <https://www.hopkinsmedicine.org/health/conditions-and-diseases/sports-injuries/common-dance-injuries-and-prevention-tips> .
- Amer Suleman & Sherwin SW. Exercise Prescription. Updated, 2021, Available Online: <https://emedicine.medscape.com/article/88648-overview>.
- Anthropometric units of measurement., last edited on 2 September 2021 <https://en.wikipedia.org/wiki/Anthropometry>.
- Asia Zierle-Ghosh & Arif Jan. Physiology, Body Mass Index. Last Update, 2021, Available Online: <https://www.ncbi.nlm.nih.gov/books/NBK535456/>.
- BMJ Best Practice, Metabolic syndrome, 2022. <https://bestpractice.bmj.com/topics/en-us/212>.
- Catherine S, Jefferson and Missouri. Anthropometric Measurements: Characteristics & urpose, Available Online: <https://study.com/learn/lesson/anthropometric-measurements-purpose.html> 2022
- Colette Gallagher. Science Saturday: Researchers explore personalized approach to anti-obesity medications, Available Online: <https://newsnetwork.mayoclinic.org/discussion/science-saturday-researchers-explore-personalized-approach-to-anti-obesity-medications/2021>.
- Dafna Merom, Anne Grunseit, Ranmalee Eramudugolla, Barbara Jefferis, Cognitive Benefits of Social Dancing and Walking in Old age: The Dancing Mind randomized Controlled Trial. Trial registration: Australian and New Zealand Clinical Trials Register, 2016.
- Daniel Bubnis & Emily Cronkleton, 6 Warm-up Exercises to Help Boost Individual's Workout, Available Online: <https://www.healthline.com/health/fitness-exercise/warm-up-exercises#benefits2019>.
- Deep Shukla & Alexandra Sanfins, Obesity: Exercising, not dieting, may be key to avoiding health risks. 2021. <https://www.medicalnewstoday.com/articles/obesity-exercising-not-dieting-may-be-key-to-avoiding-health-risks#Body-mass-index-and-mortality-risk>.
- Dhana.K, Koolhaasm.C.M, Rossum.E.F.C, Ikram.M.A, Hofman.A., Kavousi.M, Metabolically healthy obesity and the risk of cardiovascular disease in the elderly population, 2016, 11, e0154273.

Food and Agriculture Organization of the United Nations (FAO) and the Pan American Health

Organization (PAHO). Overweight affects almost half the population of all countries in Latin America and the Caribbean except for Haiti. 2017.

Gavin Van De Walle, MS, RD. What Is a Calorie Deficit, and How Much of One Is Healthy, 2019

— medically reviewed by Jillian Kubala, MS, RD. Nutrition. <https://www.healthline.com/nutrition/calorie-deficit>.

Hai-Jian Sun, Zhi-Yuan Wu, Xiao-Wei Nie & Jin-Song Bian, Role of Endothelial Dysfunction in

Cardiovascular Diseases: The Link between Inflammation and Hydrogen Sulfide. 2020. <https://doi.org/10.3389/fphar.2019.01568>.

Heather M. Francis, Richard J. Stevenson, Megan J. Oaten, Mehmet K. Mahmut & Martin R. Yeomans. The Immediate and Delayed Effects of TV: Impacts of Gender and Processed-Food Intake History. 2017. <https://doi.org/10.3389/fpsyg.2017.01616>.

Ikechi G. Okpechi¹D, Vinash Kumar Hariramani¹, Naima Sultana¹, Anukul Ghimire¹,

Deenaz Zaidi¹, Shezel Muneer¹, Mohammed M. Tinwala¹, Feng Ye¹, Megan Sebastianski, Abdullah Abdulrahman¹, Branko Braam¹, Kailash Jindal¹, Maryam Khan¹, Scott Klarenbach¹, Soroush Shojai¹, Stephanie Thompson¹, Aminu K. Bello¹. The impact of community-based non-pharmacological interventions on cardiovascular and kidney disease outcomes in remote dwelling Indigenous communities, A scoping review protocol. 2022.

Jillian Kubala & Adda Bjarnadottir, 9 Reasons One May Be Gaining Weight Unintentionally; Medically reviewed. 2019.

Jonathan Q Purnell, Definitions, Classification, and Epidemiology of Obesity, Available Online: <https://www.ncbi.nlm.nih.gov/books/NBK279167/2018>.

Jordan King & David R. Lowery. Physiology, Cardiac Output, Available Online: <https://www.ncbi.nlm.nih.gov/books/NBK470455/2022>.

Josianne Rodrigues-Krause, M.Sc., Mauricio Krause, Ph.D., and Álvaro Reischak-Oliveira, *Cardiorespiratory Considerations in Dance*, Available Online: <https://www.ingentaconnect.com/contentone/jmrp/jdms/2015/00000019/00000003/art00001?crawler=true2015>

Kelly Wood, MD & Lauren Martin, Diabetes and metabolism: What to know, Available Online : <https://www.medicalnewstoday.com/articles/diabetes-and-metabolism2021>.

Kohei Kido, Kohei Sase, Takumi Yokokawa, & Satoshi Fujita. Enhanced skeletal muscle insulin

sensitivity after acute resistance-type exercise is up regulated by rapamycin-sensitive mTOR complex 1 inhibition, 10: 2020, 8509.

Kyle Casadei & John Kiel. Anthropometric Measurement, Available Online:

<https://www.ncbi.nlm.nih.gov/books/NBK537315/2021>.

Kyle Casadei , John Kiel and Anthropometric Measurement: In Stat Pearls, **treasure Island (FL):**

Stat Pearls Publishing; Available Online: **30726000**. Bookshelf ID: NBK537315.

<https://pubmed.ncbi.nlm.nih.gov/30726000/2021>.

Lauren Sharkey & Paula Field, Exercise levels predict lifespan better than smoking, medical history, Available Online: <https://www.medicalnewstoday.com/articles/3269582019>.

Liang Shen , Xiangmin Meng , Zhongrong Zhang , Tianhui Wang. Physical Exercise for Muscle

Atrophy. 1088,529545, Available Online: <https://pubmed.ncbi.nlm.nih.gov/30390268/2021>.

María J. Guembe, Cesar I. Fernandez-Lazaro, Carmen Sayon-Orea, Estefanía Toledo & Conchi Moreno-Iribas, Risk for cardiovascular disease associated with metabolic syndrome and its components: a 13-year prospective study in the RIVANA cohort, 2020. <https://cardiab.biomedcentral.com/articles/10.1186/s12933-020-01166-6>.

Matteo Giuriato, Valentina Biino, Marianna Bellafiore, Gross Motor Coordination We Have a Problem A Study With the Korperkoordinations Test fur Kinder in Oneth, 2021, 6-13. <https://www.researchgate.net/publication/356947331>.

Mina Wang, Yan Tan, Yifan Shi, Xu Wang, Zehuan Liao & Peng Wei, Diabetes and Sarcopenic

Obesity: Pathogenesis, Diagnosis, and Treatments, 2020. <https://doi.org/10.3389/fendo.2020.00568>.

Nick Smeeton, a principal lecturer at the University of Brighton and coauthor of that report. Why Dancing Is the Best Thing One Can Do For Individual's Body. 2017. <https://time.com/4828793/dancing-dance-aerobic-exercise/>.

Oluwafunmilola Leah Dominic, Nurudeen. O. Abubakar and Sikiru Adeoye, Comparative analysis of Anthropometric and Physiological Characteristics of Kwara State Judo and Javelin Athletes, 2021. https://www.researchgate.net/publication/350385876_comparative_analysis_of_anthropometric_and_physiological_characteristics_of_kwara_state_judo_and_javelin_athletes.

OsamaHamdy, Obesity Treatment&Management, Available Online

Online:<https://emedicine.medscape.com/article/123702-treatment?reg=12022>.

Par Fannie Lajeunesse-Trempe, Association between anthropometric features, metabolic syndrome (MS) and other cardio-metabolic risk factors in a population from Kenya. March, 2018. <https://dam-oclc.bac-lac.gc.ca>.

Public Health Agency of Canada, A Common Vision for increasing physical activity and reducing sedentary living in Canada: Let's Get Moving, 2020-12-08. **ISBN:** 978-0-660-08860-0. <https://www.canada.ca/en/publichealth/services/publications/healthy-living/lets-get-moving.html>.

Robby Berman, Walking 8,200 steps a day may lower your risk of chronic disease, study finds, 2022 . <https://www.medicalnewstoday.com/articles/walking-8200-steps-a-day-may-lower-your-risk-of-chronic-disease-study-finds>.

Srdan Pandurevic, Djuro Macut, Flaminia Fanelli, Uberto Pagotto & Alessandra Gambineri. Biomediators in Polycystic Ovary Syndrome and Cardiovascular Risk. 2021.

Stephen R Bird & John A Hawley, Update on the effects of physical activity on insulin sensitivity in humans, 2017. <https://bmjopensem.bmj.com/content/2/1/e000143>.

Tanmay Sharma, Rita E. Morassut, Christine Langlois & David Meyre. *Effect of sex/gender on obesity traits in Canadian first year university students, The Geneius study*. 2021. <https://doi.org/10.1371/journal.pone.0247113>.

Xiangren Yi , One Fu, Ryan Burns and Meng Ding. Weight Status, Physical Fitness, and Health-Related Quality of Life among Chinese Adolescents: A Cross-Sectional Study. 2019. <https://pdfs.semanticscholar.org/1b7d/da1973296f2d75be9b928e851a379596a385.pdf>.

Textbooks

Deci. E.L and Ryan. R.M, *Intrinsic Motivation and Self-Determination in Human Behavior*, Plenum Press, New York, NY, USA, 1985.

Hans de Ridder, International Society for the Advancement of Ki anthropometry (ISAK). International Standard for Anthropometric Assessment 2001. pg8.

Public Health Agency of Canada, A Common Vision for increasing physical activity and reducing sedentary living in Canada: Let's Get Moving, 2020-12-08. **ISBN:** 978-0-660-08860-0. <https://www.canada.ca/en/publichealth/services/publications/healthy-living/lets-get-moving.html>

The American College of Cardiology/American Heart Association, Guideline for the

Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults, 2017.

Thesis

Ismail-Orire, Halimat I'ya. Effect of Brisk-walking on Anthropometric Indices And Physiological Characteristics of Obese Adults in Ilorin Metropolis, Kwara State University (Nigeria), ProQuest Dissertations Publishing, 2021. 28542722.

Mikela. M.E, Nylander-French Oxygen Consumption during Rehearsaland Performance in Collegiate Dancers, Thesis, 2018. <https://soar.suny.edu/bitstream/handle/20.500.12648/6702/honors/216/fulltext%20%281%29.pdf?sequence=1&isAllowed=y>

Websites

Adda Bjarnadottir, MS, RDN (Ice), 9 Reasons Why Obesity is Not Just a Choice, 2022. https://www.healthline.com/nutrition/9-reasons-obesity-is-not-a-choice#toc_title_hdr_9.

Aetna, Obesity and Surgery. 2022. https://www.aetna.com/cpb/medical/data/100_199/0157.html.

Alan Chait & J. Laura. den Hartigh, Adipose Tissue Distribution, Inflammation and Its Metabolic Consequences, Including Diabetes and Cardiovascular Disease, 25, 2020. <https://doi.org/10.3389/fcvm.2020.00022>.

All Health Matters Ltd, Benefit of Walking for health and Longevity, |2022. <https://www.allhealthmatters.co.uk/post/six-benefits-of-walking-for-individual's-health-and-longevity>.

Amer Suleman, & Craig C Oneng, Exercise Physiology, 2020. <https://emedicine.medscape.com/article/88484-overview#a4>.

American Heart Association, Recommendation for Physical Activity, 2018, https://www.heart.org/HEARTORG/HealthyLiving/PhysicalActivity/StartWalking/American-Heart-Association-Guidelines-for-Physical-Activity_UCM_307976_Article.jsp.

American Heart Association, <https://www.heart.org/en/health-topics/high-blood-pressure/understanding-blood-pressure-readings>.

American Society of Plastic Surgeons Liposuction, 10 things to know and 10 questions to ask, 2018. <https://www.plasticsurgery.org/news/blog/liposuction-10-things-to-know-and-10-questions-to-ask>.

Anna Fenton. Weight, Shape, and Body Composition Changes at Menopause, 12(3); 2021, 187–192. 10.4103/jmh.jmh_123_21.

AZCentral, What muscles are used in walking, 2021, <https://healthyliving.azcentral.com/muscles-walking-exercise-1837.html>.

Benioff Children's Hospital Oakland, Obesity 2002 - 2022. The Regents of the University of California, 2022. <https://www.ucsfbenioffchildrens.org/conditions/obesity>.

Cleveland Clinic medical professional. Aerobic Exercise, Last reviewed. 2019. <https://my.clevelandclinic.org/health/articles/7050-aerobic-exercise>.

Cleveland Clinic, Class III Obesity (Formerly Known as Morbid Obesity), 2022. <https://my.clevelandclinic.org/health/diseases/21989-class-iii-obesity-formerly-known-as-morbid-obesity>.

ClevelandClinic. Insulin Resistance, 2022. <https://my.clevelandclinic.org/health/diseases/22206-insulin-resistance>.

Danielle Hildreth, RN, CPT & Jane Chertoff . 10 Aerobic Exercise Examples: How to, Benefits, and More, 2022. <https://www.healthline.com/health/fitness-exercise/aerobic-exercise-examples>.

David Zelman, Exercise to Treat Arthritis; Medically Reviewed. 2021. <https://www.webmd.com/arthritis/exercise-treat-arthritis>.

Debra Sullivan & Jon Johnson. What to Know about low blood pressure with high pulse; Medically reviewed, 2021. <https://www.medicalnewstoday.com/articles/low-blood-pressure-high-pulse>.

Health & Fitness , 10 Best Cardio Workouts for Weight Loss, 2022. <https://www.mensjournal.com/health-fitness/best-types-cardio-workouts-weight-loss/>.

Health risks of obesity: MedlinePlus Medical Encyclopedia, 2021. <https://medlineplus.gov/MedicalEncyclopedia.https://apps.who.int/iris/bitstream/handle/10665/324835/9789241565707-eng.pdf>.

<https://timesofindia.indiatimes.com/life-style/health-fitness/weight-loss/left-sweets-for-weight-loss-take-a-look-at-this-mans-42-kg-weight-loss-and-he-had-laddoos/articleshow/64173281.cms>. 2018, 14:34.

- https://www.heart.org/HEARTORG/HealthyLiving/PhysicalActivity/StartWalking/American-Heart-Association-Guidelines-for-Physical-Activity_UCM_307976_Article.jsp.
- Jake Tipane, CPT & Sarah Kester, Science Based Training Scheme; Medically reviewed, 2020. <https://www.healthline.com/health/fitt-principle>.
- James Beckerman. Individual's Heart Rate; Medically Reviewe, 2020. <https://www.webmd.com/heart-disease/heart-failure/watching-rate-monitor>.
- Jim Frost. Percentile: Interpretations and Calculation. 2019. <https://statisticsbyjim.com/basics/percentiles/>.
- Jordan King & David R. Lowery. Physiology, Cardiac Output, 2022. <https://www.ncbi.nlm.nih.gov/books/NBK470455/>.
- Joshua. E Brinkman, Fadi Toro & Sandeep Sharma, Physiology, Respiratory Drive, 2022. <https://www.ncbi.nlm.nih.gov/books/NBK482414/>.
- Lawrence Robinson, Jeanne Segal, & Melinda Smith. The Mental Health Benefits of Exercise, 2022. <https://www.helpguide.org/articles/healthy-living/the-mental-health-benefits-of-exercise.htm>.
- mayo clinic q and a: transplant options for patients who are obese. gastric bypass (roux-en-y) .2022. <https://www.mayoclinic.org/tests-procedures/gastric-bypass-surgery/about/pac-20385189>.
- Mayo Clinic Staff, Walking: Trim your waistline, improve your health, 2021, <https://www.mayoclinic.org/healthy-lifestyle/fitness/in-depth/walking/art-20046261>.
- Mayo Clinic. Exercise intensity: How to measure it, 2022. <https://www.mayoclinic.org/healthy-lifestyle/fitness/in-depth/exercise-intensity/art-20046887>.
- Medline Plus. Aging changes in the bones - muscles - joints. 2020. <https://medlineplus.gov/ency/article/004015.htm>.
- Micky Lal, Tamera Clifton, & Nicole Davis. 5 Fat-Burning Low Impact Exercises That Won't Kill Individual's Knees, 2022. <https://www.healthline.com/health/fitness-exercise/low-impact-exercises>.
- Timothy Cuff, Historical Anthropometrics. The EHS Annual Conference 2022. <https://eh.net/encyclopedia/historical-anthropometrics/>.
- National Cancer Institute, Obesity and Cancer, Reviewed 2022. <https://www.cancer.gov/about-cancer/causes-prevention/risk/obesity/obesity-fact-sheet>.

- National Health and Nutrition Examination Survey(NHANES). Adult Obesity Facts. March 2020. <https://www.cdc.gov/obesity/data/adult.html>.
- Physiopedia, Anaerobic Exercise, 2022, https://www.physiopedia.com/Anaerobic_Exercise.
- Riddhi Ramanlal & Vikas Gupta, Physiology, Vasodilation, 2022. <https://www.ncbi.nlm.nih.gov/books/NBK557562/>.
- Running vs. dancing: What to choose if one want to lose weight, 2018. <https://timesofindia.indiatimes.com/life-style/health-fitness/weight-loss/running-vs-dancing-what-to-choose-if-one-want-to-lose-weight/articleshow/64191135.cms>.
- Sagar Patel; Alvin Jose & Shamim S. Mohiuddin, Physiology, Oxygen Transport and Carbon Dioxide Dissociation Curve, 2022.
- The Editors of Encyclopaedia Britannica, Obesity medical disorder: corpulence, fatness, 2022. <https://www.britannica.com/science/obesity/Causes-of-obesity>
- University of Copenhagen, Researchers Find the Secret behind Maintaining Healthy Weight Loss, 2021. <https://scitechdaily.com/researchers-find-the-secret-behind-maintaining-healthy-weight-loss/amp/>.
- Valentina Salvestrini, Christian Sell & Antonello Lorenzini, Obesity May Accelerate the Aging Process. 2019. <https://doi.org/10.3389/fendo.2019.00266>.
- World Health Organisation (WHO), Malnutrition, 2021. <https://www.who.int/news-room/fact-sheets/detail/malnutrition>.
- World Health Organisation (WHO), Overweight and Obesity, <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight2021>.
- World Health Organisation (WHO). World Health Statistics 2019: Monitoring Health for the Sustainable Development Goals (SDGs).
- World Health Organisation (WHO). Over Weight and Obesity, <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight2021>.
- World Health Organisation Day, <https://www.who.int/news/item/04-03-2022-world-obesity-day-2022-accelerating-action-to-stop-obesity>.
- World Health Organisation, 2022. <https://www.who.int/news/item/04-03-2022-world-obesity-day-2022-accelerating-action-to-stop-obesity>.
- World Health Organisation. 2022. https://www.who.int/health-topics/obesity#tab=tab_1.
- World Health Organisation. Fact on Obesity, 2021. <https://www.who.int/news-room/facts-in-pictures/detail/6-facts-on-obesity>.

World Health Organisation. Non-communicable, diseases, 2021. <https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases>.

World Health Organization, monitoring health for the SDGs, sustainable development goal: © World Health Organization 2019.

Z score and Percentile. E-resource. 2020.<https://anthro.du.ac.in/e-resources2020/shivani/z%20score%20and%20percentile.pdf>

Appendix I

Dance-exercise Programme for treatment group for eight weeks

Week 1(Monday, Wednesday and Friday)

Warm – up Activities (10 minutes)

| S/n | Exercise | Duration | Reps |
|-----|--------------------|----------|------|
| 1 | Static stretching | 2m | 5 |
| 2 | Dynamic stretching | 3m | 10 |
| 3 | Walking | 5m | 5 |

(30 minutes dance-exercise)

| S/n | Dance-exercise | Duration | Recovery (20 sec) | Tempo of the music |
|-----|----------------|----------|----------------------------------|---|
| 1 | Afro/pop | 10 | Active rest (matching on a spot) | 100bpm (a rhythmic or flow of sound in language) |
| 2 | Afro/pop | 10 | Active rest | 100 bpm |
| 3 | Afro/pop | 10 | Active rest | 100bpm |

Cool down exercises (10 minutes)-match in place and static stretching.

Week 2 and 3 Warm – up activities (10 minutes)

| S/n | Exercises | Repetition | Set |
|-----|----------------------------|------------|-----|
| 1 | Dynamic stretching | 2 minutes | 2 |
| 2 | Jog-in-place | 3 minutes | 2 |
| 3 | Ball throwing and catching | 5 minutes | 2 |

(30 minutes dance-exercise)

| S/n | Dance-exercise | Duration | Recovery (20 sec) | Tempo of the music |
|-----|----------------|----------|-----------------------|------------------------|
| 1 | afro/pop | 10 | Active rest (matching | 105bpm (a rhythmic or |

| | | | | |
|---|----------|----|-------------|----------------------------|
| | | | on a spot) | flow of sound in language) |
| 2 | Afro/pop | 10 | Active rest | 105 bpm |
| 3 | Afro/pop | 10 | Active rest | 105bpm |

Cool down exercises (10 minutes)-static stretching and abdominal exercises.

Week 4 and 5

Warm – up activities (10 minutes)

| S/n | Exercises | Distance | Reps |
|-----|--------------------|----------|------|
| 1 | Jump rope | 5 m | 5 |
| 2 | Jump and hop | 2 m | 5 |
| 3 | Dynamic stretching | 3 m | 10 |

(45minutes Dance-exercise)

| S/n | Dance-exercise | Duration | Recovery (20 sec) | Tempo of the music |
|-----|----------------|----------|----------------------------------|---|
| 1 | afro/pop | 15 | Active rest (matching on a spot) | 110bpm (a rhythmic or flow of sound in language) |
| 2 | Afro/pop | 15 | Active rest | 110 bpm |
| 3 | Afro/pop | 15 | Active rest | 110bpm |

Cool down exercises (10 minutes)-static stretching and abdominal exercises.

Week 6 and 7 (Warm – up Activities (10 minutes)

| S/n | Exercises | Distance | Reps |
|-----|--------------------|----------|------|
| 1 | Jump rope | 5 m | 5 |
| 2 | Jump and hop | 2 m | 5 |
| 3 | Dynamic stretching | 3 m | 10 |

(45 minutes Dance-exercise)

| S/n | Dance-exercise | Duration | Recovery (20 sec) | Tempo of the music |
|-----|----------------|----------|----------------------------------|---|
| 1 | afro/pop | 15 | Active rest (matching on a spot) | 115bpm (a rhythmic or flow of sound in language) |
| 2 | Afro/pop | 15 | Active rest | 115bpm |
| 3 | Afro/pop | 15 | Active rest | 115bpm |

Cool down exercises (10 minutes)-static stretching and plank exercises.

Week 8 (Warm – up Activities (10 minutes)

| S/n | Exercises | Distance | Reps |
|-----|-----------|----------|------|
|-----|-----------|----------|------|

| | | | |
|---|--------------------|-----|----|
| 1 | Jump rope | 5 m | 5 |
| 2 | Jump and hop | 2 m | 5 |
| 3 | Dynamic stretching | 3 m | 10 |

(45 minutes Dance-exercise)

| S/n | Dance-exercise | Duration | Recovery (20 sec) | Tempo of the music |
|-----|----------------|----------|----------------------------------|--------------------|
| 1 | afro/pop | 15 | Active rest (matching on a spot) | 120bpm |
| 2 | Afro/pop | 15 | Active rest | 120 bpm |
| 3 | Afro/pop | 15 | Active rest | 120bpm |

Cool down exercises (10 minutes)-static stretching and plank exercises.

Brisk-walking Programme for Treatment Group for Eight Week

Week 1(Monday, Wednesday and Friday)

Warm – up Activities (10 minutes)

| S/n | Exercise | Duration | Reps |
|-----|--------------------|----------|------|
| 1 | Static stretching | 2m | 5 |
| 2 | Dynamic stretching | 3m | 10 |
| 3 | Walking | 5m | 5 |

(30 minutes brisk-walking)

| S/n | Dance-exercise | Duration | Recovery (20 sec) | Tempo of the music |
|-----|----------------------|----------|----------------------------------|---|
| 1 | Brisk-walking | 10 | Active rest (matching on a spot) | 100bpm (a rhythmic or flow of sound in language) |
| 2 | Brisk-walking | 10 | Active rest | 100 bpm |
| 3 | Brisk-walking | 10 | Active rest | 100 bpm |

Cool down exercises (10 minutes)-match in place and static stretching.

Week 2 and 3 Warm – up Activities (10 minutes)

| S/n | Exercises | Repetition | Set |
|-----|----------------------------|------------|-----|
| 1 | Dynamic stretching | 2 minutes | 2 |
| 2 | Jog-in-place | 3 minutes | 2 |
| 3 | Ball throwing and catching | 5 minutes | 2 |

(30 minutes Dance-exercise)

| S/n | Dance-exercise | Duration | Recovery (20 sec) | Tempo of the music |
|-----|----------------|----------|-------------------|--------------------|
|-----|----------------|----------|-------------------|--------------------|

| | | | | |
|---|----------------------|----|----------------------------------|---|
| 1 | Brisk-walking | 10 | Active rest (matching on a spot) | 105bpm (a rhythmic or flow of sound in language) |
| 2 | Brisk-walking | 10 | Active rest | 105 bpm |
| 3 | Brisk-walking | 10 | Active rest | 105 bpm |

Cool down exercises (10 minutes)-static stretching and abdominal exercises.

Week 4 and 5

Warm – up Activities (10 minutes)

| S/n | Exercises | Distance | Reps |
|-----|--------------------|----------|------|
| 1 | Jump rope | 5 m | 5 |
| 2 | Jump and hop | 2 m | 5 |
| 3 | Dynamic stretching | 3 m | 10 |

(45minutes Dance-exercise)

| S/n | Dance-exercise | Duration | Recovery (20 sec) | Tempo of the music |
|-----|----------------------|----------|----------------------------------|--------------------|
| 1 | Brisk-walking | 15 | Active rest (matching on a spot) | 110 bpm |
| 2 | Brisk-walking | 15 | Active rest | 110 bpm |
| 3 | Brisk-walking | 15 | Active rest | 110 bpm |

Cool down exercises (10 minutes)-static stretching and abdominal exercises.

Week 6 and 7 (Warm – up Activities (10 minutes)

| S/n | Exercises | Distance | Reps |
|-----|--------------------|----------|------|
| 1 | Jump rope | 5 m | 5 |
| 2 | Jump and hop | 2 m | 5 |
| 3 | Dynamic stretching | 3 m | 10 |

(45 minutes Dance-exercise)

| S/n | Dance-exercise | Duration | Recovery (20 sec) | Tempo of the music |
|-----|----------------------|----------|---------------------------------|--------------------|
| 1 | Brisk-walking | 15 | Active rest(matching on a spot) | 115 bpm |
| 2 | Brisk-walking | 15 | Active rest | 115 bpm |
| 3 | Brisk-walking | 15 | Active rest | 115 bpm |

Cool down exercises (10 minutes)-static stretching and plank exercises.

Week 8 (Warm – up Activities (10 minutes)

| S/n | Exercises | Distance | Reps |
|-----|--------------------|----------|------|
| 1 | Jump rope | 5 m | 5 |
| 2 | Jump and hop | 2 m | 5 |
| 3 | Dynamic stretching | 3 m | 10 |

(45 minutes Dance-exercise)

| S/n | Dance-exercise | Duration | Recovery (20 sec) | Tempo of the music |
|-----|----------------------|----------|---------------------------------|--------------------|
| 1 | Brisk-walking | 15 | Active rest(matching on a spot) | 120 bpm |
| 2 | Brisk-walking | 15 | Active rest | 120 bpm |
| 3 | Brisk-walking | 15 | Active rest | 120 bpm |

Cool down exercises (10 minutes)-static stretching and plank exercises.

Nutrition Education Programme for Control Group for Eight Week

Week 1 and 2

Topic: Concept of Nutrition and Functions

| Topic | Training Objective | Activities | Duration |
|--------------------------------|---|--|------------|
| Meaning of nutrition education | Examining the relevance of nutrition to health. | Discuss the meaning of nutrition and benefits of good nutrition. | 40 minutes |

Week 3 and 4

| Topic | Training Objective | Activities | Duration |
|-----------------------------------|--|--|------------|
| Classes of food and its nutrients | To list classes of food and the nutrients in them. | Discuss classes of food and the benefits of the nutrients to their health. | 40 minutes |

Week 5 and 6

| Topic | Training Objective | Activities | Duration |
|----------------------------|---|---|------------|
| Nutrition and body weight. | To examine how nutrition affect their body weight | List food type that can affect positively and negatively the body weight. | 40 minutes |

Week 7 and 8

| Topic | Training Objective | Activities | Duration |
|------------------------------------|--|--|------------|
| Nutrition and disease of the body. | To examine how nutrition affect body immune system | List food type that can affect the body immune system positively and negatively. | 40 minutes |

Appendix II

Lead city university, Ibadan, Nigeria
Faculty of Arts and Education

Department of kinesiology, sports science and health education

Informed Consent Form

In order to assess Anthropometric and Cardiorespiratory Indices, the undersigned hereby voluntarily consents to engage in two test:

- 1) **Dance-Exercise**
- 2) **Brisk-Walking**

a) Explanation of Test

Dance is a rhythmic activities, that inhibits songs or beat style which makes exercise fun and enjoyable. On a treadmill, Brisk-walking at 100 steps per minute or 3.5 miles per hour can boost physical, mental, and emotional wellbeing, which is faster than a stroll.

b) Risk and Discomfort

Participants may experience some unpleasant signs like muscle soreness (counter shock) and pains at the beginning of the training which may make one want to quit the study. However, the pains are only some of the early effects of the training which will reduce as sufficient oxygen is released through regular participation in the exercise Programme.

c) Expected Benefit

This study will provide empirical basis on the relative effectiveness of Dance-exercise and Brisk-walking as modality for influencing anthropometric and cardiorespiratory indices of obese individual's. Also, this study will be widely disseminated; health professionals such as

nutritionists, physiotherapists, and doctors will be able to use them to build channels (campaigns, media outreach) to educate the public about the dangers of inactivity.

d) Inquiries

Questions regarding the procedure of this research work will be accommodated. If one have any question or need additional information, please ask for further explanation.

e) Freedom of Consent

Individual’s permission to perform these exercise Programme is strictly voluntary. One are free to deny consent if one wish.

I

Have read this form carefully and I fully understand the test procedure. I consent to participate in this tests.

Signature of the participants.....Signature of the Investigator.....

Date.....

Date.....

I certify that I have explained to the above individual’s the nature and purpose, the potential benefit, risk and discomfort associated with the study.

Appendix III

Physical Activity Readiness Questionnaire

| | Medical Questions | Yes | No |
|----|---|------------|-----------|
| 1. | Have one ever had any pain or injuries (ankle, knee, hip, back, shoulder, etc.)? | | |
| 2. | Have one ever had any surgery? | | |
| 3. | Has individual’s doctor ever diagnosed one with a chronic disease, such as coronary heart disease, coronary artery disease, hypertension (high blood pressure), high cholesterol or diabetes? | | |
| 4. | Has individual’s doctor ever said that one have a heart condition and that one should only perform physical activity recommended by a doctor? | | |
| 5. | Do one feel pain in individual’s chest when one perform physical activity? | | |
| 6. | In the past month, have one had chest pain when one were not performing any physical activity? | | |
| 7. | Do one lose individual’s balance because of dizziness or do one ever lose consciousness? | | |
| 8. | Do one have a bone or joint problem that could be made worse by a change in individual’s physical activity? | | |
| 9. | Is individual’s doctor currently prescribing any medication for individual’s blood pressure or for a heart condition? | | |
| | Physical Activity Questions | | |

| | | | |
|----|--|--|--|
| 10 | Do one partake in any Physical activities like, tennis, playing football etc.? | | |
| 11 | Do one have any hobby (reading, gardening, exploring the internet, etc.)? | | |
| 12 | Do one usually engage in intense Physical Activity? | | |

Appendix IV



Lead City University (LCU)

Motto: Knowledge for Self-reliance

Lagos - Ibadan Expressway, Toll Gate Area, Ibadan, Oyo State, Nigeria
Email: lcu.hrec@lcu.edu.ng



University Research Ethics Committee

Ap
pe
ndi

PROJECT TITLE: EFFECTS OF DANCE EXERCISE AND BRISK-WALKING ON ANTHROPOMETRIC AND CARDIORESPIRATORY INDICES OF OBESE UNDERGRADUATE IN LEAD CITY UNIVERSITY

PROJECT NUMBER: LCU-REC/22/026.

APPROVAL LETTER

The above-named proposal has been adequately reviewed; the protocol and safety guidelines satisfy the conditions of LCU-REC policies regarding experiments that use human subjects.

Therefore, the study under its reviewed state is hereby approved by the LCU-Research Ethics Committee.

Prof. Olusola Ladokun

*Name of LCU-REC Chairman
and Date*

11.05.2022

Signature of LCU-REC Chairman

Dr. Folahanmi Akinsolu

*Name of LCU-REC Secretary
Date*

11.05.2022

*Signature of LCU-REC Secretary and
Date*

This approval is given with the investigator's Declaration as stated below;

By signing below I agree/certify that:

- I have reviewed this protocol submission in its entirety and that I am fully cognizant of, and in agreement with all submitted statements.

Lead City University Hospital
Lead City University, Ibadan.
Internal memorandum

STATEMENT OF RESEARCH AGREEMENT

1. OLAYINKA OLAYINKA OLUMILAN (Level) Med/Sec student of department of K.M.S with matriculation number L111111111 hereby agrees to the following for research in the hospital.

1. My research topic is Effect of Poor Surgery and Sanitation on Anthropometric and Cardio-respiratory indices of obese undergraduate of Lead City University
2. That before my research begin, I have obtained approval of my research proposal from University Research Committee (RSC)
3. That I shall fund the research myself
4. I shall provide all consumables and other materials as may be assessed by the hospital to fund my research.
5. That my research will not alter, reduce or terminate the regular healthcare delivery in the hospital.
6. That I will abide by the content of approval of RSC
7. If at any point any of this above itemized statement is not obey, I agree that my research be discontinued by the hospital.

Researcher Signature

[Handwritten Signature]
OLAYINKA OLAYINKA OLUMILAN

Researcher Name

Hospital Head of Unit

[Handwritten Signature]

UOD Name

Head of Medical Services

[Handwritten Signature]
DR. M. O. Okebiyi

HMS Name

Appendix VI



Figure: 6A: The researcher taking the Anthropometric measurements of the Participants



Figure: 6B: The researcher recording the Blood Pressure of the Participants

Student's Biodata

Personal Data

Full Names: Olawale Oluwaseun, OLADAPO
Address: Day-light Avenue, Odo-ona kekere,Ibadan.
Date and Place of Birth: 7th May, 1990 /Ibadan,Oyo state
Nationality: Nigerian
Next of Kin:

Name: Magdalene OLADAPO
Address: Day-light Avenue, Odo-ona kekere,Ibadan.

Educational Background:

| | Qualification Obtained | Date | |
|------------|---------------------------------|---|-------------|
| S/N | Institution | Qualification Obtained | Date |
| 1 | Lead City University, Ibadan | Bachelors of Science in Education in Physical and Health Education | 2016 |

Working Experience:

| S/N | Company | Role | Date |
|------------|--|---|-------------|
| 1 | Muslim Grammar School Odinjo, Ibadan. | Physical and Health Education Teacher. | 2014 |
| 2 | Methodist High School Lagos/Ibadan Express way, Ibadan. | Physical and Health | 2015 |

| | | | |
|---|--|----------------------|---------------|
| 3 | Edo Boys High School, Benin City Edo State | Physical and Health | 2017 |
| 4 | Sterling Bank Plc., Ring Road, challenge, Ibadan. | Sales Representative | 2018 |
| 5 | Lead City University Ibadan, Oyo State., | Graduate Assistance | 2019-tilldate |

Signature

Date

DO NOT COPY. LEAD CITY UNIVERSITY, NIGERIA.

University Compliance Certification

This is to certify that this Thesis written by **Olawale Oluwaseun OLADAPO** with Matric No **LCU/PG/001929** in the Department of Kinesiology, Sports Science & Health Education, Faculty of Arts and Education, Lead City University, Ibadan is in full compliance with the approved University format and style.

.....

Signature

.....

Date

DO NOT COPY. LEAD CITY UNIVERSITY, NIGERIA.