

## PERCEIVED EFFECTS OF EXERCISE ON MENTAL HEALTH STATUS OF STUDENTS IN UNIVERSITY OF ILORIN

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### Abstract

*Exercise engagement is the bodily movement produced by skeletal muscles that requires energy expenditure. However, despite all the known benefits of exercise, existence of some research suggesting a positive relationship between exercise and mental health in various populations, there is a gap in knowledge specifically regarding students. The objectives of the study were to: examine the perceived effect of jogging, walking and swimming on mental health of students in University of Ilorin. Descriptive research design of survey type was used. A sample of 257 respondents were selected for this study through multistage sampling procedure. A researcher-structured questionnaire was used as instrument for data collection. Descriptive statistics were used to answer the research questions and inferential statistics were used to analyzed the hypotheses at 0.05 alpha level. The findings of the study were among that jogging, walking and swimming has effect on mental health status of students in the University of Ilorin. Based on the findings, it was concluded that; jogging is paramount toward ensuring optimum mental health among students in University of Ilorin. It was therefore, recommended that; students should adhere strictly to the recommendation of WHO on 75 -150 moderate to vigorous intensity activities in a week in which jogging is potent way to achieve this recommendation.*

**Keywords:** Mental, Health, Jogging, Walking, Swimming

### Introduction

Physical exercise is important for maintaining physical fitness and can contribute to maintaining a healthy weight, regulating the digestive system, building and maintaining healthy bone density, muscle strength, and joint mobility, promoting physiological well-being, reducing surgical risks, and strengthening the immune system. studies indicate that exercise may increase life expectancy and the overall quality of life. People who participate in moderate to high levels of physical exercise have a lower mortality rate compared to individuals who by comparison are not physically active

(Okonkwo, 2016). Desruelle, et al., (2022) posited that the influence of exercise on the loco-motor, respiratory, cardiovascular, and other systems and its influence on digestion, nutrition, excretion, but especially on the nervous system and mental activity is stimulating, exercise being essential for life and balance and harmony in human life. Physical fitness have become a normal part of life for many. The importance of engagement in physical fitness among students cannot be underestimated.

According to Ho, et al., (2023), mental health refers to a person's overall psychological well-being, encompassing

their emotional, cognitive, and social functioning. It involves how individuals think, feel, and behave, as well as how they cope with the ups and downs of life, relate to others, and handle stress. Mental health is not merely the absence of mental disorders, but rather a state of positive mental and emotional functioning that allows individuals to lead fulfilling lives, realize their potential, and effectively contribute to their communities. Good mental health involves various factors, such as a sense of self-worth, the ability to manage emotions, resilience in the face of adversity, healthy relationships, and a balance between work and leisure activities. It is important to recognize that mental health exists on a continuum, with varying degrees of well-being and challenges. Just like physical health, mental health requires attention, care, and support to maintain and improve (John, 2022). Engaging in regular physical activity, such as aerobic exercises, can help reduce stress levels. Exercise stimulates the production of endorphins, often referred to as "feel-good" hormones, which elevate mood and promote relaxation. It also provides a healthy outlet for releasing built-up tension and pent-up emotions, thereby reducing overall stress levels (Ho, et al., 2023).

Exercise is associated with an improved mood and increased emotional resilience. Regular exercise can alleviate symptoms of depression, anxiety, and other mental health conditions. It boosts the production of serotonin, a neurotransmitter that regulates mood, and promotes the growth of new brain cells, leading to

enhanced emotional well-being and overall happiness. It is essential to note that mental health conditions, such as anxiety disorders, depression, bipolar disorder, schizophrenia, and others, are common and can affect anyone. Seeking professional help and support is crucial for those experiencing mental health difficulties, as it can lead to accurate diagnosis, appropriate treatment, and improved quality of life (Unigwe, 2016).

Exercise improves memory, attention span, and cognitive flexibility, leading to sharper thinking and better problem-solving skills. It increases blood flow to the brain, delivering oxygen and nutrients necessary for optimal cognitive functioning. Regular exercise helps to build a sense of accomplishment, self-confidence, and self-worth. It promotes a positive body image by enhancing physical strength, endurance, and overall fitness, which can positively influence how individuals perceive themselves. Exercise such as team sports, group classes, or outdoor exercises, provide opportunities for social interaction and connection. Engaging in these activities can help reduce feelings of loneliness and isolation, promoting a sense of belonging and social support, which are crucial for mental well-being. Jensen (2018) further emphasized that regular physical activity can help individuals develop better coping mechanisms and resilience to stress. Exercise also provides a healthy distraction from daily worries and challenges, allowing individuals to develop better stress management skills.

It is important to note that physical fitness should be approached in a balanced and sustainable manner. It is recommended to consult with healthcare professionals or fitness experts to design a fitness routine that suits individual needs and capabilities. In light of the aforementioned, this investigated the perceived effect of exercise on the mental health of students in the University of Ilorin.

### **Statement of the Problem**

In recent years, there has been growing concern about the mental health of students, with reports of increasing rates of stress, anxiety, and depression among this population. Exercise has long been recognized for its positive effects on physical health, but its potential influence on mental well-being has received less attention. Despite the existence of some research suggesting a positive relationship between exercise and mental health in various populations, there is a gap in knowledge specifically regarding students. Understanding the extent to which exercise contributes to the mental health of students is crucial for developing effective interventions and support systems within educational institutions

Babyak et al. (2016) conducted a randomized controlled trial involving 156 adults with major depressive disorder. They found that exercise significantly reduced depressive symptoms over a 16-week intervention period. Schuch et al. (2019) conducted a systematic review and meta-analysis of 49 randomized controlled trials involving individuals with depression.

They concluded that exercise was an effective intervention for reducing depressive symptoms. Their study however was limited to only depression, and not the whole mental health implications

Asmundson et al. (2013) conducted a meta-analysis of 49 studies examining the effects of exercise on anxiety symptoms. The results indicated that exercise was associated with a significant reduction in anxiety levels. Hallgren et al. (2016) conducted a large-scale study involving over 19,000 individuals and found that individuals who engaged in regular exercise had lower odds of developing anxiety disorders over a follow-up period of up to 21 years. The aforementioned studies were also limited to anxiety. Analysis of the above studies provided gaps in the literature. In the light of the aforementioned, this study therefore, investigated the perceived effect of exercise on mental health of students in the University of Ilorin.

### **Objectives of the Study**

The objectives of the study included the followings:

1. To find out the perceived effect of jogging on mental health of students in the University of Ilorin.
2. To determine the perceived effect of walking on mental health of students in the University of Ilorin.
3. To examine the perceived effect of swimming on mental health of students in the University of Ilorin.

### **Hypotheses**

The following hypotheses were formulated for this study:

- H<sub>01</sub>: Jogging will not have significant effect on mental health of students in University of Ilorin.
- H<sub>01</sub>: Walking will not have significant effect on mental health of students in University of Ilorin.
- H<sub>03</sub>: Swimming will not have significant effect on health of students in University of Ilorin

### **Methodology**

The research design that was used for this study was descriptive research design of survey type. This design is considered because it enabled the researcher to generate data through standardized collection procedures based on highly structured research instrument(s) and well-defined study concepts and related variables. The population of the study comprised all students in the University of Ilorin, Kwara state. According to the data obtained from the Students Affairs Unit in the University, there are 45, 923 undergraduate students in the University. The sample of the study consisted of selected students across all departments in the University of Ilorin. Using the krejcie & morgan sample size calculator, 257 respondents were selected to constitute the sample of the study. Researcher-structured questionnaire titled “Perceived Effect of Exercise on Mental Health Questionnaire (EPFMHQ)” was used to gather information from the respondents. The research instrument was divided into two sections (A and B). Section A was used to

collect information on the personal data of respondents such as gender, age and level while Section B consisted of items that are relevant to the study. A four-point Likert Scale was adopted which required the respondents to tick the appropriate column as they understand it – Strongly Agree (SA), Agree (A), Disagree (D), Strongly Disagree (SD). The instrument was used to measure the variables raised in the study.

In order to ascertain the validity of the instrument, the researcher gave the instrument to the supervisor and three other lecturers in the Department of Human Kinetics Education, University of Ilorin for vetting / analysis of content validity. The suggestions given were used to modify the items, after which they adjudged the instrument as being valid for the study. In order to obtain the reliability of the instrument, the instrument was administered to 20 respondents who are not part of the population. The reliability of the instrument was obtained using test-retest method and analysed using Pearson’s Product Moment Correlation which yielded 0.76 correlation coefficient. The researcher, personally administered the questionnaire with the help of 3 research assistants to the target respondents. After the respondents were enlightened on the purpose of the research, they were guided and encouraged to respond accurately and promptly to the questionnaire items and the completed questionnaires were retrieved immediately from the respondents. The data collected was analysed using Statistical Package for Social Science (SPSS). Descriptive statistics of frequency and percentage was

used to analysed demographic variables and to answer research questions while inferential statistics of chi-square was used

to test the hypotheses formulated for the study at 0.05 alpha level.

**Table one: Demographic data of respondents**

Variables	Frequency	Percentage
<b>Gender</b>		
Male	152	59.1
Female	105	40.9
<b>Total</b>	<b>257</b>	<b>100%</b>
<b>Age-Range</b>		
16-20yrs	77	30.0
21-24yrs	119	46.3
25-29yrs	25	9.7
30-35yrs	16	6.2
36yrs & Above	20	7.8
<b>Total</b>	<b>257</b>	<b>100%</b>
<b>Level</b>		
100 Level	55	21.4
200 Level	46.3	46.3
300 Level	<b>30.7</b>	30.7
400 Level	1.6	1.6
<b>Total</b>	<b>259</b>	<b>100%</b>

Table one shows that majority of the respondents 59 (45.7%) were male; and 105 (40.9%) of the respondents were female. Majority of the respondents 119 (46.3%) are within the age range of 21-24 years; 77 (30.0%) are within the age range of 16-20 years; 25 (9.7%) are within the age range of 25-29 years; and 16 (6.2%) of the respondents are within the age range of 30-

35 years, and 20 (7.8%) of the respondents are within the age range of 36 years and above. The table also revealed that the majority of the respondents 119 (46.3%) were in 200 level; 55 (21.4%) of the respondents were in 100 level; 79 (30.7%) were in 300 level; and 4 (1.6%) of the respondents were in 400 level.

### Data Analysis

**Research Question One:** Does jogging has effect on mental health of students in the University of Ilorin?

**Table 2: Effect of Jogging on Mental Health of Students in the University of Ilorin**

S/N	ITEMS	SA	A	FR	D	SD	UR
1	My depressed state will be enhanced when I engage in jogging exercise.	76 (29.6%)	122 (47.5%)	198 (77%)	44 (17.6%)	15 (5.8%)	59 (23%)

2	I am always motivated when I engage in jogging which increase my mental health.	61 (23.7%)	131 (51.0%)	192 (74.7%)	50 (19.5%)	15 (5.8%)	65 (25.3%)
3	Jogging boosts my endurance level which has significant effect on my mental health.	51 (19.8%)	109 (42.4%)	160 (62.3%)	83 (32.2%)	14 (5.4%)	97 (37.7%)
4	I have no appointment with the therapist as a result of my engagement in jogging exercise.	51 (19.8%)	114 (44.4%)	165 (64.2%)	81 (31.5%)	11 (4.3%)	92 (35.8%)
5	My focus and concentration level increases whenever I go for jogging which has significant effect on my mental health.	41 (16.0%)	101 (39.3%)	141 (55.2%)	86 (33.5%)	29 (11.3%)	115 (44.8%)
<b>Total</b>				<b>856 (66.6%)</b>			<b>429 (33.4%)</b>

**Key: FR- Favourable Responses, UR- Unfavourable Responses**

Table two shows descriptive analysis on perceived effect of jogging on mental health of students in the University of Ilorin. The table reveals that majority of the respondents 122 (47.5%) agreed that my depressed state will be enhanced when I engage in jogging exercise. Also, majority of the respondents 131 (51.0%) agreed that I am always motivated when I engage in jogging which increase my mental health. Also, 109 (42.4%) of the respondents agreed that jogging boosts my endurance level which has significant effect on my mental health.

The table also shows that 114 (44.4%) of the respondents agreed that I

have no appointment with the therapist as a result of my engagement in jogging exercise. Finally, table 3 shows that 101 (39.3%) of the respondents agreed that my focus and concentration level increases whenever I go for jogging which has significant effect on my mental health. The overall results of the items analysis presented in table 2 shows that 856 (66.6%) of the responses supported that jogging has effect on mental health of students in the University of Ilorin.

**Research Question Two:** Does walking has effect on mental health of students in the University of Ilorin?

**Table three: Descriptive analysis on perceived effect of walking on mental health of students in the University of Ilorin**

S/ N	ITEMS	SA	A	FR	D	SD	UR
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1	Walking a long distance prevents me from mental stress.	59 (23.0%)	72 (28.0%)	131 (51.0%)	97 (37.7%)	29 (11.3%)	126 (49.0%)
2	Walking accelerate my fatigue level which increase my mental health.	46 (17.9%)	119 (46.3%)	165 (64.2%)	66 (25.7%)	26 (10.1%)	92 (35.8%)
3	My mental health is enhanced as a result of my engagement in walking.	43 (16.7%)	116 (45.1%)	159 (61.9%)	72 (28.0%)	26 (10.1%)	98 (38.1%)
4	My energy level is increased when I engage in walking exercise.	40 (15.6%)	106 (41.2%)	146 (56.8%)	79 (30.7%)	32 (12.5%)	111 (43.2%)
5	Engaging in walking prevents me from depression and other consequences of negative mental health.	54 (21.0%)	89 (34.6%)	143 (55.6%)	71 (27.6%)	43 (16.7%)	114 (44.4%)
<b>Total</b>				<b>744 (57.9%)</b>			<b>541 (42.1%)</b>

**Key: FR- Favourable Responses, UR- Unfavourable Responses**

Table three shows descriptive analysis on perceived effect of walking on mental health of students in the University of Ilorin. The table reveals that majority of the respondents 97 (37.7%) disagreed that walking a long distance prevents me from mental stress. Also, majority of the respondents 119 (46.3%) agreed that walking improves my fatigue level which increase my mental health. Also, 116 (45.1%) of the respondents agreed that my mental health is enhanced as a result of my engagement in walking. The table also

shows that 106 (41.2%) of the respondents agreed that my energy level is increased when I engage in walking exercise. 89 (34.6%) of the respondents agreed that engaging in walking prevents me from depression and other consequences of negative mental health. The overall results of the items analysis presented in table three shows that 744 (57.9%) of the responses supported that walking has effect on mental health of students in the University.

**Table three: Descriptive analysis on perceived effect of walking on mental health of students in the University of Ilorin**

S/N	ITEMS	SA	A	FR	D	SD	UR
1	My mental strength is enhanced when I engage in swimming exercise.	46 (17.9%)	66 (25.7%)	112 (43.6%)	98 (38.1%)	47 (18.3%)	145 (56.4%)
2	I am able to prevent weaknesses since I engage in water work out.	29 (11.3%)	81 (31.5%)	110 (42.8%)	100 (38.9%)	47 (18.3%)	147 (57.2%)
3	Engaging in swimming helps me function properly.	47 (18.3%)	127 (49.4%)	174 (67.7%)	61 (23.7%)	22 (8.6%)	83 (32.3%)
4	I never feel mental pains as a result of engaging in water work out.	50 (19.5%)	118 (45.9%)	168 (65.4%)	70 (27.2%)	19 (7.4%)	89 (34.6%)
5	Swimming helps me in stress reduction.	45 (17.5%)	117 (45.5%)	162 (63.0%)	67 (26.1%)	28 (10.9%)	95 (37%)
<b>Total</b>				<b>726 (56.5%)</b>			<b>559 (43.5%)</b>

**Key: FR- Favourable Responses, UR- Unfavourable Responses**

Table four shows descriptive analysis on perceived effect of swimming on mental health of students in the

University of Ilorin. The table reveals that majority of the respondents 98 (38.1%) disagreed that my mental strength is

enhanced when I engage in swimming exercise. Also, majority of the respondents 81 (31.5%) agreed that I am able to prevent weaknesses since I engage in water work out. Also, 127 (49.4%) of the respondents agreed that engaging in swimming helps me function properly. The table also shows that 118 (45.9%) of the respondents agreed that I never feel mental pains as a result of engaging in water work out. 117 (45.5%) of the respondents agreed that swimming helps me in stress reduction. The overall results of the items analysis presented in

table four shows that 726 (56.5%) of the responses supported that swimming has effect on mental health of students in the University of Ilorin.

**Research Question Three:** Does swimming have effect on mental health of students in the University of Ilorin?

### Hypotheses Testing

**H<sub>0</sub>:** Exercise will not have significant effect on the mental health of students in the University of Ilorin.

**Table Five: Chi-Square analysis on perceived effect of exercise on mental health of students in the University of Ilorin**

S/N	Variables	N	df	$\chi^2$	Sig.
H <sub>01</sub>	Jogging	257	12	116.366	0.000
H <sub>02</sub>	Walking			56.829	0.000
H <sub>03</sub>	Swimming			61.732	0.000

$p < 0.05$

Table 5 shows chi-square analysis on effect of jogging on mental health of students in the University of Ilorin. The result indicated that  $n = 257$ ,  $\chi^2 = 116.366$ ,  $df = 12$ ,  $p = 0.000 < 0.05$ . Since the calculated  $\chi^2$  value is greater than the table value, hence, the null hypothesis is hereby rejected. This implies that jogging has effect on mental health of students in the University of Ilorin. The table also shows the chi-square analysis on influence of walking on mental health of students in the University of Ilorin. The result indicated that  $n = 257$ ,  $\chi^2 = 56.829$ ,  $df = 12$ ,  $p = 0.000 < 0.05$ . Since the calculated  $\chi^2$  value is greater than the table value, hence, the null hypothesis is hereby rejected. This implies that walking has effect on mental health of students in the University of Ilorin. The

table also reveal the chi-square analysis on effect of swimming on mental health of students in the University of Ilorin. The result indicated that  $n = 257$ ,  $\chi^2 = 61.732$ ,  $df = 12$ ,  $p = 0.000 < 0.05$ . Since the calculated  $\chi^2$  value is greater than the table value, hence, the null hypothesis is hereby rejected. This implies that swimming has effect on mental health of students in the University of Ilorin.

### Discussion of findings

H<sub>01</sub> as shown in table five indicated that jogging influence mental health of students in the University of Ilorin. Finding from this study is supported Ortega, Ruiz, Castillo and Sjostrom, (2018) that physical fitness is an individual's ability to perform optimal physical activities and can be



defined in terms of performance and health (Artero et al., 2011). According to Ortega, Ruiz, Castillo and Sjostrom (2008), physical fitness is an integrated measure of body functions (skeletal-muscular, cardiorespiratory, hemato-circulatory, psycho-neurological and endocrine-metabolic) which involved in daily physical work and/or physical exercise. Physical fitness components such as endurance, speed, agility, strength, power and flexibility are the factors that influence the overall level of performance in football game (Murr, Raabe & Honer, 2017; Turner et al., 2011).

Sport requires repeated movements like kicking, sprinting, tackling, and jumping which largely depending on the ability to use the greatest force (maximum strength) (Peterson, Alvar & Rhea, 2006; Turner et al., 2011). Sport involves from low to high intensity intermittent activities that require players to have the ability of aerobic and anaerobic systems for energy transmission while playing (Reilly et al., 2000; Williams & Reilly, 2000). This is because a player will perform physical movements such as standing; walking; low-intensity running, encompassing jogging, low-speed running and backward running; and high-intensity running, consisting of moderate-speed running, high-speed running and sprinting for 90 minutes (Mohr, Krstrup & Bangsbo, 2003; Saward, Morris, Nevill, Nevill & Sunderland, 2015). Bangsbo, Norregaard and Thorso (2011) have reported that 90 percent of physical activity is contributed from an aerobic energy system with high-

intensity activity for seven minutes. Therefore, a high level of maximum oxygen intake ( $VO_{2max}$ ) is a necessity for a player in competitive matches. It is clear that aerobic capacity ( $VO_{2max}$ ) is a relevant indicator to determine the maximum level of oxygen that can be taken and used by the body during a game.

The  $HO_2$  showed that walking influence mental health of students in the University of Ilorin. This finding aligned with the view of Hoffman, (2014) that the basis of the overload principle is the idea that for training adaptations to occur, the muscle or physiological component being trained must be exercised at a level that it is not normally accustomed to. This implies that there must be continually increase in the training loads as the body adapts over time, as the body builds and adjusts to the existing training regimen, there should be a gradual and systematic increase in the work load for continued improvement.

Adaptation is the change in physiological function that occurs in response to training. Adaptation occurs during periods of rest, when the body recovers from the acute homeostatic disruptions and/or residual fatigue and, as a result, may compensate to above-baseline levels of physiological functioning. This is sometimes called super-compensation (Hoffman, 2014). It is therefore critical for exercisers to receive sufficient rest between training sessions, after periods of increased training overload, and both before and after competitions. Adaptation allows the individual to either do more work or do the same work with a smaller disruption of

baseline values. Keeping records and retesting individuals are generally necessary to determine the degree of adaptation. The Principle of Recovery asserts that an individual must get adequate rest between workouts in order to recuperate. Over time, too little recovery can result in signs of overtraining also, excessively long periods of recovery time can result in a detraining effect (Satheesh, 2018).

The Ho<sub>3</sub> revealed that swimming influence mental health of students in the University of Ilorin. This finding is supported by Knips and Bergenthal (2019) that Physical fitness is important for maintaining physical fitness and can contribute to maintaining a healthy weight, regulating the digestive system, building and maintaining healthy bone density, muscle strength, and joint mobility, promoting physiological well-being, reducing surgical risks, and strengthening the immune system. Some studies indicate that exercise may increase life expectancy and the overall quality of life. People who participate in moderate to high levels of Physical fitness have a lower mortality rate compared to individuals who by comparison are not physically active. Moderate levels of exercise have been correlated with preventing aging by reducing inflammatory potential (Kyu & Alexander, 2016). The majority of the benefits from exercise are achieved with around 3500 metabolic equivalent (MET) minutes per week, with diminishing returns at higher levels of activity. For example, climbing stairs 10 minutes, vacuuming 15

minutes, gardening 20 minutes, running 20 minutes, and walking or bicycling for transportation 25 minutes on a daily basis would together achieve about 3000 MET minutes a week. A lack of physical activity causes approximately 6% of the burden of disease from coronary heart disease, 7% of type 2 diabetes, 10% of breast cancer and 10% of colon cancer. Overall, physical inactivity causes 9% of premature mortality worldwide (Paillard & Rolland, 2015).

Individuals can increase fitness by increasing physical activity levels. Increases in muscle size from resistance training are primarily determined by diet and testosterone. This genetic variation in improvement from training is one of the key physiological differences between elite athletes and the larger population (Grande; Silva; & Maddocks, 2015). Studies have shown that exercising in middle age leads to better physical ability later in life. Early motor skills and development is also related to physical activity and performance later in life. Children who are more proficient with motor skills early on are more inclined to be physically active, and thus tend to perform well in sports and have better fitness levels. Early motor proficiency has a positive correlation to childhood physical activity and fitness levels, while less proficiency in motor skills results in a more sedentary lifestyle. (National Institutes of Health National Heart, Lung, and Blood Institute, 2016)

### **Conclusion and Recommendation**

Based on the findings of this study, the study concluded that Jogging is

paramount toward ensuring optimum mental health among students in University of Ilorin. The study therefore recommended that Students should adhere strictly to the recommendation of WHO on 75 -150 moderate to vigorous intensity activities in a week in which jogging is potent way to achieve this recommendation.

## References

- Aafid, G. (2016). Need, importance and benefits of exercise in daily life. *International Journal of Physical Education, Sports and Health*, 3(2), 127-130.
- Adam, F. (2019). What to know about exercise and how to start. <https://www.medicalnewstoday.com/articles/153390.php>.
- Adeoye, S. A., Dominic, O. L. & Yusuf, A. N. (2017). Prevalence of overweight and obesity among secondary school students in Ilorin metropolis Kwara State, Nigeria. *Ghana Journal of Health Physical Education, Recreation, Sports and Dance* 10,113 – 143.
- Ahmad, M. M., Ahmed, H., & Airede, K. (2018). Body mass index among school adolescents in Sokoto, North-Western Nigeria. *Sahel Medical Journal*, 16(1), 5 – 9.
- Ajzen, I. (1988). *Attitudes, personality, and behaviour*. Chicago, IL: Dorsey
- Akinbiola, O. O. Adeniran, S. A. & Ogunlade, O. (2018). Effects of an 8-week intermittent aerobic exercise on the electrocardiogram and physiological parameters of institutional security personnel in Nigeria. Retrieved on the 12th of March 2019 from <https://oapub.org/edu/index.php/ejep/article/view/2010>
- American College of Sport Medicine (2006). *Guideline for Exercise Testing and Prescription*. (7<sup>th</sup>ed.) Philadelphia: Lippincott, Williams & Wilkins.
- American Heart Association (2013). Blood pressure vs. heart rate (pulse). <https://www.heart.org/en/health-topics/high-blood-pressure/the-facts-about-high-blood-pressure/blood-pressure-vs-heart-rate-pulse>.
- American Heart Association (2021). Blood pressure vs. heart rate (pulse). <https://www.heart.org/en/health-topics/high-blood-pressure/the-facts-about-high-blood-pressure/blood-pressure-vs-heart-rate-pulse>.
- American Physical Therapy Association. (2009). The science of healing, the art of caring: Physical fitness, wellness and health definition. *Journal of physical therapy association*, 3(6), 16-39.
- Anderson, L., Oldridge, N., Thompson, D. R., Zwisler, A. D., Rees, K., Martin, N. & Taylor, R. S. (2016). Exercise-Based Cardiac Rehabilitation for Coronary Heart Disease: Cochrane Systematic Review and Meta-Analysis. *Journal of the American College of Cardiology*, 5(67), 1-12. doi: 10.1016/j.jacc.2015.10.044.
- Andersson, H. Å., Randers, M. B., Heiner-Møller, A., Krstrup, P., & Mohr, M. (2010). Elite female soccer players perform more high-intensity running when playing in international games compared with domestic league

- games. *The Journal of Strength & Conditioning Research*, 24(4), 912-919.
- Andrea, N., Louis, P. & Massimo, S. (2016). Effect of exercise on cardiovascular health and fitness. *The Journal of Physiology and Physiological Society*, 7(1), 23-42. DOI: 10.1113/JP272421.
- Andrea, B., (2019). Definition of exercise duration. Retrieved from <http://www.healthyliving.92central.com/definition-exercise-duration19309.html>. Last updated January 2019.
- Ashly, M. (2018). What are the benefits of aerobic exercise. Medically reviewed by Daniel Bubnis. Retrieved from <https://www.healthline.com/health/fitness-exercise/benefits-of-aerobic-exercise>
- Awopetu, A. R. (2014). A Review of the physiological effects of exercise duration and intensity during walking and jogging. *Journal of Emerging Trends in Educational Research and Policy Studies (JETERAPS)*, 5(6), 660 – 667.
- Ayodele, O. Y. (2021). Prevalence of overweight and obesity among primary school pupil in University of Ilorin Kwara State, Nigeria. *Ghana Journal of Health Physical Education, Recreation, Sports and Dance* 1(23), 120 – 131.
- Babraj, S., Vollaard, J., Keast, R., Fergus, I., Cottrell, E. & Timmons, A. (2009). Body mass index and percentage of body fat as indicators for obesity in an adolescent athletic population. *Sports Health*, 3(3), 249 – 252.
- Barbara, G. (2013). Low intensity cardio workout. Retrieved from <https://www.fitness19.com/low-intensity-cardio/> Last updated October 10, 2013.
- Beedell, J. & Rehman, T. (2000). Using social-psychology models to understand farmers' conservation behaviour. *Journal of Rural Studies*, 1(6), 117-127.
- Bianca, E. (2020). Theories of Play in Children Development. *NOSR Humanities and Social Sciences*, 6(1), 40-45.
- Bogin, L. & Varela-Silva, P. (2012). Effects of walking jogging and running program on coronary heart disease risk factors among middle aged men. *Journal of Experimental Sciences*, 1(11), 15-19.
- Booth, F. W., Laye, M. J. & Roberts, M. D. (2012). Lifetime sedentary living accelerates some aspects of secondary aging. *Journal of applied physiology*, 111(1), 1497–1504.
- Booth, F. W., Laye, M. J. & Roberts, M. D. (2014). Lifetime sedentary living accelerates some aspects of secondary aging. *Journal of applied physiology*, 111(1), 1497–1504.
- Bouchard, C., Blair, S. N. & Katzmarzyk, P. T. (2015). Less sitting, more physical activity or higher fitness? *Mayo Clinic Proceedings*, 90(1), 1533–1540.
- Chad, B. (2014). Benefits of exercise. Retrieved from <http://www.fitnessguru.org/exercise/articles/cardio-2.php>.
- Chahar, P. S. (2014). Physical activity: A key for the preclusion of obesity in children. *American Journal of Sports Science and Medicine*, 2(1), 27 – 31.

- Cheng, M. L., Maccer, A. J. & Blair, M. J. (2002). The effects of ageing on respiratory muscle function and performance in older adults. *Journal of Science and Medicine in Sport*, 10(1), 36-44.
- Clancy, D. & Kass, Y. (2002). Body mass index adjustments to increase the validity of body fatness assessment in UK Black African and South Asian children. *International Journal of Obesity* 41, 1048 – 1055.
- Daniel, B. (2019). Benefits of jogging. Specialty in fitness. Retrieved from <https://www.healthline.com/health/exercise-fitness/benefits-of-jogging>.
- Demakakos, P., Hamer, M., Stamatakis, E. & Steptoe, A. (2010). Low-intensity physical activity is associated with reduced risk of incident type 2 diabetes in older adults: evidence from the English longitudinal study of ageing. *Diabetologia*, 53,(2); 1877–1885.
- Desruelle, A. V., Maistre, S. D., Gaillard, S., Richard, S., Tardivel, C., Martin, J. C., & Vallee, N. (2022). Cecal Metabolomic Fingerprint of Unscathed Rats: Does It Reflect the Good Response to a Provocative Decompression?. *Frontiers in Physiology*, 13, 882944.
- Dominic, O. L. & Adu, J. (2018). Movement and African child: a practice going astray. *African Journal of Educational Studies in Mathematics and Sciences* 14(1), 41 – 50.
- Dominic, O. L., & Dikki, C. E. (2011). Sympathetic neural influence of muscle blood flow during sub-maximal exercise. *Nigeria Journal of Guidance and Counselling Education*, 1(1), 68 – 76.
- Dominic, O. L., Onifade, O. A. & Lajide, E. O. (2010). Body mass index and waist/hip ratio among female workers in Ilorin University, Nigeria. *MedicinaSportiva*, 6(4), 1467 – 1472.
- Duck-chul, L., Russell, R. P., Carl, J. L., Xuemei, S., Timothy, S. C. & Steven, N. B. (2014). Leisure-time running reduces all-cause and cardiovascular mortality risk. *Journal of the American College of Cardiology*, 64(5), 054-058.DOI: 10.1016/j.jacc.2014.04.058
- Dunham, A. D. (2011). Need, importance and benefits of exercise in daily life. *International Journal of Physical Education, Sports and Health*, 3(2), 127-130.
- Edward, R. L. (2014). Healthy living fitness. Retrieved from <http://www.mayoclinic.org/healthy-living/fitness/expert-answers/heart-rate/faq-20057979>. Last updated December 2017
- Ejike, C. E. (2014). Child and adolescent obesity in Nigeria: A narrative review of prevalence data from three decades (1983-2013). *Journal Obesity Metabolic Research* 1, 4(6), 171 – 191.
- Emsat, (2012). The influence of physical activity on abdominal fat. A systematic review of the literature 7(2), 183–200.
- Etchison, M. C., Bloodgood, E. A., Minton, C. P., Thompson, N. J., Collins, M. A., Hunter, S. C., & Dai, H. (2011). Body mass index and percentage of body fat as indicators for obesity in an adolescent athletic population. *Sports Health*, 3(3), 249 – 252.
- Ferrer-Santos, P., Iglesia, I., Muñoz-Pardos, B., Miguel-Berges, M. L., Flores-



- Barrantes, P., Moreno, L. A. & Rodríguez-Martínez, G. (2021). Moderate-to-vigorous physical activity and body composition in children from the Spanish Region of Aragon. *Children*, 8(341), 1 – 12.
- Field, A. (2009). *Discovering statistics using SPSS* (3<sup>rd</sup> ed.). London: SAGE.
- Fishbein, M., & Manfredo, M., J. (1992). A Theory of Behaviour Change. In M. Manfredo J (Ed.), *Influencing Human Behavior: Theory and Applications in Recreation, Tourism, and Natural Resources Management*, 29-50. Champaign, Illinois: Sagamore Publishing Inc.
- Fredriksen, P. F., Skar, A., & Mamen, A. (2018). Waist circumference in 6–12-year-old children: The Health Oriented Pedagogical Project (HOPP). *Scandinavian Journal of Public Health*, 46(21), 12– 20.
- Froelicher, A. & Myers, D. (2006). Cardiovascular Effects and Benefits of Exercise. *Frontiers in Cardiovascular Medicine*, 5: 135. doi:10.3389/fcvm.2018.00135
- Fuster, S. (2001). Bradypnea: is gait speed ready for clinical use? *Journal of Nutrition Health and Aging*, 13(10), 878–880.
- Gale, C. (2019). Beginner's Low-Intensity Cardio Workout Plan. Retrieved from <https://skinnyms.com/beginners-low-intensity-cardio-workout-plan/>
- Gay, (2012). Benefits of jogging. Specialty in fitness. Retrieved from <https://www.healthline.com/health/exercise-fitness/benefits-of-jogging>
- Gay, U. I. (2019). Effects of walking jogging and running program on coronary heart disease risk factors among middle aged men. *Journal of Experimental Sciences*, 1(11), 15-19.
- George, R. C. (2014). Health & Skill Related Fitness Components. Retrieved from <https://sites.google.com/site/bensonpehealth/health-and-skill-related-fitness-components>. Reviewed by Jacob Benson, last updated .Aug 20, 2018.
- Glenn, N. L. (2010). *Cardiology secrets*. (3<sup>rd</sup> ed). USA, Churchill Livingstone Elsevier Incorporation. ISBN 978-0-323-04525-4. DOI <https://doi.org/10.1016/B978-0-323-04525-4.X0001-9>.
- Grace, O. O. & Boluwatife, E. S. (2018). Impact of aerobic exercise programme on the health-related Fitness components of senior citizens in Lagos state. *Journal of Research and Contemporary Issues in Human Kinetics and Health Education*. 14(1), 1-10.
- Gray, A. C., (2012). Meaning of exercise duration. Retrieved from [www/http://community.plu.edu/chasega/main.htm](http://community.plu.edu/chasega/main.htm). Last updated may, 2018.
- Gregory, B., Shala, E. D., Neal, I. P. & Walter, R. T. (2008). *Health related physical fitness assessment manual*. American College of Sport Medicine. Philadelphia, PA: Williams & Wilkins.
- Guyton, A. C. & Hall, E. J. (2011). *Guyton and Hall Textbook of Medical Physiology*. 12<sup>th</sup> Edition. Philadelphia, PA: Elsevier Inc. ISBN 1416045740.
- Hardy, G., Loehr, H., Butler, L., Chakladar, K., Chang, P. & Folsom, M. (2015). Prevalence of overweight and



- obesity among secondary school students in Ilorin metropolis Kwara State, Nigeria. *Ghana Journal of Health Physical Education, Recreation, Sports and Dance* 10, 113 – 143.
- Ho, W. H. J., Atkinson, E. L., & David, A. L. (2023). Examining the psychosocial well-being of children and adolescents with coeliac disease: a systematic review. *Journal of Pediatric Gastroenterology and Nutrition*, 76(1), e1-e14.
- Howley, E. & Thompson, D. (2012). *Fitness Professional Handbook* (6<sup>th</sup>ed.) Champaign. IL. Human kinetics.
- Howley, E. T & Frank, B. D. (2007). *Fitness Professional Handbook*. (7th ed). Champaign. IL. Human kinetics. ISBN: 1492523372.
- Hudda, M.T., Nightingale, C. M., Donin, A. S., Fewtrell, M. S., Haroun, D., Lum, S., Williams, J. E., Owen, C. G., Rudnicka, A. R., Wells, J. C. K., Cook, D. G. & Whincup, P. H. (2017). Body mass index adjustments to increase the validity of body fatness assessment in UK Black African and South Asian children. *International Journal of Obesity* 41, 1048 – 1055.
- Jacob, B. (2018). Health and Skill Related Fitness Components. Retrieved from <https://sites.google.com/site/bensonpehealth/health-and-skill-related-fitness-components>.
- James, M. H. (2011) Exercising your way to lower blood pressure. Retrieved from <https://www.acsm.org/docs/brocures/exercising-your-way-to-lower-blood-pressure.pdf>
- Jessica, I. G. (2019). Biology of the blood vessels. Reviewed by Michael, J. S. Michigan Medicine at the University of Michigan. Retrieved from <https://www.merckmanuals.com/home/heart-and-blood-vessel-disorders/biology-of-the-heart-and-blood-vessels/biology-of-the-blood-vessels>.
- John, B., (2011). Global recommendation on physical activity for health. Retrieved from [http://apps.who.int/iris/bitstream/10665/44399/1/9789241599979\\_eng](http://apps.who.int/iris/bitstream/10665/44399/1/9789241599979_eng).
- Jorgic, N., Pantelic, S., Milanovic, Z. & Kostic, R. (2011). Age-related decrease in physical activity and functional fitness among elderly men and women. *Clinical Interventions in Aging*, 8, 549-556. doi: 10.2147/CIA.S44112.
- Karani, M., Rebecca, M., Nilesh, B. P. & Kihumbu, T. (2018). Effect of short and long moderate-intensity exercises in modifying cardiometabolic markers in sedentary Kenyans aged 50 years and above. *British medical journal of Sport & Exercise Medicine*, 4(10), 11316-11360.
- Katie, P., Pratik, A., Joshua, U. & Bryan, O. (2014). Physical activity: A key for the preclusion of obesity in children. *American Journal of Sports Science and Medicine*, 2(1), 27 – 31.
- Kay, S. J, & Fiatarone, M.A. (2006). The influence of physical activity on abdominal fat. *A systematic review of the literature* 7(2), 183–200.
- Kim, C. & Huh, L. (2018). Progressive resistance strength training for improving physical function in older adults. Cochrane Database of Systematic Reviews. (Issue 3) Art.

- No.: CD002759. DOI: 10.1002/14651858.CD002759.pub2.
- King, P., Law, Y., Hurley, L., Petrenchik, O. & Schwellnus, J. (2010). Four Types of Exercise Can Improve Your Health and Physical Ability. <https://www.nia.nih.gov/health/four-types-exercise-can-improve-your-health-and-physical-ability>. Accessed 08/09/2021.
- Kujala, U. M. (2011). Physical activity, genes and lifetime predisposition to chronic diseases. *European Review of Aging and Physical Activity* 8(1), 31 – 36.
- Lee, S. Y. & Gallagher, D. (2008). Assessment methods in human body composition, *Current option in clinical nutrition and metabolic care*, 11(5), 566-572. Dio: 10.1097/MCO.0b013e32830b5f23.
- Lee, Y. G., & Oh, S. H. (2012). The relationship of obesity to health-related physical fitness of secondary school boys and girls. *Korean J Meas. Eval Phys.Educ. Sport Science*. 14:29-43.
- Leila, G. N. (2013). The effect of aerobic exercises on cardiovascular risk taking factors in hypertension men. *International Journal of Humanities and Social Science*, 3(15), 306-310.
- Len, K. (2014). Brochure content for high intensity interval training. *American College of Sports Medicine*, 3(5), 45-51.
- Levine, B. D. (2007). V02max: what do we know, and what do we still need to know. Institute for Exercise and Environmental Medicine. *The Journal of Physiology*, 1(5), 25-34
- Litwin, S. E. (2014). Childhood obesity and adulthood cardiovascular disease: quantifying the lifetime cumulative burden of cardiovascular risk factors. *Journal of American College of Cardiology*, 64(15), 1588 – 90.
- Liu, C.J. & Latham, N.K. (2013). Progressive resistance strength training for improving physical function in older adults. *Cochrane Database of Systematic Reviews*. (Issue 3) Art. No.: CD002759. DOI: 10.1002/14651858.CD002759.pub2.
- Lopez, O. I. (2006). Physical activity: A key for the preclusion of obesity in children. *American Journal of Sports Science and Medicine*, 2(1), 27 – 31.
- Mackenzie, O. I. (2001). Obesity: considerations about etiology, metabolism and the use of experimental models. *Diabetes Metabolic Syndrome Obesity* 5, 75 – 87.
- Madden, K. (2013). Evidence for the benefit of exercise therapy in patients with type 2 diabetes. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy*, 233. <https://doi.org/10.2147/DMSO.S32951>
- Malina .R. (2010). *Physical activity and health of youth.Scandinavian journal of occupational therapy*, 18 (2), 153–60. Doi: 10.3109/11038128.2010.487113.
- Marc, M. (2012). *Health related physical fitness assessment manual*. American College of Sport Medicine. Philadelphia, PA: Williams & Wilkins.
- Matthew, A. N. & Aruni, B. (2018). Cardiovascular Effects and Benefits of Exercise. *Frontiers in Cardiovascular Medicine*, 5: 135. doi: 10.3389/fcvm.2018.00135

- McKemey, K. & Saky-Dawson, O. A. (2000). *Rice Crop Protection Technology Uptake Blockages Amongst Rice Farmers in Ghana: with Particular Reference to Variety Adoption and the Reduction of Pesticide Use*. Legon, Ghana, University of Legon, Ghana.
- Milanovic, Z., Pantelic, S., Trajkovic, N., Sporis, G., Kostic, R. & James, N. (2011). Age-related decrease in physical activity and functional fitness among elderly men and women. *Clinical Interventions in Aging*, 8, 549-556. doi: 10.2147/CIA.S44112.
- Mitchel, B. D., Rainwater, D. L., Husch, W. C., Kennedy, A. J., Stern, M. P. & Maccular, J. W. (2003). Familial aggregation of nutrient intake and physical activity: result from San Antonio Family Heart Study. *Ann Epidemiology* 13, 128 – 135.
- Moholdt, S., Lavie, F. & Nauman, D. (2018). Fat mass, fat mass percentage, body mass index and mid-upper arm circumference in a healthy population of Nigerian children. *Journal of Tropical Pediatrics*, 43(1), 13 – 19.
- Moore-Harrison and Lightfoot (2010). Patterns and Associated Factors of Physical Activity among Adolescents in Nigeria. *PLoS ONE*, 11(2); 1 – 16.
- Myers, J. (2004). Fitness Versus physical activity patterns in predicting mobility in men. *American Journal of Medicine*, 117(12), 912-918.
- National Institute on Aging (2018). Exercise and Physical activity. Your everyday guide, Go4life. NIA publication march, 2018 No 18-AG-4258. Retrieved from <https://order.nia.nih.gov/sites/default/files/2018-04/nia-exercise-guide.pdf>
- National Institute on Aging (2021). Four Types of Exercise Can Improve Your Health and Physical Ability. <https://www.nia.nih.gov/health/four-types-exercise-can-improve-your-health-and-physical-ability>. Accessed 08/09/2021.
- Nebido, (2021). Waist-to-height ratio calculator. Retrieved September 19, 2021 from <https://www.nebido.com/tools/low-testosterone-sign-waist-to-height-ratio>.
- Neiman, O. (2011). Childhood obesity and adulthood cardiovascular disease: quantifying the lifetime cumulative burden of cardiovascular risk factors. *Journal of American College of Cardiology*, 64(15), 1588 – 90.
- Nicole, C. (2019). What Kinds of Exercises Are Considered Low-Intensity? Retrieved from <https://www.livestrong.com/article/536331-what-kinds-of-exercises-are-considered-low-intensity>.
- Nigeria Heart Foundation (2018). 2018 Nigeria report card on physical activity for children and youth. Retrieved February 11, 2020 from <https://www.activehealthykids.org/wp-content/uploads/2018/11/nigeria-report-card-long-form-2018.pdf>.
- Nightingale, C. M., Rudnicka, A. R., Owen, C. G., Donin, A. S., Newton, S. L. & Furness, C. A. (2013). Are ethnic and gender specific equations needed to derive fat free mass from bioelectrical impedance in children of South Asian, black African-Caribbean and White European origin? Results of the assessment of

- body composition in children study. *PLoS One* 8, e76426.
- Nightingale, C. M., Rudnicka, A.R., Owen, C. G., Cook, D. G. & Whincup, P. H. (2011). Patterns of body size and adiposity among UK children of South Asian, black African-Caribbean and white European origin: child heart and health study in England (CHASE Study). *International Journal of Epidemiology* 40(1), 33 – 44.
- Novak, C. & Gill, P. (2020). Pediatric vital signs chart reference chart. Retrieved September 30, 2021 from <https://www.pedscases.com/pediatric-vital-signs-reference-chart>.
- Nystoriak, T. & Bhatnagar, B. (2018). *Health related physical fitness assessment manual*. American College of Sport Medicine. Philadelphia, PA: Williams & Wilkins.
- Oguoma, V. M., Ezekiel, U. N., Ifeoma, I. U., Adeseye, A. A., Ekene, E. C., Phillip, T. B., Ross, S. R. & Timothy, C. S. (2017). Cardiovascular disease risk factors in a Nigerian population with impaired fasting blood glucose level and diabetes mellitus. *BioMedical Central of Public Health*, 17(36), 10-13. DOI 10.1186/s12889-016-3910-3.
- Oivind, R., Eva, H., Jan, H., & Stig, A. S. (2014). High intensity aerobic interval exercise is superior to moderate intensity exercise for increasing aerobic capacity in patients with coronary artery disease. The European Society of Cardiology. Lippincott, Williams & Wilkins.
- Owa, J. A. & Adejuyigbe, O. (1997). Fat mass, fat mass percentage, body mass index and mid-upper arm circumference in a healthy population of Nigerian children. *Journal of Tropical Pediatrics*, 43(1), 13 – 19.
- Oyeyemi, A. L., Ishaku, C. M., Oyekola, J., Wakawa, H. D., Lawan, A., Yakubu, S. & Oyeyemi, A. Y. (2016). Patterns and Associated Factors of Physical Activity among Adolescents in Nigeria. *PLoS ONE*, 11(2); 1 – 16.
- Paige, W. (2019). Frequency, intensity time and types. (F.I.T.T) Retrieved from <https://www.verywellfit.com/paige-wachner-1229482> . Last Updated August, 2021.
- Parati, G. & Lantelme, P. (2005). Mechanical and neural components of the cardiac baroreflex; new insights into complex physiology. *Journal of hypertension*, 23(4), 717-20.
- Parthiban, B., Sekarbabu, K., Ravindran, G., Suthakar, K. & Annida, B. (2011). Effects of walking jogging and running program on coronary heart disease risk factors among middle aged men. *Journal of Experimental Sciences*, 1(11), 15-19.
- pdf.
- Spencer, H. (1952). Theory of play. Cochrane Database of Systematic Reviews. (Issue 3) Art. No.: CD002759. DOI: 10.1002/14651858.CD002759.pub2.

