Investigating Gender-based Nutritional Disparities among Athletes and Non-Athletes of Higher Education in Bangladesh: Insights from the University of Rajshahi

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Abstract: *This article first describes that evaluating nutritional status is important for a number of reasons, including its ability to provide light on dietary habits and nutritional health status of a person or a population. A person's nutritional status describes their current state of physical health. In order to maintain everyone's health and fitness, nutritional assessment is crucial since it can assist in the early detection of nutrient deficiencies such as malnutrition (inadequate nutrient intake) and over-nutrition (excessive nutrient consumption leading to obesity). The objective of this study is to determine the nutritional status of Rajshahi University male and female athletes and non-athletes students based on anthropometric indexes. This study aids in our understanding of the socio-demographic variables influencing the participants' nutritional status. Anthropometric factor determination is the most widely recognized, useful, and reliable method for estimating and analyzing the nutritional status of the research subjects. In accordance with the World Health Organization's guidelines, anthropometric measurements are used to determine the nutritional health of Asians in order to evaluate their BMI classification. A portable stadio-meter (RGZ-160) and weighing device are used to measure the subject's height in centimeters and weight in kilograms. Through this procedure, people can maintain their health and identify their nutritional status (underweight, overweight, normal range, obese I, and obese II).*

Keywords: Nutritional Status; Body Mass Index; Athletes and Non-Athletes; Socio-Economic Condition; University of Rajshahi; Bangladesh.

1.0 INTRODUCTION

The study of food nutrients that the body utilizes for growth and development is called nutrition. The relationship between health, diet and disease is caused by nutrients. To comprehend how nutrients affect the human body, the researcher draws on concepts from biochemistry, molecular biology and genetics. Maintaining functionally and good health requires proper nutrition. The importance of nutrition in boosting immune systems and reducing the risk of cancer and non-communicable diseases is greater in humans. Rajshahi University in Bangladesh carried out this investigation on a small scale. The participant's present nutritional status is analyzed by using a variety of measurements and tests and their conditions are compared between male and female athletes and non-athletes. In order to create a golden Bangladesh, it is essential to increase people's awareness of their nutritional status because this factor contributes to their ability to be healthy and disease free. There are several physical factors to ensure nutritional status including: Cardiovascular and aerobic conditioning, a balanced diet should be consumed for nutrition and supplements and Mental rest and relaxation.

A person's present physical condition is described by their nutritional status. Nutritional assessment is an essential part of keeping everyone healthy and fit. The nutritional assessment helps for the early detection of both nutrient deficiencies and excesses (Maqbool A. et al. 2008). Nutrients are the molecules in food that all living organisms need to produce energy and reproduce. Foods contain different types of nutrients that help the human body function. Therefore, it's crucial to consume a variety of foods which together contain the right amount of all nutrients in the human body (Butnariu M. et al. 2019). Carbohydrates, also called carbs, are the main source of energy that is ingested by the human body (Caffall, K. H., & Mohnen, D. 2009). Important nutritious food like: Carbohydrates are the body's preferred source of energy to help run the human body and brain. Glucose is the main energy source in the human body since it is primarily used by the brain and red blood cells. Carbohydrates are composed of chains of sugar molecules and contain about 4 calories per gram. Glucose can be used to store in the form of glycogen, which is always kept in the liver and skeletal muscles. When a person's body absorbs more glucose than they can use, the excess glucose is used up as fat (Asif M. et al. 2011). Proteins are the building blocks in the human body and also the energy source. Proteins are mainly used to produce hormones, enzymes and hemoglobin (Hoffman J. R. et al. 2004). In the human body, the antibodies that the body makes to fight infections are made of proteins.

2.0 LITERATURE REVIEW

According to Malla, H. B., et al. (2017), nutrition education is necessary to increase nutrition knowledge and support dietary behavior modifications. The knowledge might result in better dietary intake as well as better dietary practices. According to Ferida, P. R. A. (2012), nutritional status is the state of the body as a result of ingesting, absorbing, and using nutritional substances. A better human resource development process is supported by good nutrition and physical fitness. Additionally, improved human resources will promote the advancement of many facets of human life. Sengupta, P., and Bhattacharya, K. (2012) investigated how young Nepalese living in Pokhara, Kaski district, western Nepal, were affected by high altitude and nutritional status. According to a recent study by Pallav Sengupta, nutritional factors as well as environmental factors play a role in determining the health of young people living at Nepal's high altitude. This study also shows that environmental and nutritional factors have a good impact on young Nepalese living in Pokhara's mid-mountain regions in terms of their morphometric parameters and physiological fitness.

According to Kusumawati, E. (2017), community nutrition has to be improved throughout all stages of life, including pregnancy, infancy, preschool age, elementary school age, adolescent, adulthood, and senior age. According to Annas, M. (2011), effective national development requires a sufficient amount of human resources. To improve the health and quality of life of its citizens, the government placed a high premium on improving communal nutrition and preventing disease. The most crucial factor in raising the quality of human resources is nutritional status. Rahmadini et al., (2013) stated that several forms of malnutrition can have negative effects in the short- and long-term. Malnutrition can raise the risk of disease and result in morbidity, disability, mortality, stunting, and intellectual impairment. The attempt to improve community nutrition status is crucial for raising the standard of human resources because nutrition is a determinant of life quality.

3.0 MATERIALS AND METHODS

A cross-sectional survey of a total of 260 male and female athletes and non-athletes (Bachelor's to Master's degrees) aged 19 to 26 years from various departments at Rajshahi University to determine nutritional status was done in Matihar, Rajshahi, in Bangladesh. In this study, athletes are specifically selected from university team players from different sports like- football, cricket, handball, volleyball, basketball and track and field and they are participates in a team or individual sports which require regular competitions against others as a core component and place a high value on excellence and achievement, requiring some form of systematic training (usually intense). The study subjects who are agreed to participate and provided written informed consent asked to provide baseline information on demographic and obstetric factors. Data are collected from the subjects using a well-structured questionnaire that contains both open-ended and closed-ended questions. Male and female study participants' data are gathered at different times. Indicators of anthropometry are very important for measuring and evaluating public health. It is exceedingly challenging to assess the study subject's body nutrition variables, such as carbohydrates, protein, fat, and other nutrients, in a country like Bangladesh because doing so calls for a well-equipped laboratory with enough space and expensive chemical reagents. The most accepted, practical, and trustworthy technique to estimate and analyze the nutritional status of the study subjects is to determine anthropometric factors.

3.1 Process of Socio-Economic Condition Assessment of the study subjects

The numbers behind Bangladesh's goal of middle income status by 2021: In this country like Bangladesh their socio-economic condition has been divided into four decades since independence in 1971. Economics were divided according to 2021 GNI per capita, calculated using the World Bank Atlas (dollars) method. In March 2022 1$=86BDT. The income thresholds are

Table 1: Ideal Socio-Economic Condition

Socio-economic class	Yearly income $ (BDT)	Monthly income in BDT
Higher class	$12,476 (1,072,936) or more	89,411 or more
Middle class	$4,036 (3,47096) to $12,475 (3,47,010	28,925 to 89,404
Lower middle class	$1,026 (88,236) to $4,035 (3,47,010)	7,353 to 28,918

| Lower class | $1,025 (88,150) or less | 7,345 or less |

[Source: Hussain, Z. (2012)]

3.2 Process of Nutritional Status Assessment of the study subjects

This study aimed to assess the subjects' nutritional status by calculating their Body Mass Index (BMI = Weight in kg / (Height in m)^2).

Height Measurement Procedure: Equipment: A portable stadio-meter (RGZ-160)

The study participant is directed to maintain good posture while standing straight in barefoot, with relaxed shoulders. The participant stands against the stadio-meter (RGZ-160) with their heels, buttocks, and upper back with relaxed shoulders, straight legs, and arms at the sides, and their weight should be evenly distributed over both feet. The subject must be looking straight ahead when the base of the height meter is lower to the head. If the subject has a lot of hair, a little pressure should be applied to contact the top of the head, and the height measurement is therefore recorded in centimeters.

Weight Measurement Procedure: Equipment: Weighing machine (RGZ-160)

All participants stand over the scale after removing their heavy clothing, shoes, and everything in their pockets in order to get an accurate measurement. To achieve correct reading, the scale is initially set to zero. Participants are advised to maintain a motionless position in the middle of the scale platform, distributing their weight evenly with both feet, and leaving their arms at their sides. The participants are asked to step off the scale after the weight is recorded in kilograms.

Table 2: Ideal BMI Table for Men and Women

WHO (World Health Organization) and Asian BMI (Body Mass Index) classification for Nutritional Status:

Nutritional status	BMI range- kg/m^2
Underweight	< 18.5
Normal range	18.5-22.9
Overweight	23-24.9
Obese I	25-29.9
Obese II	>30

[Source: Lim, J. U., et al., C. K. (2017)]

In this table there describes different Nutritional status including: Underweight, Normal range, Overweight, Obese I and Obese II. The BMI is described as - kg/m^2.

4.0 RESULTS

The IBM SPSS program (version 25) is used to enter the acquired data and conduct the analysis. The factors' regarding the subject's that aid in determining the study subject's nutritional status by learning their information through a questionnaire. All data are statistically analyzed by using the IBM SPSS 25 statistical analysis program. All of the acquired data is initially entered into the SPSS application. The sample is refined by analyzing the descriptive statistical analysis, graph and also Pearson correlation. After analyzing the data, the variables with p values less than 0.05 (*p>0.05) and less than 0.01 (**p>0.01) are considered significant and highly significant, respectively. The Pearson correlation revealed that there is either a positive or negative relationship between two variables.

4.1 Sex Category of the Participants Based on Gender

The table (3) and figure (1) displayed the participant's sex category. The participants in this study come from a variety of departments from Rajshahi University. According to the materials and methods, there are 130 (50%) male athletes, 80 (30.8%) male non-athletes, 25 (9.6%) female athletes, and 25 (9.6%) female non-athletes among the students.

Table 3: Sex Category of the Participants Based on Gender

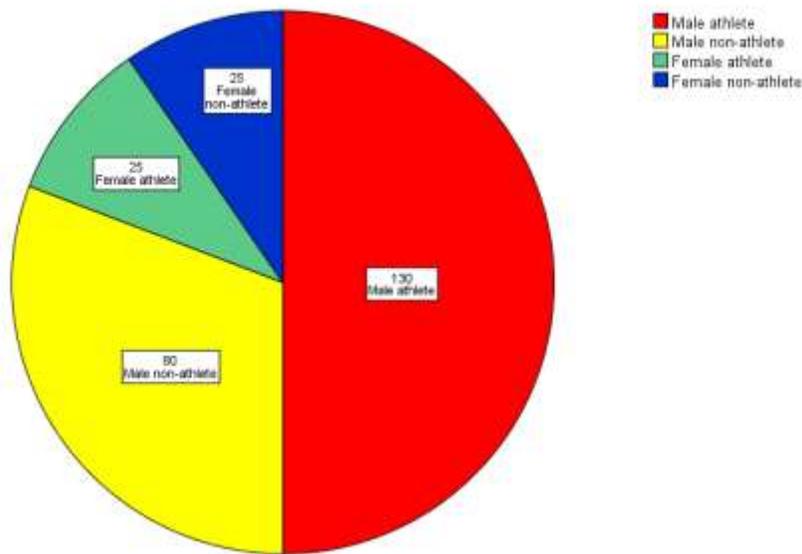| Variable	No.	%
Sex		
Male athlete	130	50.0
Male non-athlete	80	30.8
Female athlete	25	9.6
Female non-athlete	25	9.6

Fig. 1. Sex Category of the Participants Based on Gender

4.2 Socio-Economic Category of the Participants

The table (4) and figure (2) is displaying the socio-economic Category of the participants. Among the participants, 89 (34.2%) come from a higher socio-economic class, compared to 112 (43.1%) from a middle class, 50 (19.2%) from a lower middle class, and 9 (3.5%) from a lower socio-economic class.

Table 4: Socio-Economic Category of the Participants

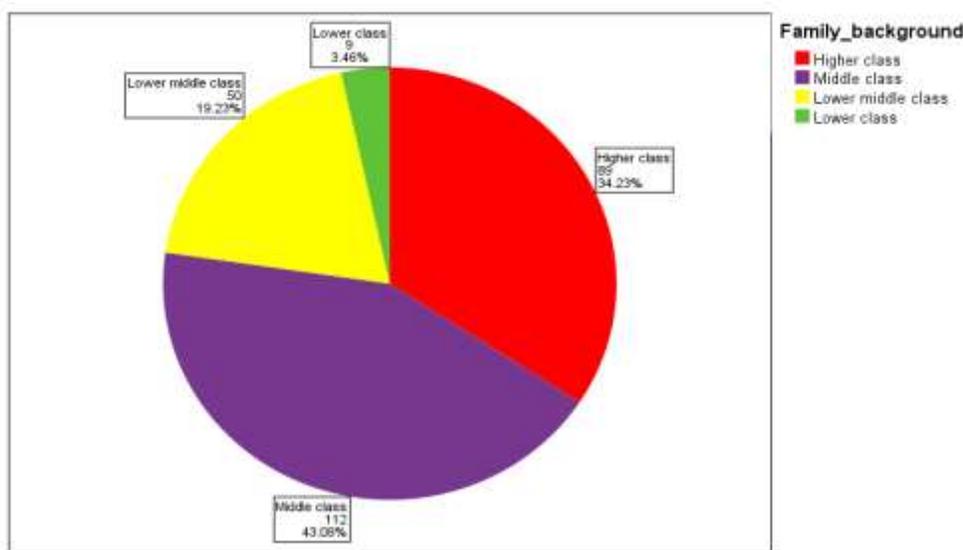| Variable	No.	%
Socio-economic condition		
Higher class	89	34.2
Middle class	112	43.1
Lower middle class	50	19.2
Lower class	9	3.5

Fig. 2. Socio-Economic Category of the Participants

4.3 Physical Characteristics of the Study Subjects Based on Gender

The table (5) shows physical characteristics of athletes and non-athletes according to gender. According to the table the mean body weight of male and female non-athletes is higher than male and female athletes. However, the mean height of male non-athletes is slightly higher (169.29 ± 6.07) than male athletes (167.75 ± 4.46) and the mean height of female athletes is higher (158.44 ± 4.27) than female non-athletes (153.24 ± 5.08). Body mass index for male athletes is lower (20.94 ± 1.61) than male non-athletes (22.40 ± 3.71) and also the mean BMI for female athletes (19.24 ± 2.35) is lower than female non-athletes (22.28 ± 2.16).

Table 5: Physical Characteristics of the Study Subjects

Anthropometric Measurement	Male athlete (n=130)	Male non-athlete (n=80)	Female athlete (n=25)	Female non-athlete (n=25)
	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD

Weight (kg)	58.99$\pm$5.72	64.31$\pm$11.76	48.24$\pm$5.59	52.36$\pm$6.22
Height (cm)	167.75$\pm$4.46	169.29$\pm$6.07	158.44$\pm$4.27	153.24$\pm$5.08

4.4 Nutritional Status of the Study Subjects Based on Gender

The nutritional status of the participants is evaluated by using their BMI (Body Mass Index) of the male athletes & non-athletes and female athletes & non-athletes in a categorical way and the results are shown in the table (6) and figure (3). It is clearly evident from the figure that 15.4%, 17.5%, 12% & 32% participants are in underweight, 82.3%, 55%, 76% & 32% participants are in normal weight, 2.3%, 17.5%, 8% & 20% are in overweight, 0%, 10%, 0% & 16% are in obese I and 0%, 0%, 4% & 0% are from obese II of male athlete, male non-athlete, female athlete and female non-athlete respectively. The Pearson correlation between the study subjects and their nutritional status is positive and highly significant and the level of significance is 0.01 (2-tailed).

Table 6: Nutritional Status of the Study Subjects Based on Gender**p<.01

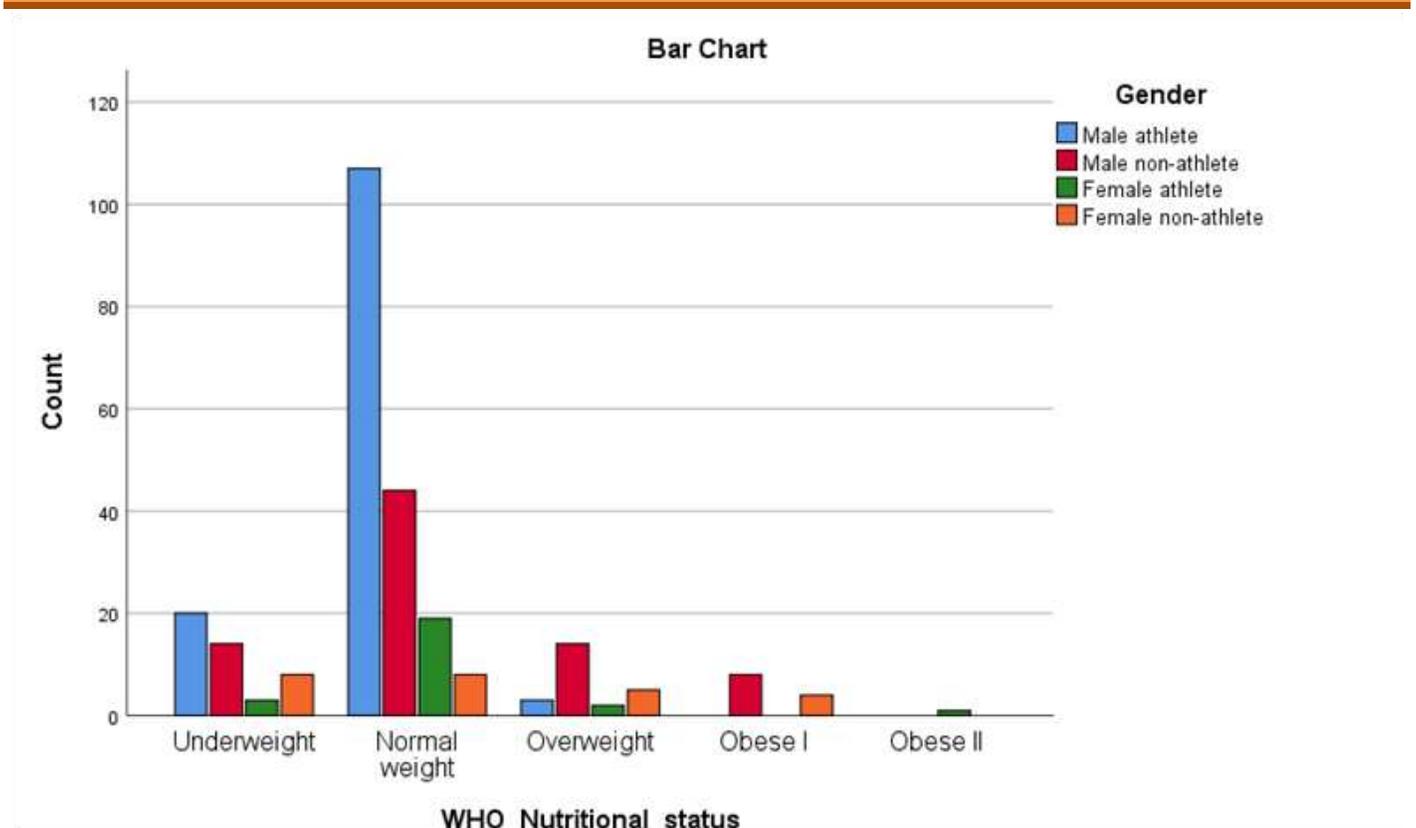| Nutritional status	Variables	Male athlete n=130 (%)	Male non-athlete n=80 (%)	Female athlete n=25 (%)	Female non-athlete n=25 (%)	Pearson Correlation
	Underweight	20 (15.4)	14 (17.5)	3 (12)	8 (32)	
	Normal weight	107 (82.3)	44 (55)	19 (76)	8 (32)	
Nutritional status	Overweight	3 (2.3)	14 (17.5)	2 (8)	5 (20)	.173**
	Obese I	0 (0)	8 (10)	0 (0)	4 (16)	
	Obese II	0 (0)	0 (0)	1 (4)	0 (0)	

Fig. 3. Nutritional Status of the Study Subjects Based on Gender

4.4 Nutritional Status of the Study Subjects According to their Socio-Economic Condition

The nutritional status according to the socio-economic group of the participants are evaluated by using their BMI (Body Mass Index) of the higher class, middle class, lower middle class and lower class in a categorical way of the participants and the results are shown in the table (7) and figure (4). It is clearly evident from the table that 22.5%, 11.6%, 18% & 33.3% participants are in underweight, 58.4%, 76.8%, 68% & 66.7% participants are in normal weight, 9%, 8.9%, 12% & 0% are in overweight, 9%, 2.7%, 2% & 0% are in obese I and 1.1%, 0%, 0% & 0% are in obese II for higher class, middle class, lower middle class and lower class respectively. The Pearson correlation between the socio-economic group of the study subjects and their nutritional status is negative and insignificant.

Table 7: Nutritional Status of the Study Subjects According to their Socio-Economic Condition

Nutritional status	Variables	Higher class n=89(%)	Middle class n= 112(%)	Lower Middle class n= 50(%)	Lower cl ass n=9(%)	Pearson Correlation
	Underweight	20(22.5)	13(11.6)	9(18)	3(33.3))	
Nutritional status	Normal weight	52(58.4)	86(76.8)	34(68)	6(66.7)	-.092

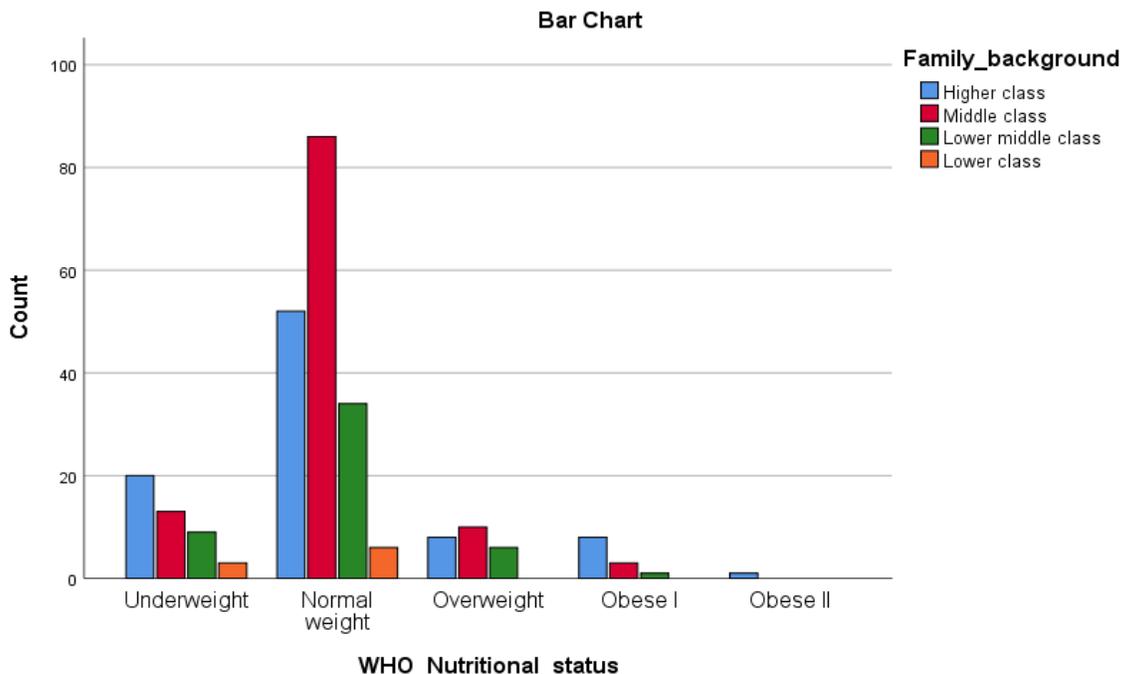|				
Overweight	8(9)	10(8.9)	6(12)	0(0)
Obese I	8(9)	3(2.7)	1(2)	0(0)
Obese II	1(1.1)	0(0)	0(0)	0(0)

Fig. 4. Nutritional Status of the Study Subjects According to their Socio-Economic Condition

5.0 DISCUSSION

The purpose of this study is to investigate and to compare the nutritional status among Rajshahi University students, specifically between the male and female athletes and non-athletes. On the basis of nutritional status of the male and female athletes and non-athletes, the study shows a higher prevalence of underweight in their nutritional status (17.5%) and (32%) participants of male and female non-athletes are in this condition and a lower prevalence of (15.4%) and (12%) among male and female athletes of the total participants. Male and female non-athletes are found to be more underweight or malnourished than male and female athletes. Among all the participants' male (82.3%) and female (76%) athletes are with higher prevalence in the condition of normal weight or healthy weight than male (55%) and female (32%) non-athletes. Based on nutritional status of the participants the study shows a higher prevalence of overweight (17.5%) male non-athletes and (20%) female non-athletes and a lower prevalence of overweight (2.3%) male athletes and (8%) female athletes. The research also reports that (10%) obese I and (16%) obese I among the participants of male non-athletes and female non-athletes and there are no obese I participants of male and female athletes of the participants. In addition only 1 (4%) female athlete among the study subjects is in obese II. As predicted, the nutritional status of athletes are higher compared to the non-athletes students and this may be because they participate in less sports and engage in less physical activity than the athletes. The Pearson correlation between nutritional status and the participants is positive (r=.173) and highly significant with the significance level of p<0.01 (2-Tailed). The study is compared with the findings of, Elias, S. S. B. M., et al., (2021) as predicted, the body weight and BMI level of male non-student athletes were higher compared to the male student-athletes. This might be due to the fact that they were not actively involved in sports and do less physical activity. The nutritional status in the range of normal or healthy weight ensures a healthy lifestyle and reduces the risk of getting the non-communicable disease.

6.0 CONCLUSION AND RECOMMENDATIONS

The study finds that the participants who are athletes have better nutritional status than non-athletes. The study observes that there is a higher frequency of overweight and obesity among male and female non-athletes based on the nutritional status of the participants. This study is crucial because overweight and obesity are avoidable; additionally, overweight and obesity raise the chance

of developing diabetes, heart disease, and cancer. The athlete participant's nutritional status, on the other hand, is within the range of normal or healthy weight, ensuring a healthy lifestyle and lowering the chance of developing the non-communicable disease.

This study shows that young adults, especially the non-athletes participants, don't have sufficient nutritional status. In comparison to their nutritional status, a large fraction of non-athletes students are underweight, overweight, and obese than athlete's students. Therefore, to treat this issue, correct nutrition intervention is required. It's crucial to raise participants' awareness of the value of a balanced diet, as well as to provide them with the necessary training, in order to improve their nutritional status.

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