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Nutritional Status and Dietary Pattern of Male Athletes in Ibadan, South Western Nigeria

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Summary: Several factors, including nutritional status and dietary pattern are paramount to optimum performance among athletes. Notwithstanding, risky behaviours that limit or impair athletic performance are widely prevalent among athletes; these include excessive weight reduction and inappropriate dietary practices. This study was conducted to provide information on the nutritional status and dietary pattern of athletes in Ibadan, Oyo State, Nigeria. This was a cross sectional descriptive study, involving 207 athletes aged 17 to 40 years in Ibadan. Nutritional status was assessed by anthropometric indices: Body Mass Index (BMI) and percentage body fat (%BF). BMI was calculated from weight and height measurements and %BF was estimated from the sum of skin-fold thickness at 4 sites (triceps, biceps, sub-scapular and supra-iliac skin-folds). Dietary pattern was assessed by food habits and food frequency questionnaire. Descriptive and inferential statistics were conducted to describe and examine relationships between variables. Mean (SD) for variables were: age; 26.09(±4.77) years, weight; 72.13(±0.45) kg, height; 1.74(±0.06)m, and BMI; 23.89(±3.34)kg/m^2. Only 4(1.93%) of the participants were underweight, 39(18.84%) were overweight and 8(3.86%) obese. Mean (SD) of %BF among overweight athletes was 14.25(±3.12) and maximum %BF among overweight athletes was 21.2. A strong and positive correlation was observed between BMI and %BF and %BF increased with age among overweight athletes. About 72% of the athletes skipped meals, 77% drank water or sports drinks during sporting activities, about 11% spent less than #40.00 for each meal. About 49% ate before sports. Foods most frequently consumed by athletes in this study were meat, fish, roots/tubers, cereals, vegetables and fruits. Milk and legumes were less frequently consumed by these athletes. Most of these athletes had nutritional status adequate for their sport activity. With regards to food habits, most of these athletes performed poorly in frequency of meals intake but did considerably well in intake of fluids. With regards to dietary pattern, sources of daily intakes comprised of mostly of meats, fish, roots and tubers, cereals and vegetables.

Keywords*:* Athletes, Nutritional Status, Dietary Pattern, Ibadan, Nigeria

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INTRODUCTION

Sports have over the years graduated from a recreational activity to a source of livelihood and employment. Success in sports brings fame, wealth and international recognition but comes as a result of consistent physical training with muscular exertions. Murray (1998) reported that severe exertion requires the body to attempt to cope simultaneously with competing demands for cardiovascular homeostasis, thermoregulatory control and maintenance of muscles energy. Costill et al. (1981) suggested that depletion of muscle glycogen store puts the athletes at a risk of hypoglycemia. Equally, severe exertion may generate several litres of sweat per day, which contains salt, water and also a number of other constituents such as iron and water soluble vitamins (Bergstom and Hultman, 1996). It is widely reported in the literature that, heavy schedule of training and competition leads to immuno-suppression in athletes, placing them at a greater risk of opportunistic infections (Bishop et al., 1999).

Adequate dietary intake, including sufficient fluid intake is paramount in ensuring athletic performance at its peak (Maughan and Burke, 2011). However, risky behaviours are widely reported among athletes. The use of high performance-enhancing drug is widely reported among young athletes. Diehl et al.(2012), in their review on unhealthy behaviours among adolescent athletes concluded that, prevalence of previous use of anabolic steroids among athletes was about 4%; and also the use of such drugs increased with increasing level of competition (Wichstrom and Pedersen, 2001).

Several studies have assessed nutritional status, dieting behavior or body-esteem, either individually or in combination (Diehl et al., 2012). Self-reported nutritional intakes (as in the case of frequency of food intakes, dietary habits etc) indicate that athletes tend to consume nutrients in excess of their recommendations.Daneshvar et al. (2013) reported that, among young male *Isfahani* wrestlers, mean intakes for energy, carbohydrates, proteins, fats and most micronutrients were higher than the

recommended daily allowances (RDA). Ghloum and Hajji (2011) reported significantly higher intakes for most nutrients among *Kuwaiti* fencing players. In contrast, analysis of biochemical levels of nutrients among athletes indicated that, athletes were likely to consume both macro- and micro-nutrients at levels below recommendations for essential minerals, carbohydrates, and overall energy intake (Beals, 2002; Ruiz et al., 2005).

Moreover, eating disorders are particularly common among athletes;unspecified eating disorders have been diagnosed in about 58% of a population of athlete; with anorexia nervosa and bulimia nervosa identified in lesser extents among athletes (Bachner-Melman et al., 2006).

Athletes who participated in certain types of sports perform in weights below their usual weights; in order to achieve this, they subjected themselves to excessive sweating, dietary and fluid restrictions (Steens and Brownell, 1990). Also these athletes employ various means to lose weights; Kiningham and Gorenflo (2001) noted that about 11% of participants of weight-dependent sports induced emesis at least weekly to lose weight. Other methods for weight reduction in addition to dieting include use of diuretics or laxatives (Kiningham and Gorenflo, 2001; Vertalino et al., 2007). Excessive dehydration from sweating can impair aerobic, anaerobic and strength performance, even in rehydration after such stress, only partial strength and work capacity can be recovered (Mikeal-Fogelholm et al. 1993).

Misinterpretation of published data and misleading media reports have led many athletes to adopt many unusual dietary regimen in the belief that these hold the key to improved performance (Bishop et al., 1999). Some sports have strict weight categories while in others, low body fat are considered an aesthetic advantage.

Studies conducted on factors that can enhance and/or limit performance among athletes, as well as those that may compromise their health status reported adequate nutritional status as critical. For instance, body composition measured by BMI and percentage body fat were within normal range among *Kuwaiti* fencing players (Ghloum and Hajji, 2011). Information on nutritional status and dietary behaviours among athletes will be useful in monitoring and supervising athletes performances in Nigeria, particularly, Ibadan in Oyo state. This study was carried out to assess nutritional status and dietary pattern among male athletes in Ibadan, Oyo state.

MATERIALS AND METHODS

Study Design: This study was descriptive cross sectional in design.

Study location: The study was carried out at the Liberty stadium and *Adamasingba* stadium both in Ibadan. The choice of locations was informed by the availability of athletes at these two stadiums and the fact that they are venues for sporting events of international standards.

Subjects: Participants of this study were male athletes; footballers, weight lifters, boxers, track and field athletes. These sports were targeted because majority of the athletes in Ibadan engage in them.

Subject selection: Minimum sample size was derived using the formula; with an expected precision of 5% at 95% confidence interval.

$n=16x2p\ (100-p)/W^2$

Where n = minimum sample size

P = proportion of athletes (1%)

W = width of confidence interval = 10%

n= 16x2x99/ 100

= 32 subjects

However, 207 athletes who voluntarily consented to participate and gave informed consent after adequate discussion were included.

Subject Management: Each subject was assessed only once. The whole data collection procedure lasted 35days excluding weekends. Weekends were excluded to ensure that part time athletes who normally train at weekends were not included in the study. The subjects were grouped by age into five:

Group A: (15-20 years);
Group B (21-25 years);
Group C (26-30 years);
Group D (31-35 years);
Group E (36-40 years).

Data Collection: Data collected included;

a. Personal data including age, marital status, kind of sport, duration of training and frequency of training.
b. Anthropometric measurements including height, weight, arm-span and skin-fold thickness (at four sites: triceps, biceps, supra-iliac and sub-scapular).
c. Dietary pattern including amount spent on meals, skipping of meals and intake of water or sport drinks during training.
d. Frequency of consumption of foods under the major food groups.

Measurements and instruments

Height: This was measured with a *stadiometer* comprising of a vertical rod, which has a fixed measuring tape and a flat platform on which the subjects stood. Each subject stood erect on the platform. A flat head piece was placed on the head and made to touch the rod. The height was then read off the scale and recorded in centimeter to two decimal places.

Weight: Body weight was measured using a portable *Salter* scale (model 109). The scale was placed on a hard flat surface and checked to return to zero before each measurement was taken. Each subject stood on the scale with light training pant on. The weight were then read off the scale and recorded to the nearest 0.1kg.

Calculation of Body Mass Index (BMI): BMI was calculated using the equation:

$$\frac{\text{Weight (kg)}}{\text{Height}^2\ (m^2)}$$

Skin-fold thickness: The skin- fold or fat-fold of the overweight athletes was measured in order to estimate the percentage body fat (%BF). Measurement of skin- fold thickness was made with a *McGraw* precision skin-fold caliper. Generally, the skin-fold measurement were taken with each subject standing erect, feet together and arms hanging relaxed by the sides. For each subjects, a vertical fold of skin plus the underlying fat was grasped using the thumb and the fore finger at the appropriate site. The skin fold was gently pulled away from the underlying muscle tissue and the caliper jaws applied at right angle, exactly at the appropriate points. The skin-fold remained held between the fingers while the measurements were taken. The skin-fold thickness was taken as the mean of two measurements.

Specific skin-fold thickness

1. **Triceps skin-fold:** this was measured at the midpoint of the back of the upper left arm between the *acromion* process and the tip of *olecranon.*
2. **Biceps skin-fold:** this was measured at the front of the upper left arm, directly above the center of the *cubital fossa*, at the same level as the triceps skin-fold.
3. **Sub-scapular skin-fold:** this was measured just below and laterally to the angle of the left shoulder blade, with the shoulder and left arm relaxed. The subjects arm was placed behind to assist in the identification of the site.
4. **Supra-iliac skin-fold:** this was measured in the mid-*axillary* line immediately just posterior to the iliac crest. The skin-fold was picked up obliquely just posterior to the mid-*axillary* line and parallel to the cleavage lines of the skin according to Lohman et al., (1988) recommendations.

Estimation of Percentage Body Fat: the sum of the skin folds measured at the four sites for each subject was compared to values from a reference table designed by Durnin and Wommersley (1974) to estimate the %BF.

Arm-span: this was measured with a non-stretch measuring tape. Each subject stood against a vertical wall with feet together, knees and spine straight and arms spread out horizontally against the wall. The position of the tip of the longest fingers were marked with a pencil and the measuring tape was then used to measure the distance between the marked points and the value recorded to two decimal places.

Categorization Criteria of Athletes

- **a.** Athletes with BMI above 29.9kg/m^2 were categorized as obese.
- **b.** Athletes with %BFabove twenty (20%) were considered obese

Statistical Analysis

Descriptive statistics (mean, standard deviation and range), percentage and inferential statistics (correlation and regression equations) were the statistical procedures employed with $p<0.05$ taken as significant.

RESULTS

A total of 207 male athletes participated in this study. Mean (SD) age of the athletes was 26.09(±4.77)years. Mean (SD) weight of the athletes was 72.13(±0.45)kg, Mean (SD) height of the athletes was 1.74(±0.06)m. Mean arm-span was 1.82(±0.07)m. Mean (SD) BMI of the athletes was 23.89(±3.34)kg/m^2.

Table 1: Distribution of Athletes according to BMI Classification

BMI Range(kg/m^2)	No (%)	Interpretation
17.5-18.4	4(1.93)	underweight
18.5-24.99	156(75.36)	normal body weight
25-29.99	39(18.84)	overweight
30-39.99	7(3.38)	obesity I
>40	1(0.48)	obesity II

Table 2: Distribution of arm span according to age group

Age (yr)	No (%)	Mean±SD	Range
15-20	22(14.10)	1.81±0.08	17.71-1.94
21-25	65(41.70)	1.82±0.07	1.65-1.95
26-30	54(34.60)	1.82±0.07	1.66-1.97
31-35	10(6.40)	1.82±0.07	1.73-1.86
36-40	6(3.20)	1.78±0.03	1.74-1.81
Total	156(100.00)	1.82±0.07	1.65-1.97

Nutritional Status: Based on BMI classification, a total of 156(75.36%) had weights in the normal range, 4(1.93%) were underweight, 39(18.84%) were overweight, 8(3.86%) were obese Table 1. Among overweight athletes, the mean (SD) BMI was 28.19(±4.04)kg/m^2,Mean(SD) of sum of skin-folds at 4 sites among overweight athletes was 31.09(±7.67) mm and Mean(SD) of percentage body fat was 14.25(±3.12). Table 2 shows the distribution of arm span for each age-group. Overall, the mean (SD) of arm span for all participants was 1.82(±0.07)m.

Table 3: Correlation Coefficients between Height, Weight and Arm Span among Athletes

Correlation coefficients between weights and heights of athletes with normal BMI	
Age Group	**Correlation coefficients**
15-20	0.76
21-25	0.70
26-30	0.76
31-35	0.75
36-40	0.80
Total	0.77
Correlation coefficients between heights and arm span of athletes with normal BMI	
15-20	0.76
21-25	0.85
26-30	0.81
31-35	0.73
36-40	0.86
Total	0.77
Correlation coefficients between BMI and Percentage Body Fat of Overweight Athletes	
15-20	-
21-25	0.75
26-30	0.84
31-35	0.81
36-40	0.89
Total	0.72
Regression equation for the estimation of athletes' height from their arm span	
15-20	Y= 0.537+0.659X
21-25	Y=0.362+0.759X
26-30	Y=0.819+0.513X
31-35	Y=1.053+0.378X
36-40	Y=1.33X-0.657

Y=Dependent variable (height)m
X=Independent variable (arm span)m

Table 4: Anthropometric Characteristics of Overweight Athletes

Age group	**Number (%)**	**Mean(SD)**	**Range**
Distribution of mean sum of skin-folds (at 4 sites)			
15-20	1(2.12)	30.00 -	-
21-25	14(29.79)	30.00(±5.55)	20-40
26-30	15(31.92)	33.40(±10.65)	20-60
31-35	10(21.28)	29.00(±7.38)	20-40
36-40	7(14.89)	31.43(±16.63)	30-40
Total	47(100.00)	31.09(±7.67)	20-60
Distribution of mean Percentage Body Fat			
15-20	1(2.12)	12.90 -	-
21-25	14(29.79)	12.70(±2.32)	8.1-16.4
26-30	15(31.92)	13.07(±3.19)	
31-35	10(21.28)	13.67(±3.22)	8.1-19.2
36-40	7(14.89)	16.63(±1.13)	16.2-19.2
Total	47(100.00)	14.25(±3.12)	8.1-21.2
Distribution of mean Body Mass Index			
15-20	1(2.12)	25.51 -	-
21-25	14(29.79)	27.68(±3.70)	25.09-35.76
26-30	15(31.92)	28.26(±4.31)	25.01-41.77
31-35	10(21.28)	27.50(±3.79)	25.06-37.20
36-40	7(14.89)	29.15(±1.34)	25.01-37.89
Total	47(100.00)	28.19(±4.04)	25.01-41.77

Table 5: Dietary Pattern of Athletes

Variables	**Number**	**Percentage**
Skipping of meals		
Yes	149	71.98
No	58	28.02
Intake of water or sports drinks during training		
Yes	160	77.29
No	47	22.71
*Amount spent on each meal		
<₦40	22	10.93
₦40-₦ 60	97	46.86
>₦60	88	42.51
Time last meal was eaten before training		
1 hour	18	8.70
2 hours	39	18.84
3 hours	49	23.67
Do not eat before training	101	48.79

*US $= ₦100

The lowest mean value, 1.78(±0.03) m was among those in 36-40years age-group, this was followed by 1.81(±0.08) for those within the 15 to 20years age-group.

Overall, the correlation coefficient between weight and height among athletes with normal body mass index was 0.77; highest value (0.80) was recorded among those in the age group 36-40 years, the least value (0.70) for those in 25-30 years age group. Correlation coefficient between height and arm-span among athletes with normal body mass index was 0.77; highest value (0.86) among those in the age range 36-40 years, the least value (0.73) among age-group, 31-35years. Correlation coefficient of BMI and %BF among overweight athletes was 0.72; highest value (0.89) was recorded among those in the age range 36-40 years.

Table 4 describes the age specific anthropometric characteristics of overweight athletes. The overall mean (SD) of skin-folds at 4 sites was (31.09±7.67) mm. The highest mean(SD) value (33.40±10.65)mm of skin- folds at 4 sites was recorded for those in the age group 26-30 years old; The least mean(SD) value of skin folds at 4 sites (29.00±7.38) was recorded for those in the age group 31-35 years old.

The overall mean(SD) percentage body fat was 14.25(±3.12), the highest mean(SD) value (16.63±1.13) of %BF was recorded for those in the age group 36-40 years old; The least mean(SD) value of percentage body fat (12.70±2.32) was recorded for those in the age group 21-25 years old.

The overall mean(SD) BMI was 28.19±4.04 kg/m^2, The highest mean (SD) value (29.15±1.34) kg/m^2 BMI was recorded for those in the age group 36-40 years old.

Table 6: Frequency of Food Consumption

Food Groups	Once daily	Twice daily	1 to 3times weekly	4 to 6 times weekly
	No (%)	No (%)	No (%)	No(%)
Cereals and products	70 (33.82)	26(12.56)	61(29.47)	50(24.16)
Roots/tubers and products	120(57.97)	30(14.49)	26(12.56)	34(16.43)
Meat and meat products	44(21.26)	111(53.62)	23(11.11)	26(12.56)
Fish and fish products	58(28.02)	72(34.78)	39(18.84)	40(19.32)
Vegetables	80(38.65)	35(16.98)	39(18.84)	55(26.57)
Fruits	68(32.85)	56(27.05)	40(19.32)	42(2.29)
Legumes and oil seeds	51(24.64)	22(10.63)	79(33.16)	44(21.26)
Milk and milk products	46(22.22)	29(14.01)	83(40.09)	48(23.19)

Table 5 describes dietary pattern of the athletes. About 72% of athletes reported that they usually skip meals. A total of 77.29% drink water during sport. Also, 10.93% spent less than #40.00 for each meal, 46.86% spend between #40.00 to #60.00 on each meal and 42.51% spent over #60.00 on each meal. About 49% reported they do not eat before sporting activity, 23.67% eat 3hours before, 18.84% eat 2 hours before and 8.70% eat an hour before sporting activity.

Eight food groups and their products were assessed in the frequency of consumption. Of these, cereals, root and tubers, legumes are staple foods consumed in large quantity daily. Highest frequency of consumption for all foods by the athletes in this study was the twice daily group (frequency of 5,334 weekly).This was followed by once daily (frequency of 3,759 weekly), 4 to 6 weekly group (frequency of 2,034 weekly) and 1 to 3 times weekly group (frequency of 1,170 weekly). For individual food and products; root and tubers (58%), meat and meat products(54%), milk and milk products (40%), cereals (24%) and legumes (21%) are consumed with appreciable frequency. Furthermore, the most consumed food among athletes was meat and meat products, reported to be eaten by 53.62% of athletes twice daily, this was followed by fish and fish products, taken by 34.78% of athletes twice daily. The least consumed foods on twice daily frequency were legumes (10.63%), cereals (12.56%), milk (14.01%) and roots/tubers (14.49%).The most consumed food ate once daily was roots/tubers and their products, taken by 57.97% of athletes, followed by vegetables, eaten by 38.65% of athletes. Cereals and fruits were the next most consumed foods eaten once daily, by 33.82% and 32.85% respectively. The least consumed foods on taken once daily were meats (21.26%), milk (22.22%) and legumes (24.64%) respectively.

DISCUSSION

This study was conducted to assess the nutritional status and dietary intakes of athletes in Ibadan, the largest city in western Nigeria. A total of 207 athletes participated in the study, with a mean age of

26.09(±4.77) years. This was a little lower but comparable to that found among athletes in Oman who had a mean age of 27 ± 3 years (Waly et al., 2013). This mean age was higher than the 21.5 ± 2.6 years (Ghloum and Hajji, 2011) found in Kuwaiti fencing players. However, all these are young adults.

Mean weight and height of athletes in this study were 72.13(±0.45) kg and 1.74(±0.06)m respectively. This was comparable to those recorded among young athletes in Oman, where the mean weight and height were 75 ± 10 kg and 1.66 ± 0.12 m respectively, however, these values were lower than those recorded among American athletes (Nindl et al., 1998), this may be explained not only by genetics but also by the secular trends in weight and height following many generations of food security.

The body mass index measures a spectrum of nutritional status ranging from chronic energy deficiency (CED)associated with long-standing inadequate dietary intake through overweight and obesity. Skin-fold or fat-fold thickness measures depot energy stored as fat in the sub-cutaneous areas while arm span is a proxy for height which is believed to correlate with long-term nutritional adequacy. The mean body mass index obtained from this study was 23.89±3.34kg/m^2. This was lower than the figure obtained by Waly et al., (2013) and 26.9 ± 2.7kg/m^2 recorded among American College athletes (Ode et al., 2006). This implies that, on the average, these athletes had less energy depot than the above cited groups of athletes. A total of 75.36% had BMI values within normal range about1.93% were underweight, 18.84% were overweight and about4% were obese..

As expected, correlation coefficients between weight and height revealed a strong relationship, but implication of higher BMI values suggests higher body fat and predisposition to associated morbidities. BMI ≥ 25kg/m^2 correlates with greater amount of body fat and associated with greater risk of developing hypertension, high blood cholesterol, diabetes mellitus, and coronary heart disease

(CGIETO, 1998). However, body mass index does not take into account the proportion of the lean body mass and/or percentage body fat (Ode et al., (2006). The influence of large muscle mass due to hypertrophy on BMI in athletes may mis-classify these individuals as overweight and obese. Therefore, the use of %BF may be more effective than BMI in assessing obesity in athletes. The mean %BF of 14.15±13.12 was obtained in this study, which was comparable to the value obtained among American athletes (13.0 ± 4.9). As reported by Ode et al.(2006), the American College of Sports Medicine (ACSM) estimated that 20% body fat in men and 33% in women are acceptable cut-off points for over-fatness corresponding to aBMI of 25 kg/m^2 in young African American and white adults (ages 20–39). The value obtained from this study is lower than the 20% cut off for young men according to ACSM, (2006).

As expected there exists a strong and positive correlation between the BMI and %BF of overweight athletes. Athletes classified by BMI as overweight had a mean %BF that was less than 75% of the cut-off point for their age. This observation is consistent with previous findings that BMI lacks the ability to effectively represent adiposity in athletic populations (Witt and Bush 2005; Nevill et al. 2006). Ode and colleagues(2006) in their study to determine the accuracy of BMI as a measure of % fat in college athletes and non-athletes found that,73% of normal fat male athletes and 40% of non-athletes,were wrongly classified as overweight. Of all measures of body fatness, %BF was particularly observed to increase with increase in age among overweight athletes, however, the correlation between BMI and %BF among overweight athletes remained strong across all age groups eliminating the impact of age on the relationship between BMI and body fat. The increasing trend of average %BF for higher age groups is consistent with the widely held believe that fat accumulation increases with age. The age grouping may, however, have attenuated this effect.

Most of the athletes skipped their meals because of tight schedules. This is similar to the findings by Waly et al., (2013), that, among young Omani athletes, about 55% took less than 3 meals per day. Tunstall (1993) reported the difficulty of fitting meals between training sessions as the main reason why many athletes skip their meals. In this study, about 49% reported they do not eat before sporting activity, 23.67% eat 3hours before sports, 18.84% eat 2 hours before sport and 8.70% eat an hour before sport. The choice of eating before sports and what to eat depends on the type of sports and what goes well with each athlete and the need to enhance stamina, endurance, strength (Clark, 1997).

Foods mostly frequently consumed by athletes in this study were meat, fish, roots/tubers and cereals, vegetables and fruits. Milk and legumes were less frequent. High frequency of consumption of meat, fish and vegetables could have been attributed to the complementary relationship in demand which exist between these and root/tuber and their products.Inadequate carbohydrate intake can lead to chronic muscle fatigue since it is needed to fuel the muscle during exercise.

Although under-nutrition and over-nutrition were found among some athletes, mean values of both BMI and percentage body fats were within normal ranges, implying that, athletes had nutritional status adequate for their sport activity. With regards to food habits, most athletes performed poorly in frequency of meals intake but did well in intake of fluids. Diets of athletes need a revisit to determine nutrient adequacy, dietary diversity, energy expenditure and their relationships.

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