Dietary Intake of College Athletes in Tertiary Institutions in the North Rift Region of Kenya

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Abstract

The concept that proper nutrition contributes to optimum performance is a widely accepted one and both the elite and college athlete aim at excelling in their performance. It was therefore necessary to determine the dietary intake of college athletes since they are the elite athletes of the future. The aim of the study was to determine the dietary intake of college athletes in tertiary institutions in the North Rift region of Kenya and compare this with recommended dietary allowances (RDA). A cross-sectional survey in the quantitative and qualitative paradigms was carried out in two technical training institutes. The study was guided by the Food Choice Process Model. A sample of 44 male and 27 female athletes, 18-26 years old was selected. Anthropometric measurements were taken to determine body mass index (BMI) and body fat percent. Micronutrient and macronutrient intakes were determined using the 7-day estimated food record. Food intake data was analyzed using Nutri-Survey software. Based on BMI, all athletes were classified as normal. Body fat percent was 6% for male athletes and 11.7% for female athletes which was lower than the standard body fat for athletes of 6%-13% and 14%-20% for males and females respectively. Diets of both male and female athletes consisted significantly lower than recommended daily intakes of energy, fat and water and the athletes were in negative energy balance. Vitamins C, folic acid, potassium and calcium intake were below RDA for both male and female athletes. Female athletes exhibited inadequate iron intakes. From the findings of the study, it was concluded that the diet of the college athletes was inadequate in energy and some micronutrients and this could put them at a risk of nutritional deficiencies and compromise their athletic performance. Poor performance in athletics would affect individual and national development. The study recommended that training institutions seek the services of qualified sports nutritionists to guide athletes in their choice of diet. It is also necessary to have nutrition education programs both for the athlete and the coach to train on basic nutrition for enhanced performance.

Keywords: *Athletes, Body Mass Index, Recommended Dietary Allowances, Macronutrients, Micronutrients*

Introduction

Sports nutrition is the application of nutrition principles for the purpose of improving training, recovery and performance (Dunford, 2010). Over the years, athletes have been advised on what to eat and the concept that dietary intake and athletic performance go hand-in-hand dates as far back as 532 BC. Then athletes took finely tuned athletic diet with meat as the staple food of their diet. Alcohol was also accepted for use during training and competition (Gill, 2012). Though these athletes may have performed well in the competitions there was no scientific research to establish the nutritional content of their diet. Today, research has established that proper nutrition increases performance, allows for proper hydration and provides fuel to the body throughout the training period (Clark, 1999). According to the International Association of Athletics Federations (IAAF), well-chosen foods for proper nutrition help athletes train hard, reduce risk of injury and achieve performance goals (Burke & Maughan, 2007). This is in line with the Position of the American Dietetic Association (ADA), Dieticians of Canada (DC) and the American College of Sports Medicine (ACSM) that physical activity, athletic performance and recovery from exercise are enhanced by optimal nutrition (ACSM, ADA, DC, 2000). On the other hand, suboptimal dietary intake has been found to result in persistent fatigue, poor exercise recovery and unwanted weight loss (Ray & Fowler, 2004).

Adequate and proper nutrition of a college athlete is important to meet their energy, macronutrient and micronutrient needs. College athletes have additional needs for macronutrients as well as micronutrients compared to their non-athletic peers hence it is necessary that their dietary intake be monitored. Their changing bodies and physical demands for training put them "at risk" for disordered eating and inadequate dietary intake especially for the female athlete. College athletes also encounter numerous barriers that can hinder healthy eating, including lack of time to prepare healthy foods (due to rigorous academic and training programs), insufficient financial resources to purchase healthy foods and

travel schedules necessitating eating away from home (Malinauskas *et al.,* 2007). Furthermore, wellness of the student athlete reduces the prevalence of injury and other health- related problems that impact performance and thus team competitiveness (Malinauskas *et al.,* 2007). An assessment of dietary intakes and practices of the college athlete is necessary as it will help them understand their intake.

With the increase in the number of physically active women participating in athletics, there is also need to understand the dietary intake of the female athlete. According to Sungot-Borden (2004), eating disorders are higher in female than male athletes. Many female athletes have been found to have such low body weights that they cease to menstruate (Webb, 2007). Research has shown many college athletes to have diets that need change in order to promote health and support performance (Malinauskas *et al.,* 2007). Their diets have been found to be low in fruits and vegetables and high in processed foods and fat (Clark *et al.,* 2003). It is therefore necessary for the dietary intake of female athletes to be determined.

Uasin Gishu and Nandi Counties in the North Rift region of Kenya are famous as home to many of international athletes who have brought fame to the country. This has motivated young people to venture into athletics and start training at an early age in the hope of making it to national then international competitions. It has also led to emergence of training camps within the region where international athletes from all over the country come to train. Since students cannot afford to train in the camps, the institutions provide opportunities for them to train and compete both in their zones and nationally with other institutions. They train and participate in middle-distance races (800m and 1500m), long-distance (more than 3000m, sprints (400m and shorter) and combined events (relays). Winning in these competitions is a way for institutions to market themselves while individual athletes use these competitions as a launching pad for bigger competitions. Since athletic performance is enhanced by optimum nutrition, it was necessary that the dietary intake of these college athletes be studied in order to establish whether they are meeting the recommended dietary allowances.

Studies have been carried out on elite Kenyan athletes to determine their dietary intake (Mukeshi & Thairu, 2004; Onywera *et al*, 2004). However, there is little documented evidence on dietary intake of college athletes in Kenya. The objectives of this study were therefore to determine the dietary intake of college athletes and compare this with Recommended Dietary Allowances and also to assess anthropometric characteristics of college athletes.

Materials and Methods

Study Design

The study adopted a cross-sectional survey design where questionnaires were used to collect primary data. This design was appropriate for the study since the information about athletes was gathered at only one point in time using questionnaires while weighing scales and height meter were used to collect anthropometric data.

Sample and Sampling Procedure

The sample consisted of male and female college athletes from two technical training institutes purposively selected in Uasin Gishu and Nandi Counties. From a total population of 245, a representative sample of 71 was selected based on the formula by Nassiuma (2000). Thereafter, a proportionate stratification formula was applied to allocate athletes into categories of male and female. Based on this, a stratified sample of 44 male and 27 female athletes from both institutes was obtained. The athletes and their coaches were contacted in order to explain the purpose of the study and the methods that were to be applied.

Data Collection

Dietary intake data was collected using the seven day estimated food record. Personal instructions were given to each of the athletes by trained assistants in advance. Household utensils including bowls, cups and spoons were provided to assist in quantifying food intake Height and weight of the athletes (taken barefoot and in light clothing) were measured to the nearest 0.1 cm and 0.1 kg respectively using a SECA weighing scale with height attachment (Vogel and Halke Hamburg, Model 7141014009). The measurements were taken twice and an average of the two recorded. Skin fold thickness measurements were taken using a skin-fold caliper (GIMA PLICOMETRO Model S.P.A Cod 70200) to the nearest 0.1mm at different sites based on gender as described by Jackson and Pollock (1985) and American College of Sports Medicine (ACSM) procedures (Durnin & Rahaman, 1967).

Data Analysis

Using the computer software Nutri-survey 2007, the quantities of food taken were entered and the energy and nutrient profile obtained. Anthropometric data (weight and height) were used to calculate body mass index (BMI) of each athlete in kg/height^2.Skinfold measurements were used to calculate

percentage body fat. The paired samples t-test was used to determine difference between nutrient intake and RDA. One-way analysis of variance (ANOVA) was used to analyze differences between dietary intake of male and female athletes. The level of statistical significance was set at $p<0.05$.

Results

Demographic Characteristics

From a sample of 67 athletes, 42(62.7%) were male, while 25(37.3%) were female. Fifty-one (76.1%) were aged between 22 and 25 years, while 1(1.5%) was above 26 years of age. Only one male athlete was married while the rest, 66(98.5%) were single. Results also showed that 33(47.2%) were in the second year of the study, 22(32.2%) and 12(18.6%) were in first and third years respectively. Regarding residence of the athletes, 62.6% (42) lived with friends, 12(18%) lived alone, 9(13.4%) lived in college hostels and 6% (4) lived with their parents.

Table 1. Demographic characteristics of college athletes

n=67	Frequency	Percentage
Gender		
Male	42	62.7
Female	25	37.3
Age of respondents		
18-21	15	22
22-25	51	76.1
26 years and above	1	1.5
Marital status		
Single	66	98.5
Married	1	1.5
Year of study		
1st year	22	32.2
2nd year	33	47.2
3rd year	12	18.6
Residence of athletes		
College hostels	9	13.4
With parents	4	6
With friends	42	62.6
Alone	12	18

Anthropometric Characteristics of Male and Female Athletes

The mean BMI for male athletes was 19.6 with the maximum of 22.1 and minimum of 17.3 Kg/m^2 while that of female athletes was 19.2 kg/m^2. There was no significant difference between BMI of male and female athletes (ANOVA = 21.1, $p>0.05$). In relation to body fats, male athletes had 6% while female athletes had 11.7% body fat. Both were below the standard body fat percentage for male and female athletes.

Table 2. Anthropometric characteristics of male and female athletes

		BMI(kg/m^2)			Body Fat		
	n	Mean	Min	Max	Mean (%)	Min (%)	Max(%)
Male	42	19.6	17.3	22.1	6	4	8.5
Female	25	19.2	17.1	21.2	11.7	5.5	15.7

Dietary Intake of Male and Female College Athletes

Mean energy intake for the male athletes was 2258.8 Kcal, which was less than recommended intake of 2900 Kcal. The difference was significant ($p<0.05$). Similarly, the analyzed water intake was 2259.2 ml which was also significantly less than recommended intake of 3700 ml ($p<0.05$). The analyzed protein intake 74.1gm) was significantly higher than the one recommended (60.5gm) intake ($p<0.05$). The analyzed fat intake (41.8gm) by the athletes was significantly lower than the recommended 69.3gm ($p<0.05$). The intake of carbohydrates and dietary fibre were significantly higher than the recommended levels. The dietary intake of female athletes was; energy (1989 Kcal), water (1678ml) and fat (39.2gm) which was significantly lower than the recommended values ($p<0.05$). Carbohydrate intake (330.4gm) was higher than recommended value of 290.7gm per day, the differences was significant at 0.05.

Table 4 presents the intake of micronutrients for male athletes. Vitamin A (1584.1mg) and magnesium (404.5 mg) was significantly higher than recommended values ($p<0.05$). The intakes of folic

acid (253.2 µg), Vitamin C (82.4gm), potassium (2198.3mg) and calcium (722.1mg) were significantly lower than the recommended ($p<0.05$). No significant difference was found in the intakes of vitamin B_1 iron and zinc. Results of micro-nutrient intake of female athletes showed folic acid (262.6µg), sodium (1188.2mg), potassium (2319.9mg), calcium (595mg) and iron (12.7mg) were significantly lower than the recommended ($p<0.05$). The intake of phosphorus (1081.7 mg) was significantly higher than recommended value.

Table 3. Macro nutrient intake of male and female athletes

	Male (n=44)		**Female (n=27)**	
	Mean	**t**	**Mean**	**T**
Energy recommended (kcal)	2900	8.8*	1989.2	-0.8*
Energy analyzed (kcal)	2258.8		2200	
Water recommended (ml)	3700	3.6*	1678	-6.6*
Water analyzed value(ml)	2259.2		2700	
Protein recommended (gm.)	60.5	-7.8*	70.8	2.2
Protein analyzed value(gm.)	74.1		60.1	
Fat recommended (gm.)	69.3	13.4*	39.2	-9.2*
Fat analyzed value(gm.)	41.8		68.3	
Carbohydrate recommended(gm.)	293.1	-2.1*	330.4	2.3*
Carbohydrate analyzed(gm.)	418.5		290.7	
Dietary fiber recommended (gm.)	30	-3.7*	33.7	2.1
Dietary fiber analyzed value(gm.)	34.3		30	

*significant at 0.05 level

Table 4. Micro nutrient intake of male and female athletes

	Male		**Female**	
Per day	Mean	t	Mean	t
VIT A Recommended (mg)	949.1	-4.76*	2028.2	2.2
VIT A analyzed(mg)	1584.1		890.9	
Folic acid recommended (µg)	393.8	11.4*	262.6	-6.8*
Folic acid analyzed(µg)	253.2		400	
Vit C recommended(mg)	99.8	3.5*	101.1	0.1
Vit C analyzed(mg)	82.4		100	
Potassium recommended(mg)	3247.5	9.3*	1188.4	-2.9*
Potassium analyzed(mg)	2198.3		2000	
Calcium recommended(mg)	1028.1	10.1*	2320.9	-6.8*
Calcium analyzed(mg)	722.1		3500	
Magnesium recommended(mg)	361.8	-2.4*	595	-7.5*
Magnesium analyzed(mg)	404.5		1000	
Iron recommended(mg)	16	-0.2	12.7	-13.7*
Iron analyzed	16.9		18	
Zinc recommended(mg)	13.1	0.2	11.3	4.5*
Zinc analyzed(mg)	12.5		8.4	

*significant at 0.05 level

Discussion

Dietary Intake of Male and Female College Athletes

Macronutrients and Water

The macronutrient analysis revealed that the macronutrients were consumed within the acceptable ranges by both male and female athletes except for fat which was below the requirements. The

high protein intake for these athletes was attributed to their dietary patterns where they were found to consume a lot of kidney beans as stew or *githeri*. The high carbohydrate diet was consistent with the high intake of *ugali* reported by athletes in this study. A similar study on Kenyan runners found out that *ugali* provided about 23% of the runners' calories Pitsiladis *et al.* (2004). The high intake of ugali was also identified by Christensen *et al.* (2002) in their study of male adolescent Kalenjin runners in Kenya. Like in the current study, the athletes' staple food was maize and kidney beans which were consumed as *ugali* and *githeri* eaten on a daily basis. Energy intake was at 77.9% and 90.4% of the RDA for male and female athletes respectively. Low energy intake was also found in Kenyan athletes in a study by Onywera *et al.* (2004) where the diet was high in carbohydrates and proteins but low in fats and energy. A similar study carried out by Mukeshi and Thairu (1993) on Kenyan long distance male runners also reported low energy intake. However, a study done on Ethiopian athletes established that the athletes met dietary recommendations for all the macronutrients (Beis *et al.*, 2011).

The low energy and fat intake by both groups was attributed to the low consumption of food items that provide high fat and energy like snacks. The athletes in this study reported skipping meals and most of them did not take snacks in between either due to lack of money or time to look for the snacks. Failure to eat snacks among athletes as demonstrated in this study implies athletes lack enough energy giving foods contrary to the American Dietetic Association (2000) requirement that the athletes consume adequate carbohydrates to nourish the body. In their study of athletes, Burke *et al.* (2003) established that the athletes ate approximately on five separate occasions each day with snacks and drinks consumed between meals. This was consistent with guidelines for sports nutrition and hence the athletes were likely to consume adequate intakes of energy giving foods. Sports nutritionists often recommend that athletes consume snacks in between meals in order to meet energy needs as well as ensuring meal are not skipped

Water intake was at 61% and 62.1% of RDA for male and female athletes respectively. Having a deficit level of hydration for the athletes as observed in this study could lead to problems such as declining performance and increased muscle injury (ACSM, ADA and CD, 2000). Water intake for both male and female athletes in the Hinton study was below the recommendations of 3700 ml/day and 2700ml/day respectively.

Micronutrients Intake of Male and Female Athletes

Data from this research on micronutrients intake indicated an adequate intake of vitamin A and vitamin B1 for male athletes while folic acid, folic acid (64.3%), vitamin C (82.6%), potassium (67.7%) and calcium (70.2%) were below the RDA. A similar pattern was observed with the female athletes. Iron intake for the female athlete was analyzed and found to be 70.6% of the RDA. The low intake of micronutrients in this study would have been caused by the low consumption of fruits and vegetables indicated in the dietary records. Dietary shortages of these micronutrients can have consequences for both health and performance (Kreider *et al.*, 2010). Similarly, in a study of elite female athletes in Greece, Hassapidou and Manastrantonic (2001) have reported micronutrient intakes above the recommended values with the exception of iron. The consumption of iron was significantly lower in female athletes. Low iron intake in female athletes is one of the most prevalent nutrient deficiencies and if not checked can impair muscle function and limit work capacity. Nande, Mudafale and Vali (2009) also found the consumption of vitamin B1 and folic acid among female athletes to be lower than the respective RDA while male athletes' folic acid was significantly lower than RDA.

Anthropometric Characteristics of Male and Female Athletes

The weight and height of the athletes were measured and BMI values calculated. The findings indicated the average BMI of male athletes as 19.6 while that of females BMI was 19.2. These values were classified as normal as per World Health Organization (WHO) standards where BMI scores between 18.5and 24.5 are classified as normal. However five female athletes had a BMI score of less than 18.5 which is regarded as underweight. A very low BMI may be an indication that the weight is too low which is likely to lower immunity.

The study also determined percent body fat using skin fold thickness of the athletes. The range for body fats in men was 3.98-8.54 (5.96 ± 1.08) while that of females was 5.46-15.72 (11.73 ± 4.87). This level was far below the known range for male and female athletes as per the classification of sports medicine of 14-20% for women and 6-13% for men (ACSM, 2000). This low percent body fat would pose potential danger to athletes as it may lead to adverse health consequences.

Conclusions

The results of this study showed inconsistency in the athletes' dietary intake and while they made an effort to consume adequate macronutrients, key micronutrients like calcium, potassium, folic acid and iron were found to be lower than recommended. There was also a lack of variety in the diet and there was

low consumption of fruits and vegetables by both male and female athletes. Both male and female athletes had body fat percentage far below the requirements for athletes. This was also reflected in the low intake of dietary fat reported by the athletes.

Recommendations

From the findings of this study, it is important for training institutions to hire the services of professional consultants to work alongside the trainers to ensure that athletes are advised on meeting their dietary requirements. It is also necessary that aspects of sports nutrition are taught to students alongside their core courses in order to give them basic knowledge of nutrition. An improvement in the dietary intake is likely to translate to improved performance hence make the college athletes more competitive both locally and globally.

The focus of this study was to explore the dietary intake of male and female athletes and determine its relationship with recommended dietary allowances in a cross-sectional survey design. It did not, however, establish the relationship between dietary intake and performance of the athletes in a longitudinal research design. As such, there is need to carry out longitudinal research to follow athletes over time and evaluate dietary intake, nutritional status and effects on performance.

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