

A Study on Dietary, Energy and Nutrient Intake among Long Distance Athletes in Ngong' Private Training Camps, Kenya

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Abstract

This study focused on long distance athletes training in selected private training camps in Ngong area, Kenya. The study was informed by inadequacy of food, calorie, Protein, Calcium and Iron intake reported by research findings. The study adopted a cross-sectional survey research design and the whole population of 36 athletes comprising 23 men and 13 women athletes participated. Food frequency questionnaire was used to collect data on food intake, while 24-hour Food Recall was used to determine their mean daily intake. Standard measuring equipment were used for accuracy of the results. The data was then analyzed by determining percentage and means of food and nutrient intake, and results presented in graphical and tabular form. Inferential statistics were done using t-test, to establish the difference between calorie intake by men and women, as well as difference in intake of protein, fat, calcium and iron by the two groups. Results indicate that dairy products and cereals were the most frequently consumed foods at 96%, followed by green leafy vegetables at 88% and meat at 63%. The mean daily carbohydrate intake for women and men was at 37.4% and 47.9% respectively, while the average daily fat intake was at 39% and 37% of the RDA respectively. Mean daily protein intake for women and men was at 54.6% and 58.9%, and the mean daily iron intake was at 53.1% and 79.8% of the RDA for men and women respectively. The average calcium intake for women and men was at 59% and 68.8% of the RDA respectively. The findings indicated that there was diversity in diet in athlete training camps, but calorie and nutrient intake was inadequate. There was need therefore, for coaches to incorporate sports' nutrition education in training camps to sensitize athletes on good dietary habits in order to ensure adequate nutrition for optimal performance.

Keywords: *Sports nutrition, Sports food intake, Sports nutrient, Athletes nutrition, Athletes food, Athletes' nutrient*

1.0 Introduction

Sports nutrition is a key aspect of sports performance. Several studies have indicated that adequate nourishment is vital for enhanced athletic performance, the athlete's age notwithstanding. Drug abuse in athletics could be a result of a number of factors including, but not limited to inadequate sports' nutrition. Many studies have stated with evidence the importance of nutrition in athletic performance (Jeukendrup, 2011). As the duration of physical exercise lengthens, protein, through the process of gluconeogenesis is used to produce glucose so as to maintain glucose level in the blood (Kato et al., 2016). Further, athletes need to take in adequate protein to meet the RDA which helps to maintain positive nitrogen balance, repair of worn out tissues as well as maintaining healthy muscle mass (Knuiman et al., 2018).

Adequate calorie intake is vital for endurance, and enables the body to spare protein and prevent muscle wasting (Vitale & Getzin, 2019a). Fat intake should be just enough to meet the RDA in order to provide alternative source of energy during the long distance competition, as well as enhance absorption of fat soluble vitamins. Apart from adequate energy and macronutrient intake, long distance endurance athletes also need to ensure adequate intake of iron to meet the RDA in order to prevent sports' anemia which is common in long distance runners (Hinton, 2014).

Calcium intake also needs to be high enough to meet the RDA, maintain strong bones and prevent osteoporosis, as well as enhance

healthy muscular activity during competition. A study to investigate effect of supplementation with protein and carbohydrate on after sports' nutritional status, reported higher levels of blood glucose as compared with unsupplemented participants (Isenmann et al., 2020). In another study which investigated anemia in sports, it was found that over one third of the participants presented depletion of iron stores in the body (serum ferritin $<12\mu\text{g/L}$)(Fernández-Lázaro et al., 2020). A separate study done on nutritional supplementation for sporting females confirmed that interventions involving use of rich dietary sources of iron; for example, products of staple foods provide alternative ways of improving intake of iron and consequently increase iron stores in exercising female athletes (DellaValle, 2013).

The current study was informed by the findings of previous studies which revealed that many of the athletes suffer from inadequate food, energy and nutrients intake and the disguised sports' anemia (Capanema et al., 2022). Since this type of anemia is very common among athletes, it was very necessary for the current study to look into food and nutrient intake of the respondents in order to establish the extent of the problem of dietary and nutrient intake among athletes so as to come up with recommendations to help those affected. The aim of this study was to investigate adequacy of calorie and nutrients intake by the athletes, and provide recommendations to address the problem.

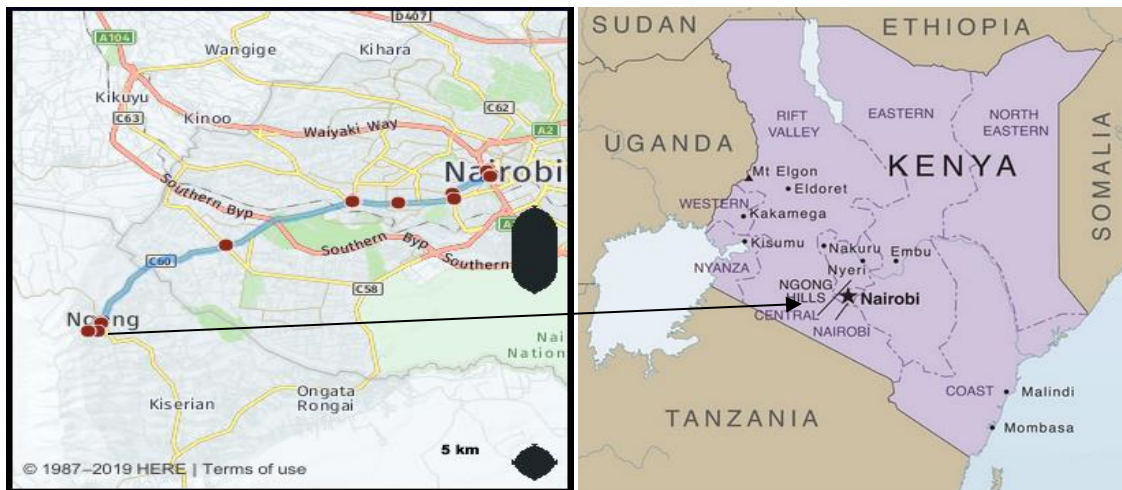
2.0 Materials and Methods

Study Setting

The main Athletics training camps in Kenya are located in Ngong area which has an altitude of 1961 meters above sea level. Ngong is located on the outskirts of the capital city of Nairobi. Similar training camps are located in Kapsabet, which is in **Figure 1**

the Rift valley region. The camps at the Ngong area were chosen for this study because they serve as grounds for recruiting and training athletes, and also for their close proximity to the National stadia in Nairobi. Ngong is situated in the Rift Valley, Kenya, and its geographical coordinates are 1° 22' 0" South, 36° 39' 0" East.

A Map of Kenya showing the Ngong area. ©www.besttourism.com



Study design

The study adopted cross-sectional survey design. The study sought to establish the nutritional status by means of Body Mass Index as well as food, Calorie and nutrient intake. The research study was conducted at the Ngong Private Athletic training camps.

Selection of participants

With permission from Athletics Kenya, two camps were selected for this study. Ethical clearance was obtained from the KNH-UoN

ERC of the University of Nairobi, reference number KNH-ERC/A/113. Permit to collect data was given by National Commission for Science, Technology and Innovation (NACOSTI Permit Ref No: 883847). The two camps had a total population of 36 athletes (23 men and 13 women), who all participated in this study. Consent was sought from all the participants (18-30 years old) and they were given consent forms to fill and sign as evidence of agreement to participate in the study.

Food and nutrient intake

Information on foods commonly consumed was collected using a structured, pre-tested questionnaire and the information summarized in a food frequency table. Nutrient intake was assessed by 24-hour food recall method, using standardized utensils (cups and spoons) for accuracy of measurements and nutrient intake adequacy for various nutrients was calculated based on their recommended dietary allowances (RDA). Percentage adequacy of carbohydrate, protein, fat, calcium and iron were computed, based on the recommendations for sports persons; that is, 60%, 15% and 25% of the total daily calorie requirement respectively (Pramukova, 2011). Percentage calorie and protein adequacy was determined based on the recommended dietary allowance (RDA) of 50 kcal and 1.2-1.4g per/kg body weight per day respectively. Average calcium and iron intake was established from the dietary intake and compared with their Recommended Dietary Allowance (RDA) which is 1200mg and 15mg, respectively (Bytomski, 2018). Adequate iron intake as per the RDA helps prevent sports’ anemia and enhances athletic performance, Calcium is very vital for effective muscular function and for prevention of osteoporosis which promotes physical performance.

Data analysis

Using SPSS (version 21), inferential statistics were done by use of t-test, to establish the difference between calorie intake by men and women as well as difference in intake of protein, fat, calcium and iron by the two groups. Means of both calorie and the target

nutrients’ intake were also calculated and compared with Recommended Dietary Allowances to determine levels of intake. Then percentage mean intake was calculated for calorie, protein, calcium and iron and the findings reported in graphical presentation. Findings on food frequency were determined by calculating the percentage of respondents consuming each of the foods enlisted and presented in tabular form.

“Adequate nourishment such as carbohydrate, protein, fat, calcium and iron is vital for enhanced athletic performance”

3.0 Results and Discussion

Demographic characteristics of the respondents

Age and sporting experience of athletes are closely related to muscle strength and level of physical endurance. Physical endurance develops over time and is dependent on consistent training. For many athletes, physical endurance reaches its peak from the ages of 25 to 35 years. Out of the twenty three (23) men who participated in the study, 77% were aged between 25 and 30 years whereas the remaining 23% were aged between 18 and 24 years. Most of those age above 25 years had participate in the long distance races for a period of 5 to 10 years, while many of those aged below 25 years had a

sporting experience of between 2 to 5 years. All the ladies in the study were aged between 20 and 27 years. About 82% of the female athletes had sporting experience of between 2 to 5 years whereas eighteen percent (18%) had sporting experience of between 5 to 10 years. These results indicate that most of the athletes (77%) in this study were at their prime age.

For the level of education, 54% of the men reported to have completed secondary level education, 31% had completed primary level education, and 15% had gone through college education. On education levels of women athletes, 82% reported to have secondary level education with the remaining 18%

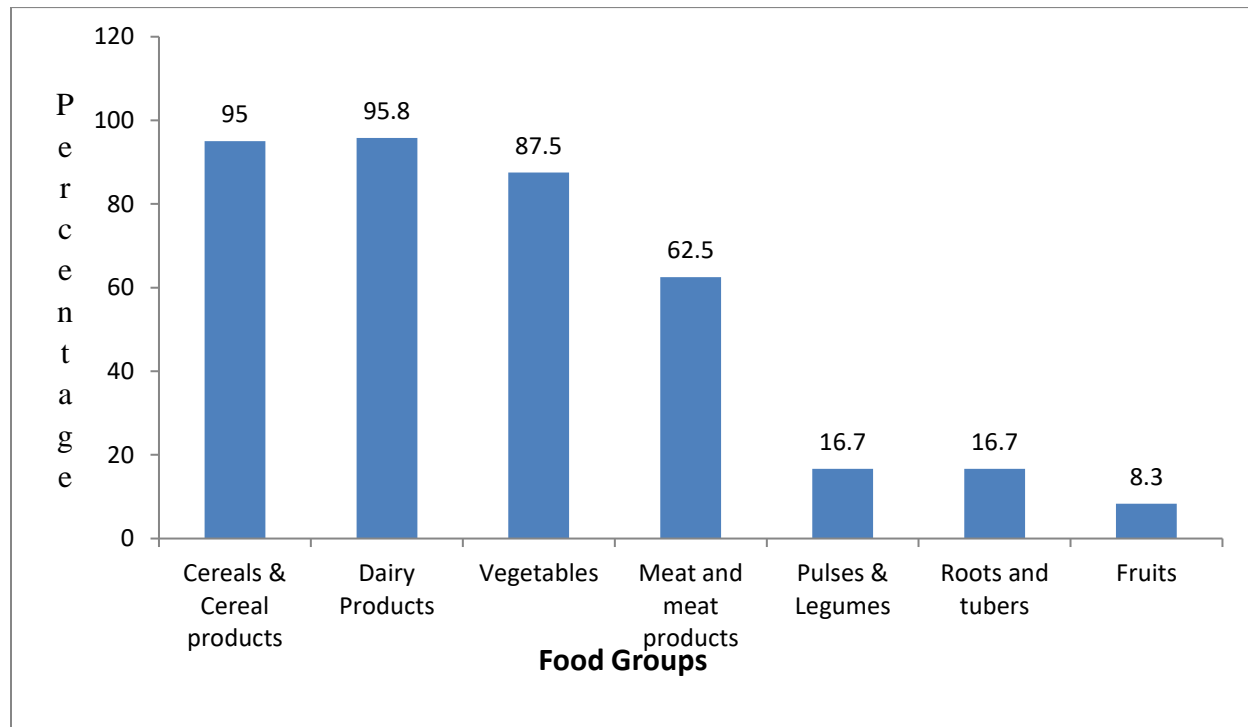
indicating having primary level education. On marital status, 62% of the male athletes were married and the remaining 38% were single. Eighty two percent of the female athletes were single and 18% were married. The level of education was generally good meaning that most respondents would have some knowledge on balanced diet and healthy feeding lifestyle. Those married had to balance between family responsibilities and training.

Food frequency of the participants

Daily food intake frequency was as illustrated in Figure 2.

Figure 2

Daily food intake frequency



Food frequency analysis showed that cereal and cereal products were consumed daily by

95.8% of all the respondents, indicating that cereal and cereal products formed the main

proportion of the respondents' diet (**Table 2**). Pulses and legumes were poorly consumed, with only 16.7% consuming them daily, 25% once a week, 25% occasionally, and 20.8% did not consume them at all. This food group

is important because an endurance athlete needs carbohydrate to fuel muscles, and protein to build and repair the muscles (Kanter, 2018).

Table 2
Food Intake Frequency.

| S. No | Food Group | Daily (%) | Frequency weekly (%) | | Monthly (%) | Occasionally (%) | Never (%) |
|-------|---|-----------|----------------------|-------|-------------|------------------|-----------|
| | | | Once | Twice | | | |
| 1 | Cereal & Cereal products (Maize, Rice, Wheat) | 95.8 | | 4.2 | | | |
| 2 | Pulses & Legumes (Beans & Peas) | 16.7 | 25 | 4.2 | 8.3 | 25 | 20.8 |
| 3 | Green leafy vegetables | 87.5 | | | | 12.5 | |
| 4 | Other vegetables (Carrots, Green peas) | 8.3 | 8.3 | | 12.5 | 45.8 | 25 |
| 5 | Fruits | 8.3 | 33.3 | 8.3 | 16.7 | 33.3 | |
| 6 | Roots & Tubers (Sweet and Irish Potatoes) | 16.7 | 33.3 | | 8.3 | 29.2 | 12.5 |
| 7 | Milk & Milk products | 95.8 | | | | 4.2 | |
| 8 | Meat & Meat products | 62.5 | 16.7 | | 16.7 | 4.2 | |

Pulses and legumes are important sources of plant protein. They are also excellent reservoirs of dietary fiber and complex carbohydrates. Pulses play vital role in metabolic and physiological processes due to the presence of various bioactive compounds, and the majority of them are phenolic acids, flavonoids, and tannins (Mizelman et al., 2020). Green leafy vegetables were very well consumed, with 87.5% of the respondents consuming them daily, and only 12.5%

consuming them occasionally. Other vegetables such as carrots and green peas were poorly consumed with only 8.3% of the respondents consuming them daily, 45.8% occasionally, and 25% having never consumed them at all. In athletes, a deficit of these micronutrients can lead to excessive production of reactive oxygen and nitrogen species that induce tissue damage, a higher frequency of inflammatory processes, reduced immunity, increased susceptibility to

injury, and prolonged recovery (Jordan et al., 2020).

Fruit intake was also poor, with only 8.3% consuming them daily, 33.3% once weekly and 33.3% occasionally. Fruits contain macro- and micronutrients, fiber, minerals, vitamins, a number of bioactive phytochemicals, including phenolic compounds such as anthocyanins and ellagitannins. They should therefore be considered a regular part of an athletes' diet (Burkhart & Pelly, 2016).

Consumption of roots and tubers was also low with only 16.7% consuming them daily, 33.3% once weekly, 29.2% occasionally, and 12.5% never taking them at all. Milk and milk products intake was excellent with 95.8% of the respondents consuming them daily, and only 4.2% taking them occasionally. Consumption of meat and meat products was good with 62.5% of the respondents taking them daily, 16.7% once in a week, 16.7% monthly, and only 4.2% occasionally. However, the amounts consumed were lower than recommended in order to meet the RDA for protein (Meyer et al., 2020).

Calorie and Nutrient needs of the respondents

Recommended Dietary Allowance (RDA) for energy in endurance athletics is 44-50 Kcal/kg body weight/day (Appiah-Dwomoh et al., 2018). Carbohydrate should account for 60% of this energy requirement, protein 15% and fat 25% (Vitale & Getzin, 2019b). The mean daily calorie intake of women was 1072.45 Kcal representing 40% of the Recommended Dietary Allowance (RDA), while calorie intake for men was 1266.76 Kcal, which represented 46.6% of the RDA. Results of t-test revealed that there was a

significant difference between calorie intake by men and women ($P=0.032$).

The mean daily carbohydrate intake for women and men was 150g and 195g respectively. This represented 37.4% and 47.9% of the RDA for the two groups respectively. This level was inadequate to maintain muscle glycogen at normal levels and prevent muscle glycogen depletion for the endurance athletes which require to be maintained at adequate levels. Statistical analysis showed that there was a significant difference between carbohydrate intake by men and women ($P<0.002$)

Average daily fat intake for women and men was 29g (39% of RDA) and 27g (37 % of RDA) respectively. This further contributed to the general inadequate calorie intake by the respondents. Fat intake therefore needed to be increased to meet the RDA in order to spare protein during the long-distance endurance race. Investigation on association between fat intake by gender established that there was no significant difference in fat intake by the two groups ($P=0.61$).

Mean daily protein intake for women and men was 54.81g and 59.53g which represented 54.6% and 58.9% of the RDA respectively. Analysis of the results also showed no significant difference between protein intake by men and women ($P<0.286$). Following the inadequate intake, the respondents were advised to increase intake of protein foods like meat, pulses and legumes in order to meet the RDA and safeguard against tissue breakdown and muscle wasting. This is crucial also to maintain positive nitrogen balance.

The mean daily iron intake for the groups I and II was 9.56mg and 11.98mg, which represented 53.1% and 79.8% of the RDA respectively. The iron intake by men and women was found to have significant difference ($P<0.001$). These results indicate a level of iron intake which was inadequate to prevent sports anemia in the two groups of the athletes, hence the reason for the anemia established by Hemoglobin (Hb) levels of the two groups. Consequently, participants were educated on iron rich foods and the importance of increasing consumption of those foods in order to boost hemoglobin levels and prevent sports' anemia.

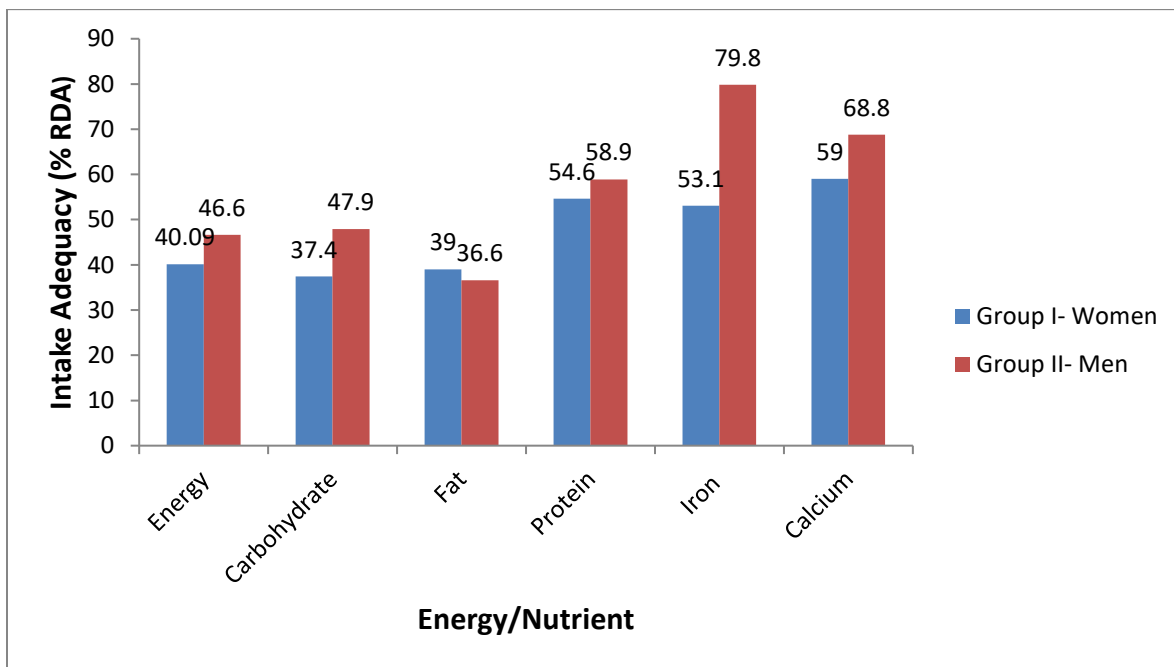
The average calcium intake for the two groups was 708.9mg and 827.23mg, which represented 59% and 68.8% of the RDA respectively. Calcium intake by both men and women had no significant difference

($P<0.229$). Therefore, there was need to increase calcium intake to enhance strength of the bones and maintain normal calcium metabolism. This gap was covered during the education sessions and all the participants were enlightened on the importance of adequate calcium intake in promoting healthy muscles contraction as well as in maintenance of optimal bone health and strength.

In summary, adequacy of daily calorie and nutrient intake for group I (women) was as follows; Calorie 40.09 %, Carbohydrate 37.4 %, Fat 39 %, protein 54.6 %, iron 53.1 % and Calcium 59 %. Adequacy daily calorie and nutrient intake for group II (Men) was as follows; Calorie 46.6 %, Carbohydrate 47.9 %, Fat 36.6 %, protein 58.9 %, iron 79.8 % and Calcium 68.8 %.

Figure 3

A Graph on Percentage Daily Calorie and Nutrient Intake by men and women



According to the research findings, apart from fat intake men had a higher calorie and other key target nutrients as compared to women. This is clearly illustrated in Figure 3 above.

Research has established that for optimal performance in long distance athletics, the ideal Body Mass Index (BMI) should be between 17.5 and 20.7 (Sedeaud et al., 2014). The mean BMI for women and men was 20.63 and 20.57 respectively.

Discussion

The study was conducted on a total population of 36 long distance athletes drawn from two camps at the Ngong training camps. The athletes included 23 men and 13 women. Food frequency and nutrient intake questionnaire was administered to collect data on foods regularly consumed and the frequency of intake, as well as calorie and key target nutrients' intake. The main nutrients targeted in the assessment were carbohydrate, protein, fat, calcium and iron. Carbohydrate intake was assessed because it is the main source of energy for the athletes. Protein intake was also of special interest because it is required for tissue repair after the wear and tear that occur during training and competition. Being the next alternative source of energy, fat intake assessment was also crucial as it contributes to the overall daily calorie intake and hence the reason why it was targeted in the current study.

Calcium is also very important to the long distance athletes as it is required for healthy muscular function as well as maintenance of healthy strong bones that are vital in supporting the intense physical activity and prevent osteoporosis. Therefore, calcium

intake was also an important factor to be evaluated in this study. Sports' anemia is very common in athletes due to increased iron losses through sweat during the long distance training. Anemia reduces oxygen transport due to low hemoglobin levels, which consequently reduce oxidation of glucose and fatty acids to supply the much needed energy during the training sessions. Reduced oxidation of glucose leads to early fatigue, reduced cardiorespiratory and muscular endurance and compromised physical performance. For this reason, iron intake was a key factor assessed in this study. To determine calorie and all the target nutrients' intake, standard food exchanges and measuring equipment were used. Standard cup (250 ml) and standard food portions (exchanges) were used in diet calculations to determine the intake.

The results show that cereals were the main source of energy with the highest intake, while consumption of pulses was very low. There was need therefore to encourage the participants who consumed pulses and legumes occasionally, as well as those who never ate them to take them more frequently as they offer a good source of protein-carbohydrate combination which is very important for optimal performance. Green leafy vegetables were very well consumed and this provided a good source of antioxidants to counteract oxidative damage of the cells which could result from free radicals generated by the prolonged periods of endurance exercise. Meat intake was also good and this supplied the body with amino acids, having an optimal composition for the support of protein synthesis for building and

maintaining muscle. Support and maintenance of skeletal muscle mass is of utmost importance in maintaining both physical function and metabolic health. The good meat intake could probably explain why protein intake by both men and women was found to have no significant difference with, P-value at 1.094. Milk and milk products intake was excellent, with 95.8% of the respondents consuming them daily. That is why data analysis on calcium intake by both men and women showed no significant difference. However, 24 hour food recall revealed that the intake was not adequate to meet the RDA for calcium. 24 hour food recall also showed that RDA for energy, protein, carbohydrates, fat and iron was not met.

Similar to many other research publications, calorie intake by men and women was found to have significant difference since men require more energy than women owing to their higher muscle mass. The difference however, does not apply on fat intake by both gender since women tend to consume higher proportions of fat in diet than men, hence no significant difference on fat intake by both gender. As reported in other research findings, carbohydrate intake levels showed there was a significant difference between men and women. This was mainly because higher energy needs in men drive them to consume much more food, especially carbohydrate since it is the main source of energy for the body. Results on iron intake by both men and women showed a significant difference. This corroborates other studies done on iron intake, since iron is related to higher dietary intake by men as compared to women. The results reveal a gap in sports'

nutrition that need to be addressed by athletics management bodies, both locally and internationally. In addition to food, calorie and nutrient intake, we established that both women and men had their mean BMI within the recommended range for long distance athletes.

4.0 Conclusion

The study revealed that daily food and nutrient intake by the athletes was below the Recommended Dietary Allowances (RDAs) and therefore inadequate to meet their nutritional needs for optimal athletic performance. The food frequency results showed variety in the daily food intake. However, the 24 hour food recall results revealed inadequate intake of the key nutrients and energy. Therefore there was need for the athletes to increase the quantities of the daily food intake to meet the RDA for energy, as well as macro and micronutrients for optimal performance. For improved nutritional status and physical performance, athletic clubs should organize and have their athletes educated on the importance of adequate nutrition in promotion of optimal performance. Both the government and the athletic clubs' management should engage nutrition experts in both sports' nutrition education and guidance on optimal nutrition for athletes. The Ministry of Sports should also develop a policy on Sports' nutrition with the aim of introducing nutrition support for athletes and other sports' persons.

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lot since no athlete would go against their decision. Last but not least, we also acknowledge the important part played by the athletes in this study and therefore we wish greatly appreciate their commitment and cooperation to ensure that the entire study was a success.

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