ASSESSMENT OF NUTRITIONAL STATUS OF ATHLETES AND ITS EFFECTS ON THEIR PERFORMANCE

THE CASE OF DEFENSE ATHLETICS CLUB

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Abbreviation

AV.AC	Average Activity Cost
BMR	Basal Metabolic Rate
C.E	Caloric Expenditure
C.I	Caloric Intake
DRI	Dietary Reference Intake
E.COST	Energy Cost
EHNRI	Ethiopian Health and Nutrition Research Institute
KCAL	Kilo Calorie
KG	Kilogram
KJ	Kilojoules

Abstract

The effort of this research is to assess the defense athletics club nutritional status which is one of the crucial factor for once enhancement in performance. Descriptive survey design was used to conduct this research. Endurance athletes were selected and stratified in to sex and their specific events, finally 50% were selected by simple random sampling from each stratum and three coaches were selected purposively. The data has been gathered mainly using questionnaire, observation, interview and direct measurement. The data has been analyzed using both qualitative and quantitative analysis methods. Accordingly, frequency counts with percentage and direct calculation of the energy intake and expenditure has been employed to analyze various information of the subjects of the study. The findings of the study revealed that, there is energy imbalance in defense club. Moreover, almost majority of the athletes have greater intake than expenditure except for only a few athletes. Finally, the recommendations were forwarded based on the major findings.

Key words: - *Caloric Intake (Amount of Food Consumed), Caloric Expenditure (Amount of Required to do an Activity), Calorie (Unit of Energy), BMR (Basal Metabolic Rate) and Kcal (Kilo Calorie)*

CHAPTER ONE

1. Introduction

1.1 Background of study

Most people know and understand the importance of eating correctly. Nutrition lacking in the essential elements to cover the basal metabolic rate- the energy required to keep body function, for growth and for exercise may lead to physiological and psychological consequences such as shortness of breath, little energy, general tiredness, muscle cramps, lack of concentration and inability of the body to respond for the specific training program which leads to be juried. Therefore, adequate nutrition is a key component of sports performance. The greater the demand for increased performance both in training and competition, the higher the nutritional value must be (Mcardle, katch, I and katch, L 1991).

McGinty J. et al. (1991) state that proper nutrition is an important consideration for athletes, who seek to maximize their performance. So, daily training will create special nutritional needs for an athlete, particularly the elite athlete whose training commitment is almost a full-time job (Burke,L.1998).

Many coaches make dietary recommendations based on their own “feeling” and past experiences rather than rely on available research evidence. This problem is compounded because athletes often have either inadequate or incorrect information concerning prudent dietary practices or the role of specific nutrients in the diet. Although research in this area is far from complete, the general consensus that active people and athletes do not require additional nutrients beyond those obtained in a balanced diet (Mcardle, katch,I and katch,L 1991) .

As Rodligue, Dimarco and Langley(2009) recommend that physical activity, athletic performance, and recovery from exercise are enhanced by optimal nutrition. In addition to this idea it is expected from athletes to consume Carbohydrates, protein, fat, fluids and manage their body weight in a recommended manner to the demands of their specific training program and sport activity. So all ideas expressed above need emphasis also with Ethiopian athletes and coaches in order to compete and reach the peak performance more than what have been done. The fundamental difference between an athlete diet and that of the general populations are that athletes require additional fluid to covers sweat loss and additional energy to fuel physical activity. Furthermore, in today's competitive sport environment athletes need to be physically & mentally fit to perform at their best. Research clearly shows that nutrition can play an important role in improving exercise performance, decreasing recovery time form strenuous exercise, preventing exercise-associated strenuous injuries due to fatigue, providing the fuel required during time of high intensity training, and controlling weight (Driskell, & wolinsky, 2008)

In general nutritional assessment should be taken in order to know the athletes current status and predict the future performance which is the main emphasis of this study. Moreover, among the selected Addis Ababa athletics club, Defense athletics club is stronger contributor for the developments of athletics in Ethiopia which has been established in 1936E.C and playing great role in producing competent athletes starting from the establishment and to the current.

Now a day defense athletics club has 165 athletes. Among these 69 of them are girls and the rest 96 of the athletes are boys.

1.2 Statements of the problem

Many coaches make dietary recommendations based on their own “feeling” and past experiences rather than rely on available research evidence. This problem is compounded because athletes often have either inadequate or extra amount or incorrect information concerning prudent dietary practices or the role of specific nutrients in the diet(Mcradle, katch,I and katch,L 1991) .

This also is true in defense athletics' club. Though it is the only club where athletes are living and feeding in the camp which is conducive for the study on the assessment of athlete’s nutritional status.

Based on the above issues the researcher has raised a question what are the major types and amount of diets for this club? Hence, this study attempted to answer the following basic research questions.

1.3 Research questions

1. What are the major types of diets consumed?
2. What is the amount of diet consumed each day /daily caloric intake?
3. Is the athlete caloric intake balanced with caloric expenditure?
4. Do age, sex and body weight of the athletes considered in the dietary intake?

1.4 Objective of the study

General objective

The main objective of the study is to assess the current nutritional status, predict their future performance and to suggest possible recommendations for improvement.

Specific Objectives

1. To identify types of diets consumed
2. To compare the daily caloric intake with the daily caloric expenditure.
3. To compare the proportion of energy yielding nutrients with the recommendation amount in the daily meal.
4. To preserve detailed information for further investigators

1.5 Significance of the study

The use of recommended diet in enhancing athletic performance is one of the most important issues for once country result in national, continental and international competitions in their events. However, some problems hinder to achieve. As a result, conducting on the current nutritional status will have the following significance.

1. create awareness for athletes, coaches and concerned body about their knowledge of nutrition
2. It initiates athletes, coaches and concerned body to look in to the possibilities of improving patterns of nutrition
3. Contribute the clubs coaching staff to include information that can be used in the development of training program.
4. It adds knowledge for the researcher about nutrition and performance.
5. The results of the study will be used as a spring board for other researchers who want to conduct in-depth study on the same or related issue.

1.6 Delimitation of the study

The researcher believe that the study is conducted in depth using different parameters or components such as dietary intake, anthropometric measurement(weight), biochemical laboratory test, clinical and physical activity needs. However, due to the limitations of time, financial and material resources, the researcher focuses on the dietary intake and anthropometric measurement (weight) to assess the nutritional status, Specially macro nutrients (yielding the energy for athletes). In addition to this the study was delimited to distance runners of defense athletics club.

1.7 Limitation of the study

Un inclusion of food outside the three meals in the camp in measurement, in caloric intake lack of dietary intake guidelines the sport in our context, un inclusion of height measurement in BMR (in Burke's steps) as well as time and materials constraints. In addition to this, the absence of documentary materials especially the athletes profile while joining the club which help to compare current data of athletes with the previous.

1.8 Operational definition.

Anthropometric measurement -measurement of body weight.

Athlete: An individual who is engaged in the training site of athletics club as senior.

athletes in order to help them develop and improve.

Basal metabolic rate: is the rate at which the body expends energy for maintenance of

Caloric Expenditure/energy expenditure/- the sum of energy required in basal &

Caloric intake: - the amount of caloric/ energy/consumed.

Calorie- A unit of energy to measure food energy content

Coach: a person who provides organized assistance to an individual and/or a group of

Distance runners = athletes engaging in middle & long distance athletic event

Energy- the capacity to do work

Macro Nutrients- Energy yielding nutrients (carbohydrates, fats & protein)

Nutrition: The science of food as it relate to optimal health & performance

performance level.

Performance: an observable behavior of athletes in training and competition.

resting metabolism, thermic effect of the food & physical activity

Training: A systematic process with the objectives of improving an athlete's fitness and

vital functions.

1.9 Organization of the study

The study was organized into five chapters. The first chapter deals with introduction parts that comprise background of the study, statement of the problem, research questions, objectives of the study, significance of the study, delimitation limitation of the study and operational definitions . The second chapter deals with review of related literatures, while the third chapter deals with research methodology, the fourth chapter discuss about presentations and analysis of the data. Finally, the fifth chapter concentrates on summary, conclusions and recommendations of the study.

CHAPTER TWO

2. Literature review

2.1 Nutrition

According to Thompson (1991), nutrition means all the food a person eats and drinks. The whole human body is made from this food, and all energy comes from food. The food acts in the body as a fuel, providing energy and chemicals for movement, growth and to keep the body healthy. What the athlete need nutritionally is affected by age, sex, body build, level of physical activity and state of health.

The carbohydrate, lipid and protein nutrients provide the necessary energy to maintain body function of rest and during various forms of physical activity. Aside from their role as biologic fuel, these nutrients, called macronutrients, play important roles in maintaining the structural and functional integrity as the organism. (Mcardle, Katch, I. and Katch, L, 1996).

2.2 Methods of assessing food intake

The ability of the sports nutritionist to determine an athlete's dietary intake and to consequently analyze his or her nutrient status is important. Reliable and accurate ways to assess food intake using food diaries (diet records), 24 hour dietary recalls, and food frequency questionnaires serve to assess food and nutrient intake in various ways. The use of a specific method can be determined by the purpose of the assessment and other factor such as time and ability of the athlete record or recall specific intake (Driskell and Wolinsky,2011).

2.2.1 Diet records (food diaries)

A diet record consists of the all the food and beverages a person consumes in certain amount of time. Three day diet records are most often used (individual's daily food and beverage consumption. Seven day food dairies are more time consuming but may afford a more complete picture of the diet. It should be noted that diet records lasting an extended amount of time are not always as accurate as more concise diet records. This is due to the fact that individuals may absent mindedly forget to write down the information daily or may find the task tedious and redundant. The seven day diet record is one of the most common approaches when assessing an individual's diet. In general, the more information collected and the more details provided, the more accurate the conclusions. Diet records, also called food diaries, are recorded on a form with one line for each food consumed and columns for portion size (Driskell and Wolinsky, 2011).

2.2.2. Twenty – four hour's unstructured interview

Twenty – four hour dietary recalls are often used as a quick nutrition assessment and many times can be used on an important basis to determine an individuals' daily intake. A dietitian will ask an athlete to list the foods that he/she has consumed with in the past 24 hours. When doing so, it can be advantageous to first review with the athlete the past day's events which then can be used to help recall specifies about dietary consumption. The 24 hour dietary recall can be performed by two different methods. The first is when the dietitian asks the individual to start from the beginning of the previous day and provide in detail all of the food and beverage consumed from the beginning of the day before. The second method starts with the current day and works backward. Both qualities is activities as a way to assist in recalling his/her dietary intake. For example, the individual would be questioned on what he/she ate prior to this visit and then work back over the past 24 hours. Both methods allow the dietitian to use the individual and food preparation play a major role when performing a 24 hour dietary recall because most of the time it is difficult for athletes to quantify the amount of food and beverage she/he consume during the past 24 hours, so athletes recalling ability play great role (Driskell and Wolinsky,2002).

2.2.3 Food frequency questionnaires

Food frequency questionnaires can assist in determining, on average, the amount of a specific macro or micronutrient an individual consumes. It too is highly dependent up on the individual's memory and ability to estimate the quantity of a particular food or food group. A list of food is given to the individual and he/she is asked to determine how often each food was consumed during a specific period, usually ranging from one day to several months (Driskell and Wolinsky,2002).

2. 3. Evaluation of Nutrient adequacy of athlete's diets

Adequate and proper nutrition is important for active individuals to meet their overall energy, nutrient, and fluid needs. Thus, many athletes are interested in learning how to improve their dietary and fluids for health and performance. One of the first steps in determining how to best improve an athlete's diet is to assess his/her food, fluid and supplement intakes with in the context of their weight goals, sport training routine, and completion schedule knowing when an athlete eats in relationship to exercise training may be as important as knowing what he/she eats. Regular assessment of an athlete's diet will help identify potential nutrition problems related to time of year, changes in training routine, health issues that arise such as injuries or illness, and/or lifestyle changes. So these parts of literature reviews the methods used to assess an athlete's diet and the guidelines used to determine the adequacy of these diets, including the dietary reference intakes, approaches for assessing dietary adequacy, and specific macro and micronutrient recommendations for active individuals and athletes (Driskell and wolinsky, 2008).

2.4. Optimal nutrition for exercise

An optimal diet is one in which the supply of required nutrients is adequate for tissue maintenance, repair, and growth without excess energy intake. It is now possible to make reasonable estimates of nutritional needs for men and women that account for normal variation in daily energy expenditure. Dietary recommendations for athletes, however, must also consider the specific energy requirements of a particular sport as well as by the athlete's dietary preferences. Although there is no one diet for optimal exercise performance, careful planning and evaluation of food intake should follow sound nutritional guidelines (Mcardle, katch,I and katch,L 1991).

2.4.1. Nutrients Requirements

Many coaches make dietary recommendations based on their own "feelings" and past experiences rather than on available evidence. This problem is compounded because athletes often have either inadequate or incorrect information concerning prudent dietary practices. Although research in the area of sport nutrition is far from complete, the general consensus is that physically active people do not require additional nutrients beyond those obtained in a balanced diet. This is important because a large number of adults exercise regularly to keep fit (Mcardle, katch,I and katch,L 1991).

2.4.2. Nutrients

Food is made up of many different things. Those things which are essential for the body to function well are called nutrients. Nutrients have different jobs, though they may work together or need the presence of others to work properly. The different types of nutrients are Protein, Carbohydrate, Fat, Vitamins, Minerals and Water (Thompson,1991).

2.4.2.1. Proteins

Proteins, from the Greek word meaning of “prime important” are found in all living matter and function primary in the growth and repair of body tissue. Proteins are similar to carbohydrates and lipids in that each molecule contains atoms of carbon, oxygen, and hydrogen. The major difference is that protein contains nitrogen, sulfur, phosphors, and iron (Mcardle, Katch,I. and Katch,L, 1991).

Protein is an essential part of the diet and plays many roles in the body. Protein’s roles are primarily structural, but it is also scarified by the body for energy during intensive exercise or when nutrition is inadequate. In these situations, to meet its metabolic needs, the body breaks down precious muscle tissues, which is a setback for an athlete who has been training hard to make gains. In addition, athletes need to eat just the right amount of protein to minimize the formation of metabolic waste products. When too much protein is consumed, the body converts the excess to fat and increase the blood levels of ammonia and nitric acid. Ammonia and uric acid are toxic metabolic waste products. The athlete’s goal therefore is to maintain proper protein intake (Burke and Gastelu , 1999).

According to Thompson (1991), until the age of about 18 the body makes new cell in order to grow. Also, throughout life, cells wear out and are replaced. Some types of cell only last a few weeks before being replaced. Others last much longer. All the material for new cells comes from food. Proteins are the main body building nutrient. As they are needed to build new body tissue during growth, and are also used to repair any damaged tissue, there is a constant need for a regular protein intake.

Eight amino acid cannot be synthesized by the body and therefore must be provided preformed in foods. These are called essential amino acid. However, the amino acids that can be manufactured in the body are formed as non-essential. This does not mean that they are unimportant, but simply that they can be synthesized from compounds ordinarily available in the body and a rate that meets the demands for normal growth. Furthermore, foods that contain all of the essential amino acids in the quality and correct ratio to maintain nitrogen balance and allow for tissue growth and repair such as eggs, milk, meat and fish are known as complete proteins, or high quality proteins. An incomplete protein, or lower quality protein, lacks one or more essential amino acid (Mcardle, Katch.I, and Katch.L, 1996).

As Thompson (1991) stated, proteins are made up of building blocks called amino acids. There are 21 types of amino acid which combine in different ways to make different proteins. Inside the digestive system proteins are broken down in to their amino acids. Of the 21 amino acids all but eight can be made inside the human body. The eight that must come from food are called essential amino acids. “Protein quality” relates to how many of the eight essential amino acids a food supplies. High quality proteins are generally animal proteins such as egg, milk, fish and meat. Lower quality protein is found in plants such as nuts, lentil and beans. For a person who does not eat meat or animal products a wide variety of plant protein must be eaten to obtain all the necessary amino acids for health. The athlete in training needs extra protein to create muscle tissue. There is also an increased need for extra calories in this situation and enough extra protein will usually be obtained simply by eating more food. If too much protein is eaten, any amount over what the body actually needs will be converted for use as an energy source or stored as body fat.

2.4.2.1.1 Protein and Energy

In addition to the functions of protein discussed above, protein the same as fat and carbohydrates can also be used for energy. Under conditions of both outright and training induced starvation, the body releases amino acids from muscle tissue for use as energy or in energy cycles. This catabolism (breakdown) of protein occurs during exercise especially during intensive workouts, in particular power exercises and prolonged endurance activities-or when the body runs out of carbohydrates from the diet or glycogen from its muscle and liver stores. Even though the body can depend on the fat that it has stored, it still uses muscle protein, unless it is fed protein as food. When dietary circumstances cause the body to use amino acids as a source of energy, it cannot also use these amino acids for building muscle tissue or for performing their other metabolic functions. This is why a proper protein intake is essential every hour of the day (Burke and Gastelu ,1999).

2.4.2.2 Fat

The same as carbohydrates, they are composed of carbon, hydrogen, and oxygen. Fat is a major nutrient and it has several functions. Oils and fats are concentrated sources of energy. Each gram of fat supplies nine (9) calories. So it play many essential functions in the body (Mudambi and Rajagopal, 2006). Their main functions are:-

- Besides providing energy, oils and fats have several functions in the body. Foods fats are a source of two groups of essential nutrients-essential fatty acids and fat soluble vitamins A, D, E and K. Food fats also aid the transport and absorption of fat-soluble vitamins.

- Cholesterol is an essential lipid synthesized in the liver. Some important hormones and bile acids are formed from cholesterol. Fat forms the fatty centre of cell walls, helping to carry nutrient materials across cell membranes.
- Fats are used to synthesis phospholipids sides, which are found in all cells
- Fat stored in various parts of the body is known as adipose tissue. The vital organs in the body are supported and protected by a web-like padding of this tissue. Fat act as a Cashion for certain vital organs. Nerve fibers are protected by the fat covering and it aids relay of nerve impulses.
- Since fat is a poor conductor of heat, a layer of fat beneath the skin helps to conserve body heat and regulate body temperature.

According to Thompson (1991), fats are a very concentrated source of energy, weight for weight, they provide twice as much energy as carbohydrates but fat is not as good on energy source as carbohydrate because it is digested very slowly and uses more oxygen to produce this energy. In addition, fat is stored under skin and inside the muscles. It is a reserve energy source and is essential to carry the fat soluble vitamins around the body. Diets that contain large amounts of fat can lead to obesity, heart diseases and cancer. A person need only a small amount of fat in the food they eat and drink to be healthy.

2.4.2.2.1 Physical exercise and lipid utilization

Physical exercise has a profound effect on the metabolism of lipid during exercise. Improvement in the aerobic production of ATP from lipids with aerobic training may aid in maintaining cellular integrity and a high level of function that would contribute to enhanced endurance independent of glycogen reserves (Mcardle, Katch,I and Katch,L, 1996).

2.4.2.3 Carbohydrates

Carbohydrates, as the name implies, are composed of carbon and water. The body gets the major part of its energy requirements from carbohydrates. They break down quickly and easily in the digestive system to form the basic fuel of glucose. The natural or complex carbohydrates enter the blood more slowly and insulin levels are steady. This increases the amount of energy available from the carbohydrate and reduces the amount stored as fat (Thompson, 1991).

According to Mcardle, Katch.I and Katch .L (1996),excessive carbohydrate in the diet is a main cause of tooth decay. The precise role, if any, that excessive dietary sugar plays in disease such as diabetes, obesity, and coronary heart diseases has been not established.

2.4.2.3.1. Role of Carbohydrate in the Body

As MCardle, Katch, and Katch, (1996) stated that, carbohydrates serve four important functions related to energy metabolism and exercise performances which are energy source, protein sparing, metabolic primer and fuel for the central nervous systems.

1. Energy source

The main function of carbohydrates is to serve as an energy fuel, particularly during exercise the energy derived from the breakdown of blood born glucose and liver and muscle glycogen is ultimately used to power the contractile elements of muscles as well as other forms of biologic work. Daily carbohydrate intake must be adequate to maintain the body's relatively limited glycogen stores. On the other hand, once the capacity of the cell for glycogen storage is reached, excess sugars are converted to and stored as lipid. This action helps to explain how the body's fat content can increase when excess carbohydrates are consumed, even if the diet is low in lipid.

2. Protein sparing

Adequate carbohydrate intake helps o preserve tissue proteins. Normally, protein serves a vital role in tissue maintains, repair, and growth and to a considerably lesser degree, as a nutrient source of energy. Glycogen reserves, however, can readily calorie and /or carbohydrate content and through strenuous exercise. The effect of reduced energy intake (40-hour fast) and total food deprivation (7-day starvation) on levels of plasma glucose and lipid breakdown components takes place. After almost 2 days of fasting, blood glucose becomes reduced by 35% but does not decrease to a lower level during a further prolonged abstinence from food. At the same time, circulating fatty acid and ketones (byproducts of incomplete lipid breakdown) levels increase rapidly, with plasma ketenes rising dramatically after 7 days of starvation.

When glycogen reserves are reduced and plasma glucose level falls, metabolic pathways exist for the synthesis of glucose from both protein and the glycerol portion of the lipid molecule. This process of gluconeogensis provides a metabolic option for augmenting carbohydrate availability (and maintaining plasma glucose levels) in the face of depleted glycogen stores, as occurs in dietary restriction or prolonged exercise. The price paid, however, is a temporary reduction in the body's protein "stores" particularly muscle protein. In extreme conditions, this causes a significant reduction in the lean tissue mass and an accompanying solute load on the kidneys, which must increase their workload to excrete the nitrogen-containing byproducts of protein breakdown.

3. Metabolic Primer

Carbohydrates serve as a “primer” for lipid metabolism. Certain products from carbohydrate breakdown must be available to facilitate the metabolism of lipid. If carbohydrate metabolism is insufficient-either through limitation in the transport of glucose into the cell, as occurs in diabetes or through depletion of glycogen through improper diet or prolonged exercise-the body will mobilize a greater amount of lipid than it can metabolize. The result is incomplete lipid breakdown and the accumulation of acetone-like byproducts (chiefly acetoacetate and hydroxybutyrate) called ketone bodies.” This situation may lead to a harm full increase in the acidity of body fluids, a condition called acidosis or more specially with regard to lipid breakdown, ketosis.

4. Fuel for the Central Nervous System

Carbohydrate is essential for the proper functioning of the central nervous system. Under normal conditions and in short-term starvation, the brain uses blood glucose almost exclusively as it’s full and essentially has no stored supply of this nutrient. In poorly regulated diabetes however, or during starvation or with a low carbohydrate intake, metabolic adaptations occur so that after about 8 days the brain uses relatively large amounts of lipid in the form of acetoacetate for its fuel requirement. There is even indication that adaptations take place in skeleton muscle that increases its ability to burn lipids for energy during exercise and concurrently spare muscle glycogen.”

At rest and during exercise, liver glycogenolysis is the primary means for maintaining normal blood glucose levels. With the depletion of liver glycogen and a continued large use of blood glucose by active muscle, blood glucose eventually falls below normal levels. The symptoms of a modest reduction in blood glucose (hypoglycemia) include feelings of weakness, hunger, and dizziness. The condition impairs exercise performance and may partially explain the “central” fatigue associated with prolonged exercise. Sustained and profound low blood sugar can cause loss of consciousness and irreversible brain damage. Because of the important role of glucose in nerve tissue metabolism, blood sugar is usually regulated within narrow limits.

2.4.2.3.2 Carbohydrate balance in Exercise

According to Mcardle , Katch. I and Katch. L (1996), the fuel mixture in exercise depends on the intensity and duration of effort, as well as the fitness and nutritional status of the exercise.

1. Intense Exercise

With strenuous exercise, neural-humeral factors increase the hormonal output of epinephrine, nor epinephrine, and glucagon, and decrease insulin release. These actions have a stimulating effect on the enzyme glycogen phosphorylase that facilitates glycogenolysis in the liver and active muscle. Because of its ability to provide energy without oxygen, stored muscle glycogen is the prime contributor of energy in the early minutes of exercise when oxygen utilization does not meet the metabolic demands. As exercise progresses, blood-borne glucose increases its contribution as a metabolic fuel. Blood glucose, for example, may supply 30% of the total energy required by vigorously active muscles, with the remaining majority of carbohydrate energy supplied by muscle glycogen. An hour of high-intensity exercise can decrease liver glycogen by about 55%; a 2-hour strenuous workout can just about deplete the glycogen in the liver and specifically exercised muscles. The uptake of circulating blood glucose by the 40th minute of exercise, glucose uptake has risen to between 7 and 20 times the uptake at rest, depending on the exercise intensity.

The increased contribution of carbohydrate in intense anaerobic exercise occurs because it is only macronutrient to provide energy rapidly when the oxygen supply and/or utilization do not meet a muscle's oxygen needs. During heavy, fatiguing aerobic exercise, the advantage of a selective dependence on carbohydrate metabolism lies in its rapidity for energy transfer compared to lipids (about twice as fast) and proteins. Also, the energy generated per unit oxygen consumed is about 6% greater for carbohydrate hand for lipid.

2. Moderate and Prolonged Exercise

Almost all the energy in the transition from rest to sub maximal exercise is supplied from glycogen stored in the active muscles, as well as the case in intense exercise. During the next 20 minutes or so, liver and muscle glycogen supply between 40 and 50% of the energy requirement, with the remainder provided by lipid breakdown, including a small utilization of protein. This nutrient energy mixture depends on the relative intensity of exercise. If the exercise is light to moderate, the main energy substrate throughout exercise is lipid. As exercise continues and glycogen stores become reduced, blood glucose becomes the major source of carbohydrate energy, and an increasingly greater percentage of the total energy is supplied through lipid breakdown. Eventually glucose output by the liver fails to keep pace with its use by muscle and plasma glucose concentration decrease. The level of circulating blood glucose may actually falls to hypoglycemic levels (less than 45 mg glucose per 100 ml blood) during 90 minutes of strenuous exercise.

During prolonged exercise in both the glycogen-depleted and the glycogen-loaded state, as sub maximal exercises in the glycogen-depleted state, blood glucose levels fall and the level of circulating lipid increases dramatically compared to exercise in the glycogen-loaded state. Concurrently, there is an increased contribution of protein to the energy pool. Under such conditions of carbohydrate depletion, work capacity (expressed as a percentage of maximum) progressively decreases so that at 2 hours, only about 50% of maximum capacity can be sustained due to the relatively slow rate of aerobic energy release from lipid breakdown.

Fatigue occurs if exercise continues to the point where liver and muscle glycogen become severely lowered, even though sufficient oxygen is available to the muscles and the potential energy from stored lipid is almost unlimited. Endurance athletes commonly refer to this sensation of fatigue as “bonking” or “hitting the wall.” Because of the absence in muscle of the phosphates enzyme that would allow for glucose exchange between muscles, the relatively inactive muscles maintain their full glycogen content. It is unclear in prolonged exercise why the depletion of muscle glycogen coincides with the functions of blood glucose as energy for the central nervous system and muscle glycogen as a “primer” in lipid metabolism. In addition, there is a slower rate of energy release from lipid compared to carbohydrate breakdown.

3. Effect of Diet on Muscle Glycogen Stores and Endurance

Ingested carbohydrate is a readily available energy nutrient for active muscles. Deist composition, however, can profoundly affect glycogen reserves. Endurance capacity during cycling exercise varied considerably depending on the diet each person consumed during the 3 days prior to the exercise test. With the normal diet, exercise could be tolerated for an average of 114 minutes, whereas endurance averaged only 57 minutes with the high-fat diet. The endurance capacity of subjects who were fed the high-carbohydrate diet was more than three times greater than when the same subjects consumed the high-fat diet. In all instances, the point of fatigue was associated with the same low level of muscle glycogen. These results clearly demonstrate the importance of muscle glycogen for high intensity exercise lasting more than an hour. Such data also emphasize the important role nutrition can have in establishing the appropriate energy reserves for both long-term exercise and strenuous training.

A diet deficient in carbohydrates rapidly depletes muscle and liver glycogen and subsequently affects performance in intense short-term exercise as well as in prolonged sub-maximal endurance activities. These observations are important for athletes and physically active individuals who have modified their diet by reducing the recommended percentage of carbohydrate intake.

2.4.3 Planning the Training Program

One of the most important responsibilities of the coach is planning the athlete's training program. Planning is a long term process since elite athletes may not reach their full performance until 24 years of age or older .In this long term planning the coach usually looks at what the athlete wants to achieve for a particular year and divides this year in to a number of periods. For younger, inexperienced athletes performance targets may need to occur at more frequent intervals such as the immediate season a head. This is because young athletes are often unable to work toward objectives that athletes think of as being too distant (Thompson, 1991).

2.4.4 Nutrition and Endurance athletes

As to Burke (1998), distance runners compete over a variety of race lengths most commonly, 10km, 15km, half marathon (21.1km), and the marathon (42.195km). To be successful in their respective events, endurance athletes require muscular endurance and cardiovascular endurance. Endurance is one of the basic components of physical fitness. As a result, most athletes have to possess some degree of muscular and cardio respiratory endurance to perform in their respective sports.

Obviously, endurance is important to almost all athletes, even those involved in sport requiring, short intermittent bursts of intense anaerobic activity that are repeated over the course of an hour or more (Karlson and Saltin, 1971).

For the purpose of this study endurance athletes are those who are engaged in continuous activity lasting between 30 minutes to 4 hours. Because of the duration and continuous nature of their sports, endurance athletes expend a tremendous number of calories not only during competition, but also in their preparatory training. This puts a tremendous demand on energy reserves that must be replenished after daily training about, making diet a key factor not only athletic success, but also for overall health. Therefore, it is critical for endurance athletes to consume sufficient calories on a daily basis to supply the energy for daily training, to ensure the delivery of nutrients needed for complete recovery from work outs, and stay health and injury free.

Failure to maintain adequate dietary intake of nutrients can quickly result in chronic fatigue dehydration, increased risk for illness and injuries, as well as muscle wasting (Burke, 1998).

Furthermore, Burke and Gastelu (1999) revealed that one of the main concerns for endurance athletes is matching energy consumption with energy expenditure. Long distance strenuous exercise require a large number of calories. Elite athletes can potentially burn more than two to three times the number of calories as their untrained. If these calories are not replaced daily, energy for training and the ability to perform during training will decline.

2.5. The Energy Balance

A person should eat and drink the number of calories to supply the energy their body requires. The average person has basic energy requirements to maintain the body through normal daily activities like sleeping and breathing. The athlete has these basic energy requirements plus the energy needed to train and compete. A typical growing adolescent needs 2500 calories of energy per day for basic energy requirements whereas athletes need more energy than sedentary individuals. The performance of an athlete who does not take in sufficient calories will be reduced. When the calories supply is constantly low the athlete will lose weight as he/she uses up the energy stored in the body. A person who takes too many calories will store any amount more than the body requires as fatty tissues. This non-essential fat will reduce performance (Thompson, 1991)

Furthermore, Whitney and Rady (2008) revealed that, to achieve energy balance, the body must meet its needs without taking in too much or too title energy. Somehow the body decides how much and how often to eat when to start eating and when to stop. People expend energy continuously and eat periodically to refuel. Ideally, their energy intakes cover their energy expenditure without too much excess. Excess energy is stored as fat, and stored fat is used for energy between meals. The amount of body fat a person deposits in, or with draw from, “storage” on any given day depends on the energy balance for that body the amount consumed (energy in) versus the amount expended (energy out). When a person is maintaining weight, energy in equals energy out whereas when the balance shifts, weight changes.

2.5.1 Energy Intake and Expenditure

According to Whitney and Rady(2008),the energy released from carbohydrates, fats, and proteins can be measured in calories which is tiny units of energy so small that a single apple provides tens of thousands of them. To ease calculation energy is expressed in 1000-caloric metric units known as kilocalories (shortened to kcalories , but commonly called calories). When it is read in popular books or magazines that an apple provides 100 calories, it actually means 100kcalories.

The energy the body gets from food is measured in calories. Different foods provide different amounts of energy, and so have different values in calories. The amount of calories a person needs depends on how big and active they are and how efficiently their body uses foods. Some people eat a lot and never get fat. They use up food for energy more quickly than those who put on weight easily. The rate at which a person converts food to energy is known as the metabolic rate .People have different metabolic rates, but every one’s metabolic rate can increase during exercise. The amount of calories a person needs also depends on his/her age. Athletes probably need more basic energy between the ages of 12 and 17 than at any other time in their life. Growing uses up a lot of energy and young athletes will find it hard to train and complete if their diet lacks energy (Thompson ,1991).

2.5.2. Exercise and food intake

As Mcardle, Katch. I and Katch. L (1996) stated, for individuals who engage regularly in moderate to intense physical activity, it is relatively easy to match food intake with the daily level of energy expenditure. Distance runners who train upwards of 100miles per week (6 minutes per mile at approximately 15 kcal per minute) probably do not expend more than 800 to 1300”Extra” calories each day above their normal energy requirement. For these endurance athletes, the daily food intake should supply approximately 4000kcal to balance the increased energy expenditure. For men, the daily energy intake ranged between 2900 and 5900kcal, whereas the intake of female athlete ranged between 1600 and 3200kcal. With the exception of the high energy intake of athletes of extremes of performance and training, daily caloric intake generally did not exceed 4000kcal for the men and 3000kcal for the women.

2.5.3 Energy intake recommendation

Recommendation to meet high – energy demands in sports depends on many factors, namely the sport itself and the changes in volume and intensity throughout training and competition. Simple strategies to meet high – energy demands during intense training are summarized as follow:

Area of focus	Strategies
Frequency of eating	– Athletes should be advised to eat three to four meals and two to three snacks per day. Snacks are predominately consumed before, during, and after exercise, between meals, and after dinner.
Meal size	– Athletes should add calories to meal, which can be accomplished by adding fruit juice, sport drink, or milk as energy – containing fluids, by including an appetizer
Fueling before, during, and after exercise	- Athletes should skilled in selecting food and fluids before, during, and after exercise to (1) optimize performance during and maximize recovery after exercise and (2) to meet the energy

demands of intense training/competition and environmental extremes. Most athletes consume a significant amount of calories during the actual training or competition period.

Illness – Athletes should use strategies to meet energy demands when ill or injured (increase or decrease energy intake).

Indeed, Driskell and Wolinsky (2002), explained about proportion of caloric consumption as follows: of the total calories consumed, the recommended balance for most athletes:

- Carbohydrate 55%- 60%
- Fat 15% - 30%
- Protein 10% - 15%

2.5.4. Energy intake measurement

As Mudambi and Rajagopal (2006) pointed out, the main source of energy for all the body activities is food, along with the energy store in body tissues as reserve. Human body needs fuel to carry out its work on a continual basis. This need starts at birth and continues as long as one lives. Furthermore, energy is the primary need of the body and takes precedence over all other needs. The metabolic products formed by digestion of carbohydrate, fats and protein which are simple sugars, glycerol and fatty acid, and amino acid; provide most of the energy need of the body. Food energy intake can be calculated by keeping on accurate record of a day’s actual food consumption. The energy values of foods eaten can be calculated by referring to food consumption table standard to know the caloric value of a meal which can be done by identifying the composition and weight of a food and then determining at water factors.

Food composition in Ethiopian context

In Ethiopia there is no adequate texts on the standards of all food composition therefore, the food composition table for use in Ethiopia part III (1997) and IV(1998) which were prepared by Ethiopia health and nutrition research institute and food and agriculture organization of the united nation were used as standard. The summery of some food composition was depicted in the following table.

Table 2.1.Composition of food commonly used in Ethiopia

Food item	Composition in terms of 100 gram		
	Protein in gram	Fat in gram	Carbohydrate in gram
Porridge	3.3	4.7	21.3
Bread	6.8	0.8	46.9
Tea	5.6	1.7	20.5
Pasta	12.3	1.5	71.8
Rice	2.1	0.1	24.5
Beef (Siga wet yebere)	30.1	5.4	2.1
Egg	11.6	10.9	2.1
Injera	4.9	1	36.3
Mutton (Siga wet yebeg)	24	6.1	0.4
Potato	1.1	0.1	21.1
Peas (Ater wet)	2.8	5.8	9.3
Butter	1.3	81.2	0.1
Oil		99.6	00
Garlic (Nech shenkurt)	4.1	0.3	29.8
Shallot (Keyi shenkurt)	1.06	0.1	16
Pepper (Berbere)	2	2.5	15.7
Tomato	1	0.1	3.9
Leek(Baro shenkurt)	1.2	0.6	12.1
Source: Food composition table for use in Ethiopia part III and IV (1997 and 1998)			

Remind that one from of carbohydrate and one from of protein contain 4kcal whereas one gram of fat contains 9kcal (Whitney and Rady, 2008).

1g carbohydrate = 4kcal

1g protein = 4kcal

1g fat = 9kcal

2.5.5 Factors that affect energy expenditure

Important factors that affect a person's total daily energy expenditure include physical activity, dietary induced thermogenesis, and climate (Mcardle, Katch.I and Katch.L 1996)

2.5.5.1 Physical activity

Physical activity has by far the most profound effect on human energy expenditure. Under normal circumstances, physical activity accounts for between 15 and 30% of a person's total daily energy expenditure.

2.5.5.2 Dietary Induced Thermo genesis

For most people, the ingestion of food stimulates energy metabolism. This dietary-induced thermogenesis consists of two components. One component, called obligatory thermo genesis (formerly called specific dynamic action, or SDA), is a result of the energy-requiring processes of digesting, absorbing, and assimilating food nutrients. The second component is called facultative thermogenesis. This increase in metabolism with food ingestion related to the activation of the sympathetic nervous system and its stimulating effect on metabolism.

In general, the thermic effect of food reaches a maximum within one hour after a meal. While considerable variability exists between individuals, the magnitude of dietary induced thermo genesis can vary between 10 and 35% of the ingested food energy in normal individuals depending on both the quantity and type of food eaten. A meal of pure protein, for example, elicits a thermic effect that is nearly 25% of the meal's total calories. The large thremic effect is due mainly to digestive processes as well as the extra energy required by the liver to assimilate and synthesize protein or dominate certain amino acids and convert them to glucose.

The calorigenic effect of protein ingestion has been used by some people to advocate a high protein diet for weight reduction. They maintain that because of protein's relatively high thremic effect, fewer calories are ultimately available to the body compared to a meal of similar caloric value but consisting mainly of lipid or carbohydrate. Although this point has some validity, many other factors must be considered in formulating a sound program for weight loss; not least of these the potentially harmful strain on kidney and liver functions that could result from excessive protein intake.

The important point is that or a physically active person, dietary-induced thermogenesis represents only a small portion of the total daily energy expenditure compared to the energy expended through regular physical activity.

2.5.5.3 Climate

Environmental factors can influence resting metabolic rate. For example, the resting metabolisms of people living in tropical climates are generally 5 to 20% higher than those of their counterparts living in more temperate areas. Exercise performed in the head also imposes a small additional metabolic load, causing an oxygen uptake increase of about 5% compared to the same work performed in a thermoneura environment. This is probably a result of the thermogenic effect an elevated core temperature as well as the additional energy required for sweat-gland activity and altered circulatory dynamics during work in the heat.

Cold environments can have a significant effect on energy metabolism both at rest and during exercise, the extent of which depends largely on a person's body fat content and the effectiveness of clothing worn. During extreme cold stress at rest, metabolic rate can double or triple as shivering commences and the body generates heat in an attempt to maintain a stable core temperature. The effects of cold stress during exercise are most evident in cold water because it is quite difficult to maintain a stable core temperature in such an environment

2.5.6 Components of Energy Expenditure

Driskell and Wolinsky (2011) stated that, the total daily energy expenditure can be estimated by the total sum of energy daily need for.

1. Basal metabolic processes, which are involuntary. The basal energy expenditure is the minimal amount of energy necessary to sustain life. The energy needed to keep the heart beating, respiration going, and maintain cell metabolism, nerve transmission, body temperature, and so forth. The basal metabolic rate requires that the person have no additional physical logic or psychological stimulation such as digestion, excess temperature regulation, psychological tension, or any physical activities or movement. So it is the energy expenditure required to maintain normal body function at rest.
2. Muscular (physical) activity, which is voluntary. It is the total energy expend during a daily physical activity or training so during physical activity the muscle need extra energy to move, the heart and lung need extra energy to deliver nutrients and oxygen and dispose of waste.

2.5.7. Estimating Energy Requirements

In estimating energy requirements the DRI committees developed questions that consider how the following factors influence energy expenditure

- Gender: in general, women have a lower BMR than men in large part because men typically have lean body mass.
- Growth: the BMR is high in people who are growing.
- Age: the BMR declines during adulthood as lean body mass diminishes. This change in body composition occurs in part because some harmony that influence appétit. Body weight and metabolism become more, or less active with age. Physical activities tend to decline as well. The decline in the BMR that occurs when a person becomes less active reflects the loss of lean body mass and may be minimized with ongoing physical activities. Because age influence energy expenditure. It is also factored in to the energy equations.

2.5.8. Energy expenditure measurement

According to Burke (1998), energy expenditure of an athlete can be calculated as follows and also used as reference for this study.

1. Step one: find the basal metabolic rate (BMR) of an athlete, which is calculated by using body weight, sex and age of an athlete.

Table 2.2 Basal Metabolic Rate for reference

Sex	Body weight	Daily energy(kilojoules/day)			
		10-18 yrs	18-30 yrs	30-60 yrs	>60 yrs
Men	55 kg	6824	6360	6295	5155
	60 kg	7195	6675	6535	5400
	65 kg	7565	6990	6775	5645
	70 kg	7935	7305	7015	5890
	75 kg	8305	7620	7255	6135
	80 kg	8675	7935	7495	6380
	85 kg	9045	8250	7735	6625
	90 kg	9415	8565	7975	6870
Women	40 kg	5140	4515	4900	4275
	45 kg	5420	4825	5070	4465
	50 kg	5700	5135	5240	4845
	55 kg	5980	5445	5410	5035
	60 kg	6260	5755	5580	5225
	65 kg	6540	6065	5750	5415
	70 kg	6820	6375	5920	5605
	75 kg	7100	6685	6090	5795
Source: Burke(1998),The complete South Africa Guide to Sport Nutrition					

2. Step two: activity level factor which is the average activity levels expressed as multiple of basal metabolic rate (non-exercise activity level).

Table 2.3. Average activity levels expressed as multiple of BMR

Activity level	Males	Females
Bead rest	1.2	1.2
Very sedentary	1.3	1.3
Bed rest and light walking	1.45	1.4
Light	1.5	1.5
Light moderate	1.7	1.6
Moderate	1.8	1.7
Heavy	2.1	1.8
Very heavy	2.3	2
Source: Burke(1998),The complete South Africa Guide to Sport Nutrition		

3. Step three: multiplying basal metabolic rate by the activity level factor
4. Step four: estimating the energy cost of training competition multiplying the frequency of exercise per week with duration of the activity and multiplying the calculated result (frequency with duration) with estimated energy cost of activity (Kg/minute) of special task or exercise. Then divide the weekly total calculated result by 7 to get a daily average.

Table 2.4. Estimated energy cost of activity (Kilojoules/minute)

Activity	Body weight				
	50 kg	60 kg	70 kg	80 kg	90 kg
Aerobic beginners	22	26	30	34	39
Aerobic advanced	28	33	40	45	51
Badminton	20	24	28	33	37
Ballroom dancing	11	13	15	17	19
Basketball	29	35	40	46	52
Boxing sparring	46	56	65	74	84
Boxing sparring in ring	29	35	40	46	52
Canoeing leisure	9	11	13	15	17
Racing	22	26	30	34	39
Circuit training	22	26	30	35	40
Cricket batting	17	21	24	28	32
Bowling	19	22	26	30	34
Cycling 9km/hr	13	16	18	21	24
Cycling 15km/hr	21	24	28	33	38
Racing	35	42	49	56	63
Football	28	33	39	44	50
Golf	18	21	25	28	32
Gymnastics	14	16	19	22	25
Hockey	18	20	24	29	33
Judo	41	49	57	65	73
Running 5.5 min per km	40	49	57	65	73
Running 5 min per km	44	52	61	70	78
Running 4.5 min per km	48	55	65	75	83
Running 4 min per km	54	65	76	87	98
Source: Burke(1998),The complete South Africa Guide to Sport Nutrition					

5. Step five: add step three result on step four
6. Step six: converting kilojoules per day in to kilocalorie by diving to 4.2

2.5.9. Effects of insufficient energy supply

Insufficiency of energy supply in occurs due to missed meals, poor schedules, neglect or poor health practices .The effects of insufficient energy supply vary with the age group affected and the extent of insufficiency. In adults, it may affect their capacity for work; in children it affects their growth and activity. Through this process body tissues are wasted in order to meet the physical demand of an individual (Mudambi and Rajagopal 2006).

CHAPTER THREE

3. Research methodology

3.1. Research design

As the main objective of this study is to assess the current nutritional status and predict the future performance of athletes descriptive survey method was used. This is because the survey design provides a quantitative or numeric description of trend or opinions of a population by studying a sample of that population (Cress well, 2009).

3.2. Research setting

The study was conducted on one club which is defense athletic club found at Addis Ababa. It was established in 1936 E.C and has been strongly contributing for Ethiopian Athletics .The club is operating with 165 total athletes of which 60 are distance runners. Beside, these three coaches were included in the study.

3.3. Sample size and sampling techniques

Distance runners are purposely selected for this study because of the duration and continue nature of their sport that they expend a tremendous number of calories not only during competition, but also in their preparatory training. As mentioned above, endurance athletes are 60 in number of which 44 are male & 16 are female athletes which still divided in to 36 long distance runner and 24 middle distance events. After these athletes had been stratified in to sex and their specific events, 50% were selected by simple random sampling method from each stratum and 3 head coaches were also purposively taken.

3.4. Source of data & data gathering tools

The data were obtained from both primary and secondary sources. The combination of primary and secondary information gathered from different sources have clear picture of about the study on the assessments of nutritional status athletes. Hence the tools used were questionnaire, direct measurement, interviews and observation.

3.4.1. Questionnaire

A set of questionnaires' were prepared to gather information regarding the back ground information, athlete's knowledge and attitude to sport nutrition. The questionnaire continued both open ended and close ended questions Amharic version was used in order to clarify ideas in the question and gather pertinent data.

3.4.2. Interviews

The researchers used unsturctuered interview to gather information from coach on training load and athletes' dietary intake or balancing of caloric intake & expenditure. This is because this approach to data collection is extremely useful in situations where either in depth information is needed or little is known about the area (Kumar, 1996). In this regard, the researcher carried out face-to-face interview in Amharic with coacher.

3.4.3. Observation

Observation is one way to collect primary data. As to Kumar (1996), there are many situations in which observation is the most appropriate method of data collection, for example when the researcher want to learn about the interaction in a group, study dietary patterns of a population & ascertain the functions performed by worker (Kumar, 1996).Hence, the researcher used participatory observation for ten meals to see the amount served and composition roughly. Beside their non-participatory observation was used to see the training session (Macro cycle) and the appropriateness of feeding center.

3.4.4. Direct measurements

3.4.4.1. Body mass of athletes

Aim= to measure body weight and to compare the caloric expenditure.

Equipment- an electronic balance scale

Techniques: - the subject is dressed down to only underwear. The subject stands on the center of the scale with out support and with the weight distributed evenly on both feet. The head is up; arms at the sides of and the eyes look direct a head the measurement is to the nearest 0.1kg (Norton et.al, 1996).

3.4.4.2. Measurement of caloric intake & expenditure

I. Caloric intake

Energy intake should support the variability of the athlete's annual training and completion plan to bring dedicated months and years of training to fruition with expected performance outcome. Hence it should be balanced with caloric expenditure (Driskell & wolinsky, 2011)

Hence, the researcher used to measure each item of the food in each meal for five consecutive days by using new born body scale (0.1-5kg)

While measuring each identifiable item in the meal was put in to the very soft plastic bag where as unidentifiable item such as oils, butter and spices were measured as a whole and divided to the whole athletes, the measurement is to the nearest o.1 gram.

In this regard the caloric content (carbohydarate fat and protein) of each food time is calculated by using the food composition table for use I Ethiopia (part III. 1997, part IV (1998). Then the composition of energy yielding foods was converted in to grams and seen with the standard of EVHRI (part IV&IV) in order to find out the total grams of each food yielding nutrients. Then the caloric content of each macro-nutrient is calculated by multiplying by 4 for carbohydrate, & protein and by 9 for fat.

In doing so, the estimated caloric content of each meal per day is calculated for five consecutive days and finally the average per day caloric intake is driven.

II. Caloric expenditure

The researcher used the steps in the complete South African guide to sports Nutrition (Burke, 1998) to calculate caloric expenditure. This is because though, this approach does not consider height in BMR calculation, it inculcate regular physical activities and sport training per week in reference with frequency, duration and intensity of exercise in detail with BMR.

Hence, the steps are:-

1. BMR based in Age, Sex, & body weight
2. Activity level factor(non- Exercise Activity level)
3. Step 1 x step2.

4. a. Exercise per week

   Frequency x Duration x energy cost kJ/minute

   b/ Exercise per day= <u>step 4a</u>

5. Total daily energy expenditure

Step 3 + step 4b

Finally, the sum in KJ is divided by 4.2 to gat kilo Calorie (Kcal).

3.5. Data analysis

After the collection of the data through questionnaires, observation with checklists, interviews & direct measurements the data was analyzed using tabulation and percentage. In addition to this the caloric energy balance was made to compare caloric intake & expenditure.

CHAPTER FOUR

4. Data presentation and analysis

Under this chapter the data collected through different data collection tools were analysed and interpreted.

Table 4.1. Back Ground information

No	Items		Respondents	
			No	%
1	Age	10-18 yrs		
		18-30 yr	30	100
		> 30 yrs		
		Total	30	100
2	Sex	Male	22	73.
		Female	8	26.7
		Total	30	100
3	Types of Athletics event	Middle distance	12	40
		Long distance	18	60
		Total	30	100
4	How long have you stayed in the club?	1 yr		
		2 yrs	5	27
		3 yrs	15	50
		4 yrs	6	20
		> 4 yrs	4	13
		Total	30	100

As it is shown in the above table item 1, the age composition of the sample athletes, 30 (100%) are found to be in the age range of 18yrs-30yrs. This indicates that, except a few the majority are senior athletes. Besides this all athletes were categorized under the same age category of Burke (1998), basal metabolic rate composition. Regarding the sex distribution, in item 2, the vast majority 22(73.3%) of the respondents are male where as the remaining 8(26.7%) are female athletes. This indicates that the distance events are dominated by male.

As far as the table is concerned, 18(60%) are long distance runners and the remaining 12(40%) are middle distance athletes. Item 4 in the same table, reveals the experience of athlete in the club. Hence, 25(83%) of the athletes are with the experience of three and above years in the club. This shows that the majority of the respondents are well experienced that the information they provided is believed to be reliable.

Table 4.2. Training and feeding habits of athletes

No	Items		Respondents	
			No	%
1	How many days do you engage in training per week?	3 days		
		4 days	11	36.67
		5 days	7	23.33
		6 days	12	40
		Total	30	100
2	How long do you train per day?	1hr		
		1.30 hrs	8	26.67
		2 hrs	16	53.33
		2.30 hrs	6	20
		Total	3o	100
3	If you are long distance runner, what is your daily training intensity?	17 Km/hr	3	10
		18 Km/hr	3	10
		19Km/hr	8	26.67
		20Km/hr	4	13.33
		21Km/hr		
		Total	18	60
4	If you are middle distance runner, what is your training intensity?	20 Km/hr	1	8.33
		21 Km/hr	3	25
		22Km/hr	5	41.67
		23Km/hr	1	8.33
		24Km/hr	1	8.33
		25Km/hr	1	8.33
		Total	12	100
5	The extent to which you make effort to cover the training load?	High	30	100
		Medium		
		low		
		Total	30	100
6	What do you usually do after training?	Bead rest		
		Walking		
		Bed rest and waking	30	100
		Moderate exercise		
		Total	30	100

As item 1 in table 4.2 depicts, 12(40%) of athletes engaged six days in training per week, 11(36.67%) engaged for four days per week, and the rest 7(23.33%) of athletes engaged five days per week. This indicates that majority of them are intensively on training. With respect to item 2 in the same table, the vast majority 22 (73.33%) trains for 2 and above hours in a session as most of them are long distance runners. Beside this in item 3 and 4, it is indicated that long distance runners are engaging in training with the intensity of 17km/hr to 21km/hr and middle distance runners are engaging with the intensity of 20km/hr to 25km/hr respectively.

Regarding to item 5, 30(100%) of the athletes responded that they are making high effort to cover the training load they are given. This shows that they exert maximum energy to cover the intensity.

Athletes were also asked about what they do after their training in item of the same table. Accordingly, 30 (100%) of them responded that they take bed rest and then walk with in the time after training. This indicates that they are expending energy for high activities outside training.

Furthermore, this was raised in the interview conducted with a coach and the coach stated that, as athletes are different in their experience or training level and in terms of the events they engage, most middle distance athletes engage for one half hours and other long distance athlete engage for more than two hours.

Table 4.3. Feeding or diary habits of athlete

No	Item		Respondents	
			No	%
1	The extent of your knowledge on the relation of the training and dietary intake?	High	22	73.3
		Medium	8	26.7
		Low		
		Total	30	100
2	Does your coach trains about dietary intake?	Yes	28	93.33
		No	2	6.67
		Total	30	100
3	Do you have fasting day?	Yes		
		No	30	100
		Total	30	100
4	How many meals do you have per day?	3 meals	30	100
		5 meals		
		6 meals		
		Total	30	100
5	Which nutrient is dominates in your meal?	Carbohydrate	28	93.3
		Protein	2	6.7
		Fat		
		Total	30	100
6	Do you have additional food outside the camp?	Yes	30	100
		No		
		Total	30	100
7	If yes, how often?	Always		
		Sometimes	30	100
		Total	30	100

Item 1 in the table reveals athlete knowledge of nutrition in accordance with their training load. In this regard, 22(73.33%) of the athlete responded that they have knowledge of dietary intake whereas the remaining 8 (26.75%) have responded that their knowledge is medium. Concerning item 2, the vast majority 28 (93.3%) have pointed out that their coach teaches about dietary intake. This indicates that they do have known how and their coach values the dietary intake. This also was explained by each coach in the interview as they follow up the athlete nutrition.

When item 3 in the same table above is viewed, 30(100%) of the athlete s realized that they do not have fasting day. This implies that athletes are well concerned about the science of sport nutrition that stands the jumping or skipping of meals because of many reasons that hinder athletics performance. As far as item 4 is concerned, it was revealed by all athletes as they have 3 meals per day. This was also proved true in researcher's observation.

In item 5 it was revealed by the vast majority [93.3%] of respondents that the amount of carbohydrate in a meal is higher than other energy yielding nutrients. In this regard, it is recommended to increase athletes intake of carbohydrates about 60 % or by some researchers up to 70% of the total calories to prevent gradual depletion of glycogen stores with successive days of training (Mcardle, Katch.I & Katch.L,1999).

Regarding items 6 &7 in the same table above, all athletes responded that they use additional food outside the three meals of the camp though the intake was not continuous. From this, one can understand that athletes are taking additional energy to some amount though the researcher was not able to measure the amount because of its inconsistency.

In general, all the aforementioned quantitative and qualitative analysis and interpretations of the data are used as input and supportive in the computation of the daily caloric intake and expenditure of individual athletes and the proportion of carbohydrates, fats and proteins in the daily intake.

Table 4.4. Daily diet record for five days

Day	Daily meal	Types of food	Amount in gram	Energy content in calories (kcl)			
				protein	Fat	Carbohydrate	Total
Monday	Breakfast	Porridge	400	52.8	169.2	340.3	562.8
		Bread	200	54.4	14.4	375	444
		Tea	200	44.4	30.6	164	239.4
		Total	**800**	**152**	**214.2**	**880**	**1246.2**
	Launch	Past boiled	400	196.8	54	1148.8	1399.6
		Potato boiled	400	17.6	3.6	337.6	358.8
		Bread	200	54.4	14.4	375.2	444
		Total	**1000**	**268.8**	**72**	**1861.6**	**2202.4**
	Dinner	Rice	400	33.6	3.6	406.4	443.6
		Beef boiled (Yebre Wet)	200	240.8	97.2	16.8	354.8
		Bread	200	54.4	14.4	375.2	444
		Total	**800**	**328.8**	**115.2**	**795.4**	**1242.4**
	Overall daily total		**2600**	**749.6**	**401.4**	**3540**	**4691**
Tuesday	Breakfast	Egg	200	92.8	196.2	16.8	305.8
		Bread	200	54.4	14.4	375.2	444
		Potato	200	44.8	30.6	164	293.4
		Total	**600**	**192**	**241.2**	**556**	**989**
	Launch	Past	400	196.8	54	1148.8	1399.6
		Bread	200	54.4	14.4	375.2	444
		Potato	400	17.6	3.6	337.6	358.8
		Total	**100**	**268.8**	**72**	**1861.6**	**2202.4**
	Dinner	Injera	400	78.4	36	580	694.4
		Mutton boiled (Yebeg wet)	600	576	329.4	9.6	915
		Total	**1000**	**654.4**	**365.4**	**589.6**	**1610.4**
	Overall daily total		**26200**	**1115.**	**678.2**	**3007.2**	**4802**

Table 4.4. Continued

Day	Daily meal	Types of food	Amount in gram	Energy content in calories (kcal)			
				protein	Fat	Carbohydrate	Total
Wednesday	Breakfast	Porridge	400	52.8	169.2	340.3	562.8
		Bread	200	54.4	14.4	375	444
		Tea	200	44.4	30.6	164	239.4
		Total	**800**	**152**	**214.2**	**880**	**1246.2**
	Launch	Beef boiled (Yebre Wet)	200	240.8	97.2	16.8	354.8
		Potato boiled	200	8.8	1.8	168.8	179.4
		Rice	400	33.6	3.6	406.4	443.6
		Bread	200	54.4	14.4	375.2	444
		Total	**1000**	**337.6**	**117**	**967.2**	**1421.8**
	Dinner	Injera	400	78.4	36	580	695.4
		Peas (Ater wet)	600	67.2	313.2	223.2	603.6
		Total	**1000**	**145.6**	**349.2**	**803.2**	**1299**
	Overall daily total		**2800**	**635.2**	**680.4**	**2650.4**	**3967**
Thursday	Breakfast	Egg	200	92.8	196.2	16.8	305.8
		Bread	200	54.4	14.4	375.2	444
		Tea	200	44.8	30.6	164	293.4
		Total	**600**	**192**	**241.2**	**556**	**989**
	Launch	Past	400	196.8	54	1148.8	1399.6
		Bread	200	54.4	14.4	375.2	444
		Potato	400	17.6	3.6	337.6	358.8
		Total	**100**	**268.8**	**72**	**1861.6**	**2202.4**
	Dinner	Injera	400	78.4	36	580	694.4
		Beef boiled (Yebre Wet)	600	722.4	291.6	50.4	1064.4
		Total	**1000**	**800.8**	**327.6**	**630.4**	**758.8**
	Overall daily total		**2600**	**1261.6**	**640.8**	**3048**	**4950.4**
Friday	Breakfast	Porridge	400	52.8	169.2	340.3	562.8
		Bread	200	54.4	14.4	375	444
		Tea	200	44.4	30.6	164	239.4
		Total	**800**	**152**	**214.2**	**880**	**1246.2**
	Launch	Beef boiled (Yebre Wet)	200	240.8	97.2	16.8	354.8
		Potato boiled	200	8.8	1.8	168.8	179.4
		Rice	400	33.6	3.6	406.4	443.6
		Bread	200	54.4	14.4	375.2	444
		Total	**1000**	**337.6**	**117**	**967.2**	**1421.8**
	Dinner	Injera	400	78.4	36	580	695.4
		Peas (Ater wet)	600	67.2	313.2	223.2	603.6
		Total	**1000**	**145.6**	**349.2**	**803.2**	**1299**
	Overall daily total		**2800**	**635.2**	**680.4**	**2650.4**	**3967**

In addition to the above food items, 3kg of butter, 6 litters of oil, 5kg of garlic, 15kg of shallot, 2kg of pepper, 5kg of tomato and 3kg of leek has been used for preparing each day meal for total 400 athletes of which some are basketball, handball, volleyball players and workers of the club .Moreover, athletes, basketball players, handball players, volleyball players and workers all are consuming together the prepared food in the club camp. So, the total daily used items for food preparation should be divided for these 400 athletes so as to get individual athlete intake in daily meal and summarized in the table below.

Table 4. 5. Additional nutrients

Item	Energy content in calorie			
	protein	Fat	Carbohydrate	Total
Butter	0.39	54.81	0.03	55.23
Oil		134.49		134.49
Garlic (Nech shenkurt)	2.05	0.3375	14.9	17.2875
Shallot (Keyi shenkurt)	1.54	0.3375	24	25.8775
Pepper (Berberrye)	0.4	1.125	3.14	4.665
Tomato	0.5	0.1125	1.95	2.5625
Leek (Baro shenkurt)	0.09	0.045	0.9075	1.0425

Table4.4 and table4.5 has been calculated using the table2.1 which is adopted from food composition table for use in Ethiopia. Moreover, the average daily caloric intake and the composition of carbohydrates, fats and proteins have been calculated from table4.4 and table4.5.

Table 4.6. Average daily caloric intake in Kcal and percentage

Item	Composition			
	Protein	Fat	Carbohydrate	Total
Table 4.4	4396.8	3081.6	14896	22374.4
Table 4.5	24.85	955.83	224.64	1305.32
Total	4421.65	4037.43	15120.64	23579.72
Average daily intake	884.33	807.486	3024.128	4717.41
Percentage	18.74	17.117	64.11	100

As it can be seen from the table, the composition of carbohydrate, fat and protein in the average daily intake are 64%, 17% and 19% respectively. This implies that there is no significant difference in composition than the recommended in Driskell and Wolinsky(2002), as carbohydrate(55%-60%),fat(15%-30%) and protein (10%-15%). However, as athlete in the study are endurance athlete and rely more on fat other than carbohydrate that amount of fat should be increased nearer to the upper limit than protein.

Event		Weight	Age	Sex	BMR	Av.Ac. level	E.Cost	Intensity (km/h	Session/we	Duration/session	C.E/day (Kcal/d)	Av.C.I/d (Kcal/	Av.C.I. minus C.E.
Long distance	marathon	45	19	F	4825	1.4	59.4	18	6	2.5	3426.7	4717.41	1290.71
		45	20	F	4825	1.4	56.1	17	6	2.5	3325.68	4717.41	1391.73
		57	24	M	6591	1.45	71.06	17	5	2	3725.67	4717.41	991.74
		60	20	M	6775	1.45	82.33	19	4	2.5	3984.67	4717.41	732.74
		60	21	M	6775	1.45	73.67	17	4	2.5	3807.93	4717.41	909.48
		60	25	M	6775	1.45	83.33	19	6	2.5	4824.77	4717.41	-107.36
		64	24	M	6883	1.45	83.19	18	5	2	4047.03	4717.41	643.38
		65	23	M	6990	1.45	84.49	18	6	2	4482.48	4717.41	234.93
	10000m	46	19	F	4932	1.4	64.09	19	4	2	2690.37	4717.41	2027.04
		65	21	M	6990	1.45	93.88	20	4	2	3946.08	4717.41	771.33
		65	21	M	6990	1.45	89.19	19	4	2	3869.36	4717.41	848.05
		65	20	M	6990	1.45	89.19	19	6	2	4597.44	4717.41	119.97
		69	24	M	7201	1.45	99.67	20	5	2.5	4942.83	4717.41	-225.42
	5000m	55	22	F	5445	1.4	76.63	20	5	2.5	4942.83	4717.41	1025.68
		59	22	M	6564	1.45	86.53	19	6	2	3691.73	4717.41	685.35
		65	22	M	6990	1.45	89.19	20	5	2	4032.04	4717.41	119.98
		70	24	M	7305	1.45	96.58	19	5	2	4492.99	4717.41	224.42
		74	23	M	7511	1.4	119.8	20	5	2	4788.89	4717.41	-71.48
Middle	3000m	50	20	F	5135	1.4	77	21	6	1.5	3125.95	4717.41	1591.46
		50	19	F	5135	1.4	73.33	20	6	1.6	3058.54	4717.41	1658.87
		55	26	M	6360	1.45	84.7	21	6	1.5	3751.42	4717.41	965.99
		60	22	M	6675	1.45	95.33	22	5	2	4249.97	4717.41	667.44
		65	21	M	6990	1.45	98.56	21	4	1.5	3620.28	4717.41	1097.13
	1500m	50	20	F	5135	1.4	80.67	22	6	1.5	3193.3	4717.41	154.11
		60	19	M	6675	1.45	99.67	23	4	1.5	3524.91	4717.41	1192.5
		66	22	M	7097	1.45	104.87	22	4	2	4162.25	4717.41	555.16
		75	25	M	7620	1.4	119.82	22	6	2	5565.08	4717.41	-847.65
	800m	51	19	F	5238	1.4	80.67	22	4	1.5	3227.69	4717.41	1489.722
		65	21	M	6990	1.45	117.35	25	4	1.5	3850.2	4717.41	867.21
		65	21	M	6990	1.45	112.7	24	4	2	4252.56	4717.41	464.85

Table 4.7. measurements of caloric expenditure and comparison of its results with caloric intake of individual athlete

As indicated in the above table4.7, almost all females have less basal metabolic rate than the males. Also as observed in the same in column 11, all females in long distance and middle distance have low daily energy expenditure than males in the same events. Hence, from the above analysis one can conclude that the female athletes have lower expenditure and basal metabolic rate than males in the same athletic events. So, this implies that they are taking more calories per day than the recommended amount.

In other hand, based on the weight of the athlete, the energy intake and output the athletes with high weight have showed the high basal metabolic rate than athletes of low body mass, but different in caloric intake and expenditure based on various intensity, duration and session per week in each event.

Based on the above information, one can reveals that the athletes with high body weight or mass have high basal metabolic rate than the athletes with low body mass at the same or similar event. Moreover, regarding to basal metabolic rate and energy expenditure based or considering of training load , as indicated in the above table 4.7 observation result revealed that the daily training load in terms of frequency, intensity and duration affect the daily caloric intake and expenditure of each athlete regardless of individual sex and athletic events. That means, athletes who perform or undertake length high intensity training session in each day have greater energy than the athletes who participate in short and less intensity training per day within the same event.

In light to, athletes in 6^{th} line under marathon, in 5^{th} line 5000m and in the 4^{th} line of 1500m were showed that the negative difference value of daily caloric intake in relation to daily caloric expenditure. This shows that, those athletes who perform more frequent lengthy and high intense training then the rest athletes in their specific events. So, their daily energy expenditure greater than daily caloric intake, due to heavy training loads per week.

From the above information, one can infer that, there were athletes in the same event have different caloric expenditure due to their different level of training load. This means when the training loads in terms of frequency, intensity and duration of training per week increases, also increase in daily caloric expenditure per day which have a greater influence one athletic performance. Therefore, the coaches, long and middle distance athletes must give great attention to maintain daily caloric intake and expenditure of each athlete based on individual athlete training load level, which helps to improve their performance.

In general as indicated in the above table4.7, information concerning the difference of daily caloric intake and caloric expenditure of each athlete result in column 13, of table4.7, except a few athletes, almost all athletes are taking more calories than they expend. This result reveals that, athlete in defence club have high caloric intake than daily caloric expenditure.

Based on the above information, one can understand that in the defence club the majority of the athletes are taking more calories than their daily expenditures. This in the long run can cause increases of body weight in athletes that directly affect their performance. Furthermore, if it continued for a long period of time, it results in heart diseases and illness. Because of this reason, long and middle distance athletes and coaches in the defence club must give attention to improve their caloric intake and expenditure to maintain their energy balance in daily meals, which plays a great role in athletes exercise performance and health status.

CHAPTER FIVE

5. Summary Conclusion and Recommendations

The final part of this thesis deals with the summary of the major findings, conclusions and recommendations forwarded on the basis of the findings.

5.1. Summary of Major Findings

The major purpose of this study was to assess the nutritional status of defense athletic club, especially for those athletes who are engaged in distance running falling between 800 meter and marathon. To these end, basic questions addressing the assessments of nutritional status were raised. From the data analysis the major findings obtained listed under here

1. As the finding result shows all athletes were falling under the same age categories (18 years to 30 years) which indicates except few athletes the majority are senior athletes and the majority of the athletes have stayed three and above year in the club.
2. As one can see from the finding all the athletes perform for four days to six days per week with average duration of one half to two half hour in daily training program.
3. The information from the finding indicates long distance runners have been working with the intensity of 17km/hr to 21km/hr, whereas the middle distance runners perform their daily training with 20km/hr to 25km/hr and all the athletes have high interest to cover the given training load.
4. All the athletes in the club do not work additional activities outside their training program but they take bed rest and light walking.

5. The finding indicates that majority of the athletes have knowledge about the nutrition and their coach inform them. In addition to this, all the athletes were not skipping meal or do not participate in fasting and they do have three meal per day.
6. The majority of the athletes reported that almost the main diet usually prepared in the club camp was carbohydrate
7. As the finding reflect that all the athletes use additional food outside three meals which is inconsistence because they use sometimes and the athletes unable to quantify.
8. As the finding shows there is insignificant difference of food composition with the percentage recommended intake.
9. As the findings reveals the majority of the athletes (26) energy intake is greater than their energy expenditure, however, a few athletes (4) expend more than what they intake. Furthermore, these energy imbalances occur due to individual difference with basal metabolic rate, sex, weight, and status of training load (intensity, frequency and duration) which cannot be considered with the club in planning training and meal. So individual difference play great role in nutrition and athletics.

5.2. Conclusion

In the light of the major findings those indicated above, the following conclusions are drawn.

- ❖ Majority of the athletes were senior and have three years and above experience in the defense club. Furthermore, the finding result shows that athletes perform four to six days per week with an average duration of one half to two half hours per daily training program
- ❖ The training intensity varies from 17km/hr to 21km/hr for long distance runners and 20km/ hr to25km/hr for middle distance runners.

- ❖ There were no additional activities outside training program and their off training time but they take bed rest and light walking.
- ❖ Regarding to feeding, all the athletes have awareness about nutrition and no one skip the meal or not take part in fasting
- ❖ Carbohydrate prepared in defense club is usually greater than protein and fat.
- ❖ Athletes use sometimes additional food outside the club meal which is difficult to quantity and measure.
- ❖ Regarding the composition of carbohydrate, fat, and protein there was insignificant difference between the intake and the recommended but a few additional amount of fat is demanded for distance runners.
- ❖ In defense club there was imbalance between energy intake and energy expenditure. In addition to this there was no consideration of individual difference in nutrition.

5.3. Recommendation

Depending on the findings of the study and conclusions arrived at the following recommendations are suggested to solve the problem

- ❖ Regarding the composition of the macro nutrients there was insignificant difference between the intake and the recommended carbohydrate, fat and protein. So the club has to follow the same proportion for these macronutrients prepared for the athletes to keep the composition except for a few amount fats to be added for distance runners.
- ❖ Concerned bodies such as defense athletics club staffs and athletes should cooperate to discuss and solve the problem of nutrition imbalance with their training program. Furthermore, coach should consider individual difference according to their capacity

(current fitness levels to provide training load) ,age, sex, and weight in planning training program in connection with nutrition.

- Coach should regularly follow up what the athletes take in the club and outside the club meal through different mechanism such as observation, questioning and finally giving information regarding what they eat or not eat in order to control their weight and to reduce energy imbalance and keep their performance.
- Further investigation should be taken for what the athletes use outside the club and the micronutrients which was not considered in this study and which may affect the energy intake and expenditure.

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DECLARATION

I declare that this thesis is my original work, has not been presented for a degree in another university and that all Sources of materials used for the thesis have been duly acknowledged.

Name: - : - --------------------- ---

Signature: ------------------------

Date: - --------------------- ---

This has been submitted for examination with my approval, as a university advisor.

Name: - ------------------------

Signature: - ------------------------

Date: - -----------------------