

**EFFECT OF 8 WEEKS NUTRITION EDUCATION PROGRAM ON
KNOWLEDGE OF SPORT NUTRITION, SELECTED DIETARY
INTAKE AND BODY COMPOSITION AMONG JUNIOR
INTERNATIONAL TAEKWONDO ATHLETES IN CASE OF
WESTERN GUJI ZONE BULE HORA TOWN, OROMIA REGIONAL
STATE**

MSc THESIS

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Effect of 8 Weeks Nutrition Education Program on Knowledge of Sport Nutrition, Selected Dietary Intake and Body Composition among Junior International Taekwondo Athletes in Case of Western Guji Zone Bule Hora Town, Oromia Regional State

**A Thesis Submitted to the Department of Sport Science,
Postgraduate Program Directorate
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**In Partial Fulfilment of the Requirements for the Degree of
MASTER OF SCIENCE IN SPORT NUTRITION**

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**May 2017
Haramaya University, Haramaya**

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Final approval and acceptance of the Thesis is contingent upon the submission of its final copy to the Council of Postgraduate Program Directorate (CPGPD) through the candidates department or school graduate committee (DGC or SGC)

DEDICATION

I dedicate this Thesis Manuscript to my grandmother W/ro Ergechachewu Weldetsadik Gefawosen for her strong devotion and prayer to the success of my life.

STATEMENT OF THE AUTHOR

By my signature below, I declare and affirm that this Thesis is my own work. I have followed all ethical and technical principles of scholarship in the preparation, data collection, data analysis and compilation of this Thesis. Any scholarly matter that is included in the Thesis has been given recognition through citation.

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ACRONYMS AND ABBREVIATIONS

AMDR	Acceptable Macronutrient Distribution Range
BMI	Body Mass Index
DRI	Dietary Reference Intakes
EER	Estimated Energy Requirements
FFM	Fat free mass
IRERC	Institutional Research Ethics Review Committee
TKD	Taekwondo

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ABSTRACT

In Ethiopia many adolescent athletes' choice foods based on their family socio economic status and on their feeling without any nutritional knowledge or nutritional advice. This study was therefore designed to assess the effect of 8 weeks nutrition education program on knowledge of sport nutrition, selected dietary intake and body composition among junior international taekwondo athletes in Western Guji Zone Bule Hora Town, Oromia Regional State. Nutrition knowledge, dietary intake and body composition were measured before and after an eight weeks nutrition education program. In this study the researcher used single group research design. The Stratified simple random sampling method was employed to select the samples from the population. The subjects of this study were 30 junior international taekwondo athletes aged 16-19 years old, of this 15 were males and the rest 15 were females. In order to collect the adequate and reliable data the researcher used questioners (Closed-ended) and body composition measurement. The data has been analyzed using SPSS version 20. As a result of the nutrition education program, nutrition knowledge of the athletes improved from 2.32 to 2.95 of mean score ($p=0.011$), fruit and vegetable intake improved from 2.26 to 3.34 of mean score ($p=0.0001$), fluid intake was improved from 1.83 to 2.83 of mean score ($p=0.001$), and athletes body composition was improved from 19.95 to 20.04 of mean score ($p=0.369$). The present study suggests that a nutrition education program can improve knowledge of sport nutrition, dietary intake and body composition among junior international taekwondo athletes. Therefore, Nutrition Education should have to be incorporated into training activities of international taekwondo athletes.

Key Words: *Nutrition Education, Nutrition Knowledge, Dietary Intake and Body Composition.*

1. INTRODUCTION

1.1. Background of the Study

Many of the world's nutrition problems relate to a failure to match energy intake to energy requirements. In many under developed countries, chronic under nutrition is a leading nutritional problems. In industrialized countries, however, excess intake of dietary energy is the major problem leading to overweight and obesity (Maughan, 2006).

Adequate dietary intake is important for athletes to maintain health and athletic performance (Meyer *et al.*, 2007). However, athletes` diets often fail to meet the current recommendations of sports nutrition and general population (Burke *et al.*, 2001). One reason for the inadequate dietary intake might be poor nutrition knowledge (Torres-McGehee *et al.*, 2012).

Nutrition educators acknowledge that a wide variety of factors influence adolescents' eating behaviour. Factors that could influence an adolescent's food choices are: nutrition knowledge, physiological needs, body image, food preferences, parental practices, peers, media, social norms, fast foods, and personal experiences (St Pierr and Resmovic, 1982).

Nutrition education among athletes is essential for maximizing performance. It is recognized that physical activity, athletic performance and recovery from exercise are all improved with the proper nutrition (Rodriquez *et al.*, 2009). In fact, Dr. David Costill, one of the most recognized and respected researchers in the field of exercise science, is quoted saying, "other than the limits imposed by heredity and training, no single factor plays a greater role in optimizing performance than diet" (D.Costill, 2013).

What an athlete`s eats or drinks affects directly or indirectly his/her performance. Diet directly affects the performance, fitness and health of each athlete's (Thompson, 2009). Body composition is one of a health related physical fitness and athletes must keep and maintain their body composition for a better performance by having a balanced diet. Body composition refers to the proportion of fat and fat-free mass in the body. A healthy body composition is one that includes a lower proportion of body fat and a higher proportion of fat-free mass. Body composition is one measurement that is used to assess health and fitness level (Jennifer R. Scott, 2016).

Taekwondo refers to "Tae" means "foot" or "to strike with the feet". "Kwon" means "hand", or "to strike with the hand". "Do" means discipline, art, or way. Hence Taekwondo (foot-hand-way) means literally "the art of the feet and the hands" or "the art of kicking and punching" (A Summary of Korean Terminology for Taekwondo). The ideal diet for combat sports such as TKD should bring a total caloric intake of 60-65kcal/kg body weight with high proportion of carbohydrates and a low proportion of lipids with sufficient supply of protein and fiber, as well as plenty of fluid (Pawlett and Pawlett, 2004).

Food consumption patterns in Ethiopia are diverse, and unlike in many other countries, no single crop dominates the national food basket (e.g., rice in most of East Asia, maize in Latin America, or cassava in Central Africa). The Ethiopian food basket consists of a wide variety of grains and other staples. However, consumption levels and mixes of these grains vary widely according to differences in agro-ecology, socioeconomic levels, and livelihood strategies. Moreover, given dependence on own production, particularly in rural areas, food grain consumption varies at different times of the year. As in many other traditional societies, dietary preferences and consumption patterns are heavily influenced by cultural values and traditions and may not necessarily reflect availability or the nutritional quality of specific food items (Guush *et al.*, 2011). Because of poor eating habits among many adolescents, this research was attempted to find some explanation for adolescents' nutritional knowledge, dietary intake and body composition by exploring what relationships exist between them.

1.2. Statement of the Problem

The energy and nutrient needs of physically active individuals are different from those of their sedentary counterparts. Athletes and highly active individuals need to make sure their diets are adequate in energy and nutrients to assure peak athletic performance while also supporting activities of daily living, maintenance of health, recovery from exercise, and the nutrient needs for growth. In adults, these nutritional needs are focused on replenishing glycogen, maintaining and building lean mass, and supporting performance demands and they have to increase energy and nutrient needs, both to support their active lifestyle and for their physical and mental growth (Cotugna *et al.*, 2005).

Developing good dietary behaviours and habits requires knowledge of energy and nutrient needs and food selection and preparation. For the active adolescent, energy needs are largely determined from the demands of growth and athletic competition (Desbrow *et al.*, 2014). But consequences due to poor food choices and a lack of nutrition knowledge negatively impact performance and health of adolescent athletes. Many adolescent athletes' choose foods based on their family socio economic status and on their feeling without enough nutritional knowledge or nutritional advice. This is also true in Ethiopian adolescent athletes. So that, this study was tried to fill the nutritional knowledge gap between the athletes and provide important information's about how nutritional knowledge can improve adolescent's dietary intake and body composition. Therefore, this study attempted to answer the following basic research questions.

- What was the relationship between nutritional knowledge and dietary intake among junior international taekwondo athletes?
- How was junior international taekwondo athlete's baseline nutritional knowledge?
- What effect eight week nutritional education bring on sport nutrition knowledge, dietary intake and body composition of junior international taekwondo athletes?

1.3. Scope of the Study

The scope of this study was Western Guji Zone, Bule Hora town international Taekwondo training centers to assess the effect of nutrition education program on knowledge of sport nutrition, selected dietary intake and body composition among junior international taekwondo athletes in Bule Hora, Ethiopia.

This study was delimited itself and concentrated basically on nutritional knowledge, fruit, vegetable and fluid intake and its effect on body composition of junior international taekwondo athletes. Assessment of any additional supplements and nutritional ergogenic aids was not being included in this study.

1.4. Significance of the study

This study concerning the effect of nutrition education program on knowledge of sport nutrition, selected dietary intake and body composition among junior international taekwondo athletes was provide the following significances:

- It increases the nutrition knowledge of the athletes.
- With an improved nutrition knowledge and diet, the athletes see an improvement in perceived athletic performance.
- This study evaluates the effectiveness of a nutrition education program among junior international taekwondo athletes.
- This study helps to develop the field of sports nutrition and promote appropriate nutritional standards and understanding of this knowledge and practices by the athletes.
- It helps the researchers as review of related literature for further studies.

1.5. Objectives of the Study

1.5.1. General objective

- To assess the effect of 8 weeks nutrition education program on knowledge of sport nutrition, selected dietary intake and body composition among junior international taekwondo athletes in Western Guji Zone Bule Hora Town.

1.5.2. Specific Objectives

- To sort out the baseline nutrition knowledge of junior international taekwondo athletes.
- To identify the relationship between nutritional knowledge and dietary intake among junior international taekwondo athletes.
- To indicate whether a nutrition education among junior international taekwondo athletes improves nutrition knowledge, dietary intake and body composition.

2. LITERATURE REVIEWS

2.1. Nutrition and Sport

Meeting energy needs is the first priority for athletes. Specific nutrient requirements can vary depending on many factors, including type of sport participation, food preferences, body weight, and body composition goals (Manore and Thomson, 2000).

Many people think of nutrition as something that people must have in order to survive. However, not many people know what it is, about nutrition that makes it so important. For athletes, nutrition is a key not only for performance but also for injury prevention. A study, completed by Reid-St., examined eating habits and injury rates among female runners. It concluded that 55% of the athletes polled reported injuries and those athletes also ate approximately 200 fewer calories per day (Reid and John, 2003). An athlete who is well nourished is not only healthy but typically capable of training more intensely and competing quite successfully, as well as being less susceptible to injury (Rodriguez, 1999). Although the same diet will not suit everyone, it is the basic principles that matter. For instance, the typical diet for an athlete is 40-60% carbohydrates, 20-30% protein and 15-20% fat (Bernard, 2000).

Carbohydrates are the favoured fuel for exercise and are stored in the form of glycogen in the liver and muscles. Those who train several hours a day require more carbohydrates (Vinci, 2002). Carbohydrates are the body's most efficient source of energy. Foods that are high in carbohydrates are breads, cereal, rice, and pasta (Arnheim and Prentice, 1997). Now, with the new low carbohydrate diet craze, it would be hard for athletes to maintain their carbohydrate needs.

Regardless of gender or sport, athletes are always attentive to protein intake injury (Rodriguez, 1999). Athletes have higher protein needs related to protein's role in repairing muscle tissue, ligaments, and tendons (Vinci, 2002).

Fat is an energy-dense nutrient, which is needed in everyone's diet to help maintain the nervous system and cell membranes in the body. Fat can also be a good source of calories for athletes with higher energy needs. However, athletic trainers should encourage athletes

to choose lower fat foods or healthier sources of monounsaturated and polyunsaturated fats, such as nuts, seeds, high-fat fish, olive oil, and canola oil (Vinci, 2002).

2.2. Nutrition Considerations for Athletes

Nutrition plays a significant role in the performance of athletes. In 2009, a comprehensive review of nutrition and athletic performance was published by three governing organizations related to the field of nutrition. Their position on nutrition and athletic performance is stated as follows: “It is the position of the Academy of Nutrition and Dietetics, Dieticians of Canada, and the American College of Sports Medicine that physical activity, athletic performance, and recovery from exercise are enhanced by optimal nutrition. These organizations recommend appropriate selection of foods and fluids, timing of intake, and supplement choices for optimal health and exercise performance (Rodriguez *et al.*, 2009).

2.2.1. Energy

Adequate energy intake is essential for maximizing performance. Without adequate calorie consumption, the body will use lean muscle tissue for energy during exercise resulting in poor performance, a greater recovery period will ensue, and a reduction in strength over time will occur. Not only will performance be compromised without proper energy intake but the athlete would be at risk for nutrient deficiencies that could lead to osteoporosis, anaemia and stunted growth.

Many factors influence energy expenditure making it difficult to establish individual energy needs. Age, gender, heredity, body size, the amount of fat free mass (FFM) and type, duration and frequency of exercise all directly influence energy expenditure (Donahoo *et al.*, 2004). In general, males have higher energy needs than females; additionally, energy needs are greatest in adolescence, decrease with age and increase as greater muscle mass increases. The Dietary Guidelines for Americans (2010) and the Institute of Medicine, have established Dietary Reference Intakes (DRI) for different age, gender and physical activity using Estimated Energy Requirements (EER) equations. These are displayed below in Table 2.1.

Age	Male/Moderately Active	Male Active	Female/Moderately Active	Female Active
12	2200	2400	2000	2200
13	2400	2600	2000	2200
14	2600	2800	2000	2400
15	2800	3000	2000	2400
16	2800	3200	2000	2400
17	2800	3200	2000	2400
18	2800	3200	2000	2400
19	2800	3200	2000	2400

Table 2.1:- EER based on age and activity, modified from the Dietary Guidelines for Americans (2010).

2.2.2. Carbohydrates

Carbohydrates are the most efficient source of energy for the body and are the only source of energy available for anaerobic activity. For this reason, inadequate intakes of carbohydrates will greatly impede sport performance. Additionally, carbohydrates spare muscle tissue, are the primary energy source for the nervous system and help improve and maintain intestinal health (Rosenbloom, 2000). DRI for carbohydrate consumption among adolescent males (ages 14-18 years old) is 100 grams per day (DGA, 2010). The DRI is established as the minimum amount of carbohydrates needed to supply the brain adequate energy to function appropriately.

This DRI does not take into consideration the carbohydrates needed to maintain blood glucose during exercise or the need to maintain adequate skeletal muscle glycogen (Petrie *et al.*, 2004). The more physically active the athlete is, the more carbohydrates that athlete needs to consume. Additionally, the amount of carbohydrates required is dependent on the athlete's total energy expenditure, gender, type of sport and the environmental condition in which the athlete is competing (Rodriguez *et al.*, 2009).

The recommended intake of carbohydrates for athletes ranges from 6 to 10 g/kg/day. In general, athletes competing in endurance activities have higher carbohydrate needs than athletes competing in strength activities. It is recommended that an athlete consume no less than 50% of their calories as carbohydrates (Rodriguez *et al.*, 2009).

2.2.3. Protein

Protein supports the growth, maintenance and repair of body tissues, particularly muscle. Protein makes up enzymes that are needed to facilitate chemical reactions within the body. Protein helps maintain fluid balance, transport nutrients and helps defend the body against disease (Rosenbloom, 2000). For the athlete, protein plays an essential role for muscle growth and recovery following intense training (Phillips *et al.*, 2007). The DRI for protein for 14 to 18 year old males is 0.73 g/kg/day and the Acceptable Macronutrient Distribution Range (AMDR) for protein is 10-35% of total calories (DGA, 2010). Dietary protein requirements are increased with exercise and adequate energy intake is essential to maximize utilization of protein specifically for muscle growth and repair (Rosenbloom, 2000).

Both endurance and strength exercises influence the protein needs of an athlete. For the endurance athlete, an increase in protein oxidation during exercise provides the basis for an increased protein need. The recommended protein intake for endurance athletes range from 1.2 to 1.4 g/kg/day. For athletes participating in strength and resistance exercises, adequate protein is essential to support muscle growth and repair. The recommended protein intake for strength athletes range from 1.2 to 1.7 g/kg/day (Phillips *et al.*, 2007).

2.2.4. Fat

Fat provides energy to the body serves as an abundant energy reserve and protects and insulates internal organs. Fat is a structural component of cell membranes, a precursor to the hormones testosterone and estrogen and is the carrier of fat soluble vitamins A, D, and E (Rosenbloom, 2000). The AMDR for fat is 20% to 35% of calorie intake (IOM, 2002).

2.2.5. Hydration

Hydration is an important but often forgotten aspect of nutrition. The body is sixty percent water, so adequate hydration is a significant part of nutrition. However, as with all aspects

of nutrition, circumstances may arise that will alter the needs for a nutrient. Age, activity level, climate, and altitude can influence the fluid needs of an individual and increase risk for dehydration (Grandjean and Campbell, 2004). Dehydration is the result of not meeting fluid needs and can lead to headache, coma or even death (Casa *et al.*, 2000).

During physical activity the body generates heat and responds by sweating to maintain temperature homeostasis. The sweat evaporates and through this physiological process provides a method to maintain temperature homeostasis during physical activity. The water that is lost through sweat needs to be replaced and this makes hydration critical to the athlete's performance and health. Dehydration is defined as a water deficit that is greater than 2% of body weight (Sawka *et al.*, 2007). Dehydration reduces both aerobic and anaerobic performance as well as cognitive performance (Rodriguez *et al.*, 2009).

Maintaining adequate hydration status is important for health and exercise performance in adolescent athletes. The goal of pre-exercise hydration is to assure that the athlete begins the exercise session euhydrated. This process should begin at least four hours before activity begins, with close monitoring of urine output during practice sessions to establish hydration goals. Hyper hydration is not encouraged, as it will increase the likelihood of having to void during the exercise session, and offers no physiologic or performance advantage (Sawka *et al.*, 2007).

The main goal of during exercise fluid intake is to avoid dehydration greater than a 2% loss in body weight (Sawka *et al.*, 2007). Fluid losses, represented as $\geq 4\%$ decrease in body weight, have the potential to detrimentally effect performance and lead to heat exhaustion or stroke (Desbrow *et al.*, 2014). It is difficult to create general hydration plans for active youth due to the amount of individual variation in sweat rate, heat acclimatization, among other factors. In general, fluid intake is encouraged, with personal monitoring of body weight changes during exercise (Sawka *et al.*, 2007).

2.3. Fruit and Vegetable Intake of Adolescent Athletes

Adolescence is a unique stage of life that requires special attention to nutrition. Other than that of birth, adolescence is the only period of life where the acceleration of growth increases. During this stage, the adolescent goes through puberty exhibiting physical, cognitive, emotional and hormonal changes. During the time of adolescence 15% of the

adult height, 45% of the skeletal mass and about 50% of the ideal adult weight is gained (Spear, 2002). These changes, particularly the physical growth and development, make it critical for adequate nutrient intake. Additionally, adolescents who are involved in sporting activities have an even greater nutrient need (Lytle, 2002).

An increased consumption of fruit and vegetables is associated with many health benefits. Fruit and vegetables provide essential nutrients that are not being met through a diet characterized by low consumption of fruits and vegetables; this includes vitamins A, C and K, foliate, magnesium, potassium and fiber. Increasing fruit and vegetable intake reduces the risk of multiple chronic diseases such as obesity and cardiovascular disease, and may help reduce the risk of cancer. Furthermore, because of the low calorie content of fruits and vegetables, an increased consumption can help maintain an adequate and healthy weight (DGA, 2010).

The United States Department of Agriculture Dietary Guidelines for Americans has established fruit and vegetable recommendations for adolescents. The active adolescent male should consume at least two cups of fruit and three cups of vegetables per day (DGA, 2010).

Fruit and vegetable consumption in particular has received much attention. Diets high in fruit and vegetables are associated with a lower risk of cancer, coronary heart disease, stroke and other chronic diseases. Therefore, as well as promoting health during adolescence, meeting the recommendations for fruit and vegetable intake can have positive implications for long term health.

2.4. Nutrition Knowledge of Adolescent Athletes

It is well documented that adolescent athletes lack the necessary nutrition knowledge to make sound nutritional decisions. In a study conducted by (Douglas P and Douglas J, 1984), a three part questionnaire was sent to ten different high schools to assess nutrition knowledge and food practices. The purpose of the questionnaire was to gather information on the athlete's sport, food practices and nutrition knowledge. The sample consisted of 943 male and female athletes. The mean score for nutrition knowledge was 55%. The mean food practice score was 2.21 out of a possible 5. Male athletes had a higher food practice score but females had a significantly higher nutrition knowledge score. The higher food

practice scores seen by males were attributed to the fact that young males tend to eat more in general making more likely that nutrient needs will be fulfilled. It is relevant to note that football players scored slightly lower on the nutrition knowledge portion at 52% and slightly higher on the food practice score at 2.40 compared to the overall mean (Douglas P and Douglas J, 1984). The low nutrition knowledge and food practice scores demonstrate a deficiency in nutrition knowledge among high school athletes.

Adequate dietary intake is important for athletes to maintain health and athletic performance (Meyer *et al.*, 2007; Heaney *et al.*, 2011). However, athletes' diets often fail to meet the current recommendations of sports nutrition and general population. One reason for the inadequate dietary intake might be poor nutrition knowledge (Torres-McGehee *et al.*, 2012). However, it is not clear whether a relationship between nutrition knowledge and diet quality exists. Some authors reported a link between higher nutrition knowledge and better dietary intake in adult athletes, whereas others did not. One reason for the lack of linkage might be the poor assessment methods of both nutrition knowledge and dietary intake. There is a need to develop valid instruments to assess general and sport-specific nutrition knowledge and to compare nutrition knowledge to the athletes' dietary intake (Heaney *et al.*, 2011). Nutrition education programs for athletes might have the potential to close the gap between diet recommendations and individual food intake. Unfortunately, an evaluation of nutrition education programs is rarely reported for athletes (Abood *et al.*, 2004). One issue might be that the nutrition knowledge is affected by several factors, such as gender, educational level, and age. Female sex and a high educational level are positively influencing nutrition knowledge. Additionally, the nutrition knowledge is increasing during maturation. However, athletic status does not influence general nutrition knowledge, but slightly increases sport-specific nutrition knowledge (Heaney *et al.*, 2011).

2.5. Body Composition

Body composition refers to the proportion of fat and fat-free mass in the body. A healthy body composition is one that includes a lower proportion of body fat and a higher proportion of fat-free mass. Body composition is one measurement that is used to assess health and fitness level (Jennifer R. Scott, 2016).

The body is composed of two types of mass: body fat and fat-free mass. Body fat is fat that is located within the body. Body fat can be in muscle tissue, under the skin or around organs. Some fat is necessary for overall health. It helps protect internal organs, provides energy and regulates important body hormones. Fat-free mass includes bone, water, muscle, and tissues. Fat-free mass is also important for the body to function properly (Jennifer R. Scott, 2016).

2.6. Nutrition for Taekwondo Athletes

Taekwondo (TKD) is a predominantly anaerobic sport (both alactacide and lactacide) with a significant aerobic component too. Movements themselves imply anaerobic qualities however the combat duration (3 rounds of 2min with 1min recuperation between rounds) and repetition of combats in the same competition involves aerobic qualities too because a good maximum consumption of oxygen contributes to the fast payment of oxygen debt and to the recovery of macroergic phosphate compounds. Maximum power is increased to sustain up to 50% of the alactacide maximum power and can be reached in the first 10-15s all the way up to 40s, after which the intensity of the performance decreases (Wilmore and Costill, 2004)

Food means any product that, once introduced into the body, serves to maintain its vital processes, ensuring the growth and repair of cells. Moreover, food assures the activity carried out without being harmful to health but, on the contrary, contributing to its strengthening. Foods are formed of nutrients - trophins (proteins, lipids, carbohydrates). Good nutrition can be daily achieved through nutrition management, including the regulated intake of carbohydrates, fats, protein, vitamins, minerals and water (Chung and Lee, 1994).

Experts in this field believe that the concept of food balance is related mainly to the distribution of certain types of food that nutritionists have ranked in categories. However, foods in the same category may have different qualities that must be taken into account when choosing them (Trémolières *et al.*, 1956). It is well known that ergogenic nutrients in food are divided into three categories: proteins, lipids and carbohydrates (Savoie, 2010).

Several nutrients are essential for the proper body functioning: carbohydrates and forms of sugar, lipids and fatty acids, proteins and amino acids, water, vitamins and, minerals and

trace elements (Savoie, 2010). An effective athlete diet must meet not only the biological needs of energy nature, but also the psychological and social ones. A well structured diet should be determined based on the individualization of food balance for each athlete.

The ideal diet for combat sports such as TKD should bring a total caloric intake of 60-65kcal/kg body weight with high proportion of carbohydrates and a low proportion of lipids with sufficient supply of protein and fiber, as well as plenty of fluid (Pawlett M and Pawlett R, 2004).

The daily energy expenditure is calculated by adding other additional expenditures to the basal metabolism: energy consumption required to maintain constant temperature, energy expenditure for digestion processes (20-30 of basal metabolism) and energy expenditure to support physical activity. All these energy expenditures generally amount to 2000-2800kcal/day for a sedentary adult. A few more percents are added in the case of unforeseen circumstances (illness, stressful environment, etc.) or in intense intellectual activity (exams, etc). In the case of children and young people up to the age of 16-18 years, the daily caloric needs are increased with the energy expenditure necessary for growing up, whose values are equal to 10-20% of basal metabolism. Regarding the TKD athletes, one hour of intensive training in this sport event involves an energy consumption of about 730 calories for a person with a body mass of 75 kg (Ainsworth *et al.*, 2011).

The body has the ability to store glucose as glycogen, which will be reconverted when glucose is needed. It is stored in limited amounts in the liver (110g, 451 kcal) and muscle (250 g, 1025 kcal). It is sufficient to ensure energy expenditure for about 30 minutes of intense effort. Since a TKD match lasts well below this value, in this sport event there is no question about depletion of glycogen reserves. However, long duration workouts can rely on lipolysis energy too when glycogen was depleted. A low carbohydrate intake causes prolonged depletion of muscle glycogen reserves; it produces chronic fatigue and disruption of training process (Achten *et al.*, 2004).

2.7. Nutrient Timing

2.7.1. Pre-exercise Nutrition

Carbohydrate is a key nutrient in the pre-exercise meal since it is an important energy substrate during exercise. Thus, carbohydrate intake must be adequate to assure glycogen replacement and maintenance of blood glucose to maximize exercise performance. Research has shown that carbohydrate consumption in the 1-4 hours prior to exercise can have a beneficial effect on athletic performance (Jeukendrup, 2011).

The timing and volume of carbohydrate ingestion prior to exercise is important for both maximizing exercise performance and minimizing gastrointestinal discomfort (Rodriguez et al., 2009; Burke *et al.*, 2011; Galloway *et al.*, 2014) examined the effects of both timing and carbohydrate concentration on high-intensity exercise capacity. They found that a carbohydrate drink containing 32 g of carbohydrate (6.4% carbohydrate) ingested 30 minutes before exercise decreased time to exhaustion by 14-17%. These results are similar to the carbohydrate feeding recommendation made by (Burke *et al.*, 2011) of 1-4 grams of carbohydrate per kilogram body weight consumed 1-4 hours prior to exercise. General recommendations given in the Position Stand on Nutrition and Athletic Performance from the American College of Sports Medicine, Academy of Nutrition and Dietetics, and the Dieticians of Canada are that the consumption of larger meals further from exercise and smaller, carbohydrate rich meals closer to exercise (Rodriguez *et al.*, 2009).

2.7.2. During Exercise Nutrition

Fluid loss as little as 2% of body weight (1.4kg in 70 kg athlete) has been shown to decrease endurance performance (Casa *et al.*, 2003) Depletion of fuel stores can be an issue for football matches, especially for players in mobile positions or with a running game style. High carbohydrate strategies – fuelling up for the game and consuming extra carbohydrate during the match – have been shown to enhance performance in such players.

Better intake of fluid and fuel during a game may not only keep players running further and faster in the second half of a match, but it can also help to maintain skills and judgment when players would otherwise become fatigued. Games are often won and lost in

the last minutes of the match, and fatigued players are at increased risk of injury (Sawko and Coyle, 1999).

2.7.3. Post-Exercise Nutrition

Post-exercise nutrition, or recovery nutrition, plays a key role in replenishing glycogen stores and providing the energy and nutrients needed for building and repair of tissues. Protein, carbohydrate, and fat all need to be part of the post-exercise meal, with carbohydrate and protein playing important physiological roles in recovery from exercise. Carbohydrate helps to replenish the body's stores of glycogen, thus, preparing the athlete for the next exercise session, while protein is necessary for tissue building and repair during the recovery process. Thus, the post-exercise meal should contain appropriate amount of carbohydrate and protein and be consumed as soon as convenient after an exercise session to obtain the greatest recovery benefits (Desbrow *et al.*, 2014).

Dietary carbohydrate is essential for glycogen replacement. If the recovery time from the end of one exercise bout to the start of the next is greater than 24 hours, then dietary carbohydrate intake from an energy adequate diet is sufficient to replace glycogen losses. If glycogen stores need to be replaced quickly, then ingesting carbohydrate at 0.25-1.0 g/kg body weight/hour immediately after exercise will restore muscle glycogen levels faster, and therefore exercise capacity (Betts and Williams, 2010).

Protein is an essential component of body tissue. The protein consumed post-exercise is used to rebuild muscle tissue and restore nitrogen balance (Rodriguez *et al.*, 2009). Active adolescents need higher protein intakes (g/kg) compared to active adults due to their overall demands for growth and development (Desbrow *et al.*, 2014).

Protein is an important substrate for lean tissue accretion (Desbrow *et al.*, 2014). Ingestion of protein with carbohydrate increased skeletal muscle synthesis rate and whole body net protein balance when compared to ingestion of drinks matched for carbohydrate or energy intake. In particular, chocolate milk has been extolled as a beneficial exercise recovery drink due to its combination of carbohydrate and protein. As (Lunn *et al.*, 2011) 480 ml of chocolate milk consumed after exercise increases muscle fractional synthesis rate by 38% and suppressed whole-body protein turnover compared to an isocaloric carbohydrate-only control beverage. This increased anabolic state is induced when the milk is consumed as a

single bolus or in multiple feedings, both of which elicit the same metabolic response (Lunn *et al.*, 2011). Thus, protein intake post-exercise is important for lean tissue repair and recovery from exercise.

3. MATERIALS AND METHODS

3.1. Description of the Study Area

This research was conducted at western Guji Zone Bule Hora Town for Two consecutive months from December 2016 to January 2017. Bule Hora or Hagere Mariam has an estimated total population of 55,784 of whom 25,046 were men and 20,738 were women. The 1994 national census reported this town had a total population of 12,718 of whom 6,533 were males and 6,185 were females. It is the largest town in Bule Hora woreda. Hagere Mariam (also known as Alga, Kuku) is a town in southern Ethiopia located on the paved Addis Ababa-Moyale highway, in the Borena Zone of the Oromia Region; it is the largest town in the region traditionally inhabited by the Guji Oromo. It has a latitude and longitude of 5°35'N 38°15'E and an altitude of 1716 meters above sea level. Nowadays, Bule Hora is located at Western Guji zone 476 kilo meters far from Addis Ababa in south Ethiopia and bounded in north with Gedeo Zone, in south with Borena Zone, in east with Guji Zone and in west with Burji Wereda (Map of the study site on Appendix VI page 55).

3.2. Study Material

The materials used during this study were class room, chalk, blackboard, projector, laptop, stadiometer and weight measuring device.

3.3. Definition of Variables

Dependent variables: - Nutritional knowledge, Dietary intake and body composition

Nutritional Knowledge: - refers to knowledge of concepts and processes related to nutrition and health including knowledge of diet and health, diet and disease, foods representing major sources of nutrients, and dietary guidelines and recommendations (McKinnon *et al.*, 2014).

Dietary intake: - is the amount of food taken in a unit of time, usually daily (The free medical Dictionary).

Body composition: - is the proportion of fat and fat-free mass in the body. A healthy body composition is one that includes a lower proportion of body fat and a higher proportion of fat-free mass. Body composition is one measurement that is used to assess body health and fitness level (Jennifer R. Scott, 2016).

Independent variable: - Nutrition education program

Nutrition education: - is any combination of educational strategies, accompanied by environmental supports, designed to facilitate voluntary adoption of food choices and other food- and nutrition-related behaviours conducive to health and well-being (Wikipedia).

3.4. Treatments and Study Design

The study design used for this study was single group research design. The total population of the study were 240 and among them thirty (30) international taekwondo athletes were offered a chance to receive the education. The nutrition education program was conducted for eight weeks. All participants were measured their body composition using weighing scale, Metre and BMI (Body Mass Index), completed a pre-education questionnaire consisting of question items related to nutrition knowledge, and dietary intake. The program was consisted of a nutrition education presentation that was presented by the researcher to all study subjects. Over the course of eight weeks, subjects were received a nutrition education material or hard copy and they attended an educational class to discuss the week's nutrition education program. After the eight-week educational class, subjects were completed the post-test questionnaire and body composition measurement.

The nutrition education presentation contains basic nutrition information relevant to adolescent athletes including nutrition considerations for adolescent athletes (energy, carbohydrates, protein, fat and hydration), nutrient timing (before exercise, during exercise and after exercise) and fruit and vegetable intake of adolescent athletes. Following the initial session, group discussion was scheduled each week for eight weeks (three days in a week and one hour per a day) for the study subjects.

3.5. Description of Population and Sampling Methods

The population for this study were from the three international Taekwondo training centers found in Bule Hora town. There are around 80 athletes found on training center one, 90 on training center two and 70 on training center three. Therefore, the total population of this study were 240. Out of these population 15 female and 15 male athletes (5 male and 5 female athletes from each training center), generally 30 subjects were selected as a sample.

Stratified simple random sampling method was used to select the subjects from the population.

3.6. Types of Data and Data Collection methods

Both primary and secondary source of data were used for this study, so that the primary data was obtained from the educational setting according to the designed educational program and secondary data was obtained from different documents, journals, books, internet sources and other published materials.

Data collection methods were questionnaire and body composition measurement.

3.6.1. Questionnaire

A set of questionnaires' was adapted to gather information regarding the back ground of athlete's knowledge to sport nutrition and dietary intake habit. Questionnaires about nutritional knowledge and fruit and vegetable intake was adapted from (Schwartz, 2014) and National Cancer Institute Fruit and Vegetable Screener (DHHS, 2013) and questionnaire about fluid intake was adapted from (ACSM 2006). The questionnaires were close ended questions.

3.6.2. Body Composition Measurement

Body Weight Measurement

Body mass of athletes: - $(\text{BMI} = \text{weight in kilograms} / (\text{height in meters})^2)$.

Aim: - to measure body composition of the athlete.

Equipment: - Weighing scale and Meter

Techniques: - the subject is dressed down to only underwear. The subject stands on the center of the scale without 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).

Standard:-

Classification	BMI (kg/m²)	Risk of co-morbidities
Underweight	Less than 18.5	Low (but risk of other clinical problems increased)
Healthy weight	18.5–24.9	Average
Overweight (or pre-obese)	25–29.9	Increased
Obesity, class I	30–34.9	Moderate
Obesity, class II	35–39.9	Severe
Obesity, class III (severely or morbidly obese)	40 or more	Very severe

Table 3.1:- Standard for BMI

Source: National Institute for Health and Clinical Excellence, 2006, adapted from World Health Organization, 2000.

3.7. Methods of Data Analysis

SPSS statistical software version 20 was used to analyze the data. Paired sample t-test was used to investigate the difference of the pre- and post- test data. Paired sample t-test was used for pre- and post- test nutrition knowledge, pre- and post- test fruit, vegetable and fluid intake and pre- and post- BMI score. An alpha score of ≤ 0.05 was used to determine a level of statistical significance. The Linkert Three point and Linkert Five point scales were used to interpret the data in to quantitative form.

3.8. Data Quality Control

To insure data quality, all the tests, procedures, collection of data and handling information was carried out in accordance with standard protocols and fine measurements. The researcher used assistant to collect the data. To avoid errors, training was given for the assistance data collector on how to use and record data collecting instruments and measurements during data collection. Only standardized materials were used to keep the quality of the data additionally, all tests were recorded with photograph finally the data was coded and fed to software twice with different persons to avoid error in data feeding.

3.9. Research Ethics

The study was deal with the ethical issues related to the investigation. It protects the privacy of research participants and can make guarantees and confidentiality of the information that was given to the study, and risk of harm due to participation. Participation of subjects in this study was purely a voluntary activity and their right not to participate and can resign at any time of education session was respected. Therefore the study was conducted all actions based on the university rule, code of conduct and policies concerning research ethics. Ethical approval was obtained from Institutional Research Ethics Review Committee (IRERC) of Haramaya University College of health science. The protocols were approved by the university guide lines and written consent was given and informs the concerned bodies.

4. RESULT AND DISCUSSION

4.1. Attendance

There were a total of 8 weeks nutrition education meetings. The mean attendance at each session was 24 participants. The range of attendance each week was 20-30 participants.

The attendance implies that, few study subjects does not attended the education program regularly but most of the study subjects has participated the education program according to the schedule and the mean attendance at each session was around 80% with the range attendance of 66-100% each week.

4.2. Demographics

The sample consisted of 30 junior international taekwondo athletes. 15 (50%) of the participants were male and 15 (50%) of the participants were Females. The mean age of participants was 17.23 ± 1.278 years, with a range of 16-19 years and the mean grade of participants was 9.10 ± 1.094 , with the range of 7-12 grades.

Based on this information all study subjects were junior or adolescent international taekwondo athletes. Among them, 50% of the participants were male with the age of 16-19 years old and 50% of the participants were female with the age of 16-18 years old.

Mean Age of Study Subjects		
Mean	N	Std. Deviation
17.23	30	1.278

Table 4.1:- Mean Age of Study Subjects;

Mean Grade of Study Subjects		
Mean	N	Std. Deviation
9.10	30	1.094

Table 4.2:- Mean Grade of Study Subjects

Before nutrition education program most of the athletes consume foods three times in a day with minimum amount fruits, vegetables and fluid intake. But, after 8 weeks nutrition education program most of the athlete's food practice was improved in to four times in a day with enough fruits, vegetables and fluid intake.

No	Breakfast	Lunch	Snack	Dinner
1	Bread with Tea	Meat	Rice	Meat
2	<i>Injera Firfir</i>	Pasta	Vegetables	Pasta
3	Rice	Fruits	Bread with tea	<i>Misirwot</i>
4	Milk	<i>Injera with wot</i>	<i>Firfir</i>	Vegetables
5	Juice	String bean	Soups	<i>Injera with wot</i>
6	Soups	Vegetables	Fruits	Potatoes
7	Vegetables	<i>Kocho</i>	Biscuits	Soups
8	Macaroni	Juice	Soft drinks	<i>Kocho</i>
9	Egg	Honey	Juice	<i>Gomen be siga</i>
10	Fruits	<i>Shirowot</i>	-	Fruits
11	Yogurt	<i>Misirwot</i>	-	Sweet Potatoes
12	Spaghetti	<i>sigawot</i>	-	Rice
13	<i>Genfo</i>	Minstoni	-	<i>Shirowot</i>
14	<i>Dabo firfir</i>	Cheese	-	Milk
15	<i>Asanbusa</i>	Macaroni	-	Spaghetti

Table 4.3:- Athletes Food Practice Before and After the Education Program

4.3. Nutritional Knowledge

		Mean	N	Std. Deviation	Std. Error Mean
Carbohydrates are the main energy source for the athlete.	Pre	2.63	30	.718	.131
	Post	3.00	30	.000	.000
Olive oil is the best “healthy fat.	Pre	2.37	30	.765	.140
	Post	2.93	30	.254	.046
Fruits are important because they supply vitamins.	Pre	2.73	30	.583	.106
	Post	2.97	30	.183	.033
Two cups of fruit are needed daily for adolescents aged 14-19 years old	Pre	2.17	30	.747	.136
	Post	2.90	30	.305	.056
Three cups of vegetables are needed daily for adolescents aged 14-19 years old.	Pre	1.97	30	.765	.140
	Post	2.90	30	.305	.056
Fresh, frozen, and canned vegetables all have different nutrient values.	Pre	2.17	30	.950	.173
	Post	2.97	30	.183	.033
Nutrients can be destroyed if vegetables are overcooked.	Pre	2.43	30	.858	.157
	Post	3.00	30	.000	.000
It is very importance of what you eat and drink to your performance.	Pre	2.47	30	.819	.150
	Post	3.00	30	.000	.000
During exercise last longer than 1 hour, sport drinks are better than water.	Pre	2.07	30	.907	.166
	Post	2.90	30	.305	.056
During activity, thirst is an adequate guide to the need of fluids.	Pre	1.67	30	.802	.146
	Post	2.93	30	.254	.046
Dehydration can reduce performance.	Pre	2.00	30	.947	.173
	Post	2.97	30	.183	.033
Foods such as potatoes and honey are best eaten after exercise.	Pre	2.57	30	.728	.133
	Post	2.97	30	.183	.033
Protein is vital for the growth and repairing of body tissues.	Pre	2.77	30	.568	.104
	Post	3.00	30	.000	.000

About 20 - 25% of calories in the diet should be provided by fat.	Pre	1.93	30	.691	.126
	Post	2.73	30	.450	.082
A sound nutritional practice for athletes is to eat a wide variety of different food types from day to day.	Pre	2.27	30	.868	.159
	Post	2.97	30	.183	.033
The type of food an athlete eats affects his/her performance.	Pre	2.13	30	.937	.171
	Post	3.00	30	.000	.000
Learning about nutrition is important to improve athlete's knowledge about healthy eating.	Pre	2.83	30	.531	.097
	Post	3.00	30	.000	.000
Learning facts about nutrition is the best way to achieve favourable changes in food habits.	Pre	2.77	30	.568	.104
	Post	3.00	30	.000	.000

Table 4.4: - Paired Sample Statistics for nutrition knowledge

The nutrition knowledge questionnaire consisted of 18 multiple choice questions. The mean score prior to the nutrition education was 2.33 ± 0.764 (77.6%). The mean score after the nutrition education was 2.95 ± 0.154 (98.3%). A paired sample T-test was conducted to measure if the nutrition education program changed nutrition knowledge. Mean score improved 20.7% after the nutrition education program. The change was statistically significant (Sig = 0.011).

As result of this, we can conclude from the information gathered and analyzed concerns about nutrition knowledge of the athletes, after exposure to an eight weeks nutrition education program, nutrition knowledge of junior international taekwondo athletes improved by mean score of 0.62 or around 20.7%. This improvement was statistically significant ($p=0.011$).

Researchers concluded the need for smaller, more intimate group settings for nutrition education to be effective in young athletes (Reading, 1999). According to the result obtained from this study, nutrition education is important to improve athlete's nutrition knowledge.

Mean nutrition knowledge (N=30)			
Score	Before Education	After Education	Sig.
	2.33	2.95	.011

Table 4.5:-Mean nutrition knowledge

4.4. Fruit and Vegetable Intake

		Mean	N	Std. Deviation	Std. Error Mean
100% Juice such as orange, apple or grape.	Pre	2.73	30	.907	.166
	Post	3.57	30	.728	.133
Banana, Avocado, papaya or Mango.	Pre	2.90	30	1.242	.227
	Post	4.03	30	.669	.122
Any other fresh or canned fruits.	Pre	2.40	30	1.163	.212
	Post	3.63	30	.890	.162
Vegetable Juice like tomato or carrot Juice.	Pre	1.87	30	1.306	.238
	Post	2.93	30	.980	.179
Green salad	Pre	1.60	30	1.070	.195
	Post	3.03	30	1.033	.189
Vegetable soups as tomato or minestrone juice.	Pre	1.83	30	1.392	.254
	Post	2.80	30	.925	.169
Any other vegetable like string bean, peas, corn or broccoli.	Pre	2.53	30	1.167	.213
	Post	3.43	30	.858	.157

Table 4.6: - Paired Sample Statistics for fruit and vegetable intake

The fruit and vegetable questionnaire consisted of 7 questions. The mean score prior to the nutrition education was 2.26 ± 1.178 (45.2%). The mean score after the nutrition education was 3.34 ± 0.869 (66.8%). A paired sample T-test was conducted to measure if the nutrition education program changed fruit and vegetable intake. Mean score improved 21.6% after the nutrition education program. The change was statistically significant (Sig = 0.0001).

As indicate below on table 4.7, after 8 weeks nutrition education program athlete's fruit and vegetable intake was improved by mean of 1.08 or about 21.6%. This improvement was statistically significant ($p=0.0001$). Before the nutrition education program the athletes consume minimum amount of fruits and vegetables.

Nutrition education programs for athletes might have the potential to close the gap between diet recommendations and individual food intake (Abood *et al.*, 2004). Therefore, this study supports the above idea and depends on the result, nutrition education has a potential to improve athletes dietary intake.

Mean Fruit and Vegetable Intake (N=30)			
Score	Before Education	After Education	Sig.
	2.26	3.34	.0001

Table 4.7:-Mean fruit and vegetable intake

4.5. Fluid Intake

		Mean	N	Std. Deviation	Std. Error Mean
I drink approximately 2 litres of water daily	Pre	2.10	30	.845	.154
	Post	2.83	30	.461	.084
I drink approximately 2 to 3 cups of water 2 hr before exercise	Pre	1.90	30	.995	.182
	Post	2.97	30	.183	.033
I drink approximately 1 to 2 cups of water 15 minutes before exercise	Pre	1.53	30	.860	.157
	Post	2.87	30	.346	.063
I drink approximately 1 to 1.5 cups of water every 15 minutes during exercise	Pre	1.13	30	.434	.079
	Post	2.57	30	.679	.124
I drink approximately 2 to 3 cups of water immediately after exercise	Pre	2.50	30	.777	.142
	Post	2.93	30	.254	.046

Table 4.8: - Paired Sample Statistics for fluid intake

The fluid intake questionnaire consisted of 5 questions. The mean score prior to the nutrition education was 1.83 ± 0.782 (61%). The mean score after the nutrition education was 2.83 ± 0.384 (94.3%). A paired sample T-test was conducted to measure if the nutrition education program changed fluid intake. Mean score improved 33.3% after the nutrition education program. The change was statistically significant (Sig = 0.0001).

Based on the information analyzed above, one can conclude that after 8 week nutrition education program athlete's fluid intake was improved by mean of 1 or about 33.3%. This improvement was statistically significant (P=0.001). Before the nutrition education program the athletes consume minimum amount of fluids daily, before, during as well as after exercise.

According to the positions of the American College of Sports Medicine (ACSM), the American Dietetic Association (ADA), and the Dieticians of Canada (DC) athletes should hydrate before, during and after exercise to improve their athletic performance (Joint Position, 2009). From the analysis made, before the education program the athletes were drink not that much enough water daily, before and after exercise and none of the athletes experienced in drink water during training. After the nutrition education program the athlete's fluid intake was completely changed or improved.

Mean Fluid Intake (N=30)			
Score	Before Education	After Education	Sig.
	1.83	2.83	.001

Table 4.9:-Mean fluid intake

4.6. Body Mass Index

		Mean	N	Std. Deviation	Std. Error Mean
Body Mass Index	Pre	19.953	30	2.3563	.4302
	Post	20.040	30	2.1639	.3951

Table 4.10: - Paired Sample Statistics for Body Mass Index

BMI was calculated for each study subjects before and after the education program. The mean BMI for participants prior to the education was $19.9 \text{ kg/m}^2 \pm 2.3$. Eight participants (26.6%) were classified as underweight (BMI > 18.5), Twenty-one participants (70%) were classified as normal weight (BMI 18.5-24.9) and One participant (3.3%) was classified as overweight (BMI 25-29.9). The mean BMI for participants after the nutrition education program was $20.0 \text{ kg/m}^2 \pm 2.1$. Seven participants (23.3%) were classified as underweight (BMI > 18.5), Twenty-Two participants (73.3%) were classified as normal weight (BMI 18.5-24.9) normal weight and One participant was classified as overweight (BMI 25-29.9). A paired sample T-test was conducted to measure the change in BMI as a result of the nutrition education program. Mean BMI increased 0.09 however this improvement was not statistically significant (Sig= 0.369).

Mean Body Mass Index (N=30)			
	Before Education	After Education	Sig.
Score	19.95	20.04	.369

Table 4.11:-Mean Body Mass Index

As a result of this, after 8 week nutrition education program athlete's Body Mass Index was improved by mean of 0.09. This improvement was statistically not significant (p=0.369).

5. SUMMARY AND CONCLUSION

5.1. Summary and Conclusion

The main objective of this study was to assess the effect of 8 weeks nutrition education program on knowledge of sport nutrition, selected dietary intake and body composition among junior international taekwondo athletes in Western Guji Zone Bule Hora Town. This research mainly focuses on Western Guji Zone Bule Hora Town junior international taekwondo athletes to examine their sport nutrition knowledge, dietary intake and fluid intake experiences before, during and after training and their body mass index.

In order to achieve the objective of the study the following basic research questions were answered:

- What was the relationship between nutritional knowledge and dietary intake among junior international taekwondo athletes?
- How was junior international taekwondo athlete's baseline nutritional knowledge?
- What effect eight week nutritional education bring on sport nutrition knowledge, dietary intake and body composition of junior international taekwondo athletes?

In this study the researcher used single group research design or pre - post study design. The Stratified simple random sampling method was employed in this study. The subjects of this study were 30 junior international taekwondo athletes, of this 15 were males and the rest 15 were females.

In order to collect the adequate and reliable data the researcher used questioners (Closed-ended) and body composition measurement and document analysis were employed as data gathering tools. In attempt to address the basic research questions different literatures and documents were referred.

After data gathered through questioner, the information were analyzed and interpreted with SPSS version 20. The findings of the study were summarized as follows:

- The first basic research question for this study was, what was the relationship between nutritional knowledge and dietary intake among junior international taekwondo athletes. It was concluded that, there is a great relationship between nutritional knowledge and dietary intake among athletes because to improve

athletes dietary intake athletes should have to know what to eat, why to eat, how much to eat, how often to eat and when to eat. This can be achieved by providing proper nutrition education program for the athletes.

- The second basic research question for this study was how baseline nutrition knowledge of junior international taekwondo athletes is. It was concluded that baseline nutrition knowledge of junior international taekwondo athletes was medium. Of the 30 international taekwondo athletes that completed the nutrition knowledge questionnaire, the mean score was 77.6%.
- The third basic research question for this study was designed to indicate whether a nutrition education among junior international taekwondo athletes improves knowledge of sport nutrition, selected dietary intake and body composition. This was summarized as follow:
 - ✓ After 8 weeks nutrition education program most of the athlete's food practice was improved in to four times in a day with enough fruits, vegetables and fluid intake.
 - ✓ After exposure to an eight weeks nutrition education program, sport nutrition knowledge of junior international taekwondo athletes improved by mean score of 0.62 or around 20.7%.
 - ✓ After 8 weeks nutrition education program athlete's fruit and vegetable intake was improved by mean of 1.08 or about 21.6%.
 - ✓ After 8 week nutrition education program athlete's fluid intake was improved by mean of 1 or about 33.3%.
 - ✓ After 8 week nutrition education program athlete's Body Mass Index was improved by mean of 0.09.

Optimal nutrition is essential for peak performance. Now, more than ever athletes need accurate sport nutrition information. By supporting this point (Lippineot and Wilking, 2011) elaborates as optimal nutrition is an integral part of peak performance while an inadequate diet and lack of fuel can limit an athlete's potential for maximum performance. This can be achieved by providing proper nutrition education program for the athletes.

5.2. Recommendations

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

- Nutrition Education should be incorporated into training activities of international taekwondo athletes. The athletes should be encouraged to complete the education as they would have better understanding of nutrition and other factors related. This activity should include educating the managers, coaches and other officials who will then pass the knowledge to the athletes as they come.
- Careful consideration should be taken when developing a nutrition education program for adolescent athletes. Coaches and parents should be more intimately involved due to their substantial role for facilitating change.
- The athletes should have to know their body composition regularly to prevent the known health implication associated with underweight or overweight.
- Increasing the emphasis on nutrition among athletes leads to the improvement of body composition. Therefore, athletes should have to give great emphasis for nutrition and balanced diet.
- More research should be conducted and a different method of reporting be conducted such as focus groups to ensure accurate information and data.

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7. APPENDICES

Appendix I

Pre Nutrition Education Program Questionnaire to be filled by Athletes

Date: _____

Instructions

Please read each question carefully and, to the best of your ability, answer each one honestly and with what you believe to be is the correct answer. Please only select one answer for each question.

Part I: Demographics

- 1) How old are you _____
- 2) Sex _____
- 3) Grade _____
- 4) Food practices

Breakfast	Lunch	Snack	Dinner

Table 7.1:- Pre Food Practice Completing Table

Part II: Nutrition Knowledge

1. Carbohydrates are the main energy source for the athlete.

- A. True B. False C. Not sure

2. Olive oil is the best “healthy fat”.

- A. True B. False C. Not sure

3. Fruits are important because they supply vitamins.

- A. True B. False C. Not sure

4. Two cups of fruit are needed daily for adolescents aged 14-19 years old?
- A. True B. False C. Not sure
5. Three cups of vegetables are needed daily for adolescents aged 14-19 years old?
- A. True B. False C. Not sure
6. Fresh, frozen, and canned vegetables all have different nutrient values
- A. True B. False C. Not sure
7. Nutrients can be destroyed if vegetables are overcooked.
- A. True B. False C. Not sure
8. It is very importance of what you eat and drink to your performance?
- A. True B. False C. Not sure
9. During exercise last longer than 1 hour, sport drinks are better than water.
- A. True B. False C. Not sure
10. During activity, thirst is an adequate guide to the need of fluids.
- A. True B. False C. Not sure
11. Dehydration can reduce performance.
- A. True B. False C. Not sure
12. Foods such as potatoes and honey are best eaten after exercise.
- A. True B. False C. Not sure
13. Protein is vital for the growth and repairing of body tissues.
- A. True B. False C. Not sure
14. About 20 - 25% of calories in the diet should be provided by fat.
- A. True B. False C. Not sure

15. A sound nutritional practice for athletes is to eat a wide variety of different food types from day to day.

A. True

B. False

C. Not sure

16. The type of food an athlete eats affects his/her performance.

A. True

B. False

C. Not sure

17. Learning about nutrition is important to improve athlete's knowledge about healthy eating.

A. True

B. False

C. Not sure

18. Learning facts about nutrition is the best way to achieve favourable changes in food habits.

A. True

B. False

C. Not sure

Source: (Schwartz, 2014), Nutrition Knowledge Questions.

Part III: Fruit and Vegetable Intake

Please think about your eating habit over the past month. About how often do you eat each of the following foods? Remember breakfast, lunch, dinner, snacks and eating out. Choose the best one from the given alternatives.

No.	Fruit and Vegetable intake	Never	Very Rarely	Rarely	Occasionally	Very Frequently
1	100% Juice such as orange, apple or grape.					
2	Banana, Avocado, papaya or Mango.					
3	Any other fresh or canned fruits.					
4	Vegetable Juice like tomato or carrot Juice.					
5	Green salad.					
6	Vegetable soups as tomato or minestrone juice.					
7	Any other vegetable like string bean, peas, corn or broccoli.					

Table 7.2:- Pre Fruit and Vegetable Intake Questionnaires

Source: National Cancer Institute Fruit and Vegetable Screener (DHHS, 2013).

Part IV: Fluid Intake

Please think about your fluid intake habit daily, before, during and after exercise over the past month. Choose the best one from the given alternatives.

No.	Fluid intake	Yes	No	Not Sure
1	I drink approximately 2 litres of water daily			
2	I drink approximately 2 to 3 cups of water 2 hr before exercise			
3	I drink approximately 1 to 2 cups of water 15 minutes before exercise			
4	I drink approximately 1 to 1.5 cups of water every 15 minutes during exercise			
5	I drink approximately 2 to 3 cups of water immediately after exercise			

Table 7.3:- Pre Fluid Intake Questionnaires

Source: American Collage of Sport medicin (ACSM, 2006).

“Thank You for Taking Time to Respond”

Part V: Body Composition

Pre Body Mass Index Measurement of the study subjects.

No.	Kg	M ²	BMI	Classification
Sample 1				
Sample 2				
Sample 3				
Sample 4				
Sample 5				
Sample 6				
Sample 7				
Sample 8				
Sample 9				
Sample 10				
Sample 11				
Sample 12				
Sample 13				
Sample 14				
Sample 15				
Sample 16				
Sample 17				
Sample 18				
Sample 19				
Sample 20				
Sample 21				
Sample 22				
Sample 23				
Sample 24				
Sample 25				
Sample 26				
Sample 27				
Sample 28				
Sample 29				
Sample 30				

Table 7.4:- Pre Body Mass Index Recording Sheet

4. Two cups of fruit are needed daily for adolescents aged 14-19 years old?
- A. True B. False C. Not sure
5. Three cups of vegetables are needed daily for adolescents aged 14-19 years old?
- A. True B. False C. Not sure
6. Fresh, frozen, and canned vegetables all have different nutrient values
- A. True B. False C. Not sure
7. Nutrients can be destroyed if vegetables are overcooked.
- A. True B. False C. Not sure
8. It is very importance of what you eat and drink to your performance?
- A. True B. False C. Not sure
9. During exercise last longer than 1 hour, sport drinks are better than water.
- A. True B. False C. Not sure
10. During activity, thirst is an adequate guide to the need of fluids.
- A. True B. False C. Not sure
11. Dehydration can reduce performance.
- A. True B. False C. Not sure
12. Foods such as potatoes and honey are best eaten after exercise.
- A. True B. False C. Not sure
13. Protein is vital for the growth and repairing of body tissues.
- A. True B. False C. Not sure
14. About 20 - 25% of calories in the diet should be provided by fat.
- A. True B. False C. Not sure

15. A sound nutritional practice for athletes is to eat a wide variety of different food types from day to day.

A. True

B. False

C. Not sure

16. The type of food an athlete eats affects his/her performance.

A. True

B. False

C. Not sure

17. Learning about nutrition is important to improve athlete's knowledge about healthy eating.

A. True

B. False

C. Not sure

18. Learning facts about nutrition is the best way to achieve favourable changes in food habits.

A. True

B. False

C. Not sure

Source: (Schwartz, 2014), Nutrition Knowledge Questions.

Part III: Fruit and Vegetable Intake

Please think about your eating habit over the past month. About how often do you eat each of the following foods? Remember breakfast, lunch, dinner, snacks and eating out. Choose the best one from the given alternatives.

No.	Fruit and Vegetable intake	Never	Very Rarely	Rarely	Occasionally	Very Frequently
1	100% Juice such as orange, apple or grape.					
2	Banana, Avocado, papaya or Mango.					
3	Any other fresh or canned fruits.					
4	Vegetable Juice like tomato or carrot Juice.					
5	Green salad.					
6	Vegetable soups as tomato or minestrone juice.					
7	Any other vegetable like string bean, peas, corn or broccoli.					

Table 7.6:- Post Fruit and Vegetable Intake Questionnaires

Source: National Cancer Institute Fruit and Vegetable Screener (DHHS, 2013).

Part IV: Fluid Intake

Please think about your fluid intake habit daily, before, during and after exercise over the past month. Choose the best one from the given alternatives.

No.	Fluid intake	Yes	No	Not Sure
1	I drink approximately 2 litres of water daily			
2	I drink approximately 2 to 3 cups of water 2 hr before exercise			
3	I drink approximately 1 to 2 cups of water 15 minutes before exercise			
4	I drink approximately 1 to 1.5 cups of water every 15 minutes during exercise			
5	I drink approximately 2 to 3 cups of water immediately after exercise			

Table 7.7:- Post Fluid Intake Questionnaires

Source: American Collage of Sport medicin (ACSM, 2006).

“Thank You for Taking Time to Respond”

Part V: Body Composition

Post Body Mass Index Measurement of the study subjects.

No.	Kg	M ²	BMI	Classification
Sample 1				
Sample 2				
Sample 3				
Sample 4				
Sample 5				
Sample 6				
Sample 7				
Sample 8				
Sample 9				
Sample 10				
Sample 11				
Sample 12				
Sample 13				
Sample 14				
Sample 15				
Sample 16				
Sample 17				
Sample 18				
Sample 19				
Sample 20				
Sample 21				
Sample 22				
Sample 23				
Sample 24				
Sample 25				
Sample 26				
Sample 27				
Sample 28				
Sample 29				
Sample 30				

Table 7.8:- Post Body Mass Index Recording Sheet

Appendix III

Nutrition Education Program Outline

No.	Week	Day	Duration	Contents
1	One	Tuesday	1 Hour	Nutrition and Nutrients
		Thursday	1 Hour	Balanced Diet
		Saturday	1 Hour	Revision and Discussion
2	Two	Tuesday	1 Hour	Nutrition and exercise
		Thursday	1 Hour	Energy
		Saturday	1 Hour	Revision and Discussion
3	Three	Tuesday	1 Hour	Carbohydrate
		Thursday	1 Hour	Protein
		Saturday	1 Hour	Revision and Discussion
4	Four	Tuesday	1 Hour	Fat
		Thursday	1 Hour	Hydration
		Saturday	1 Hour	Revision and Discussion
5	Five	Tuesday	1 Hour	Dehydration
		Thursday	1 Hour	Pre exercise nutrition
		Saturday	1 Hour	Revision and Discussion
6	Six	Tuesday	1 Hour	During exercise nutrition
		Thursday	1 Hour	Post exercise nutrition
		Saturday	1 Hour	Revision and Discussion
7	Seven	Tuesday	1 Hour	Body Composition
		Thursday	1 Hour	Measurements of body composition
		Saturday	1 Hour	Revision and Discussion
8	Eight	Tuesday	1 Hour	History of Taekwondo sport
		Thursday	1 Hour	Nutrition for Taekwondo athletes
		Saturday	1 Hour	Revision and Discussion

Table 7.9:- Nutrition Education Program Outline

Appendix IV

Description about the Three Taekwondo Training Centers Found In Bule Hora Town

1. Ayu International Taekwondo Training Center

This training center is nongovernmental International Taekwondo Training Center and established in 2014 G.C. Subunim Ayub Tahir is the owner and coach of the training center and he had 1st Dan coaching certificate from Ethiopian International Taekwondo Federation. Since, there are about 80 athletes train in this training center.

2. Peacock International Taekwondo Training Center

This is also nongovernmental International Taekwondo Training Center and established in 2013 G.C. Subunim Gemechis Amente is the owner and coach of the training center and he had 2nd Dan Coaching certificate from Ethiopian International Taekwondo Federation. Since, there are about 90 athletes train in this training center.

3. Keyre International Taekwondo Training Center

It is another nongovernmental International Taekwondo Center found in Bule Hora town and established in 2010 G.C. Subunim Keyredin Nesro is the owner and coach of the training center and he had 2nd Dan coaching certificate from Ethiopian International Taekwondo Federation. Since, there are about 70 athletes train in this training center.

Appendix V

Sample Pictures While Study Subjects Attending Nutrition Education Program and Taking Height and Weight Measurement.





Appendix VI

Map of the Study Site

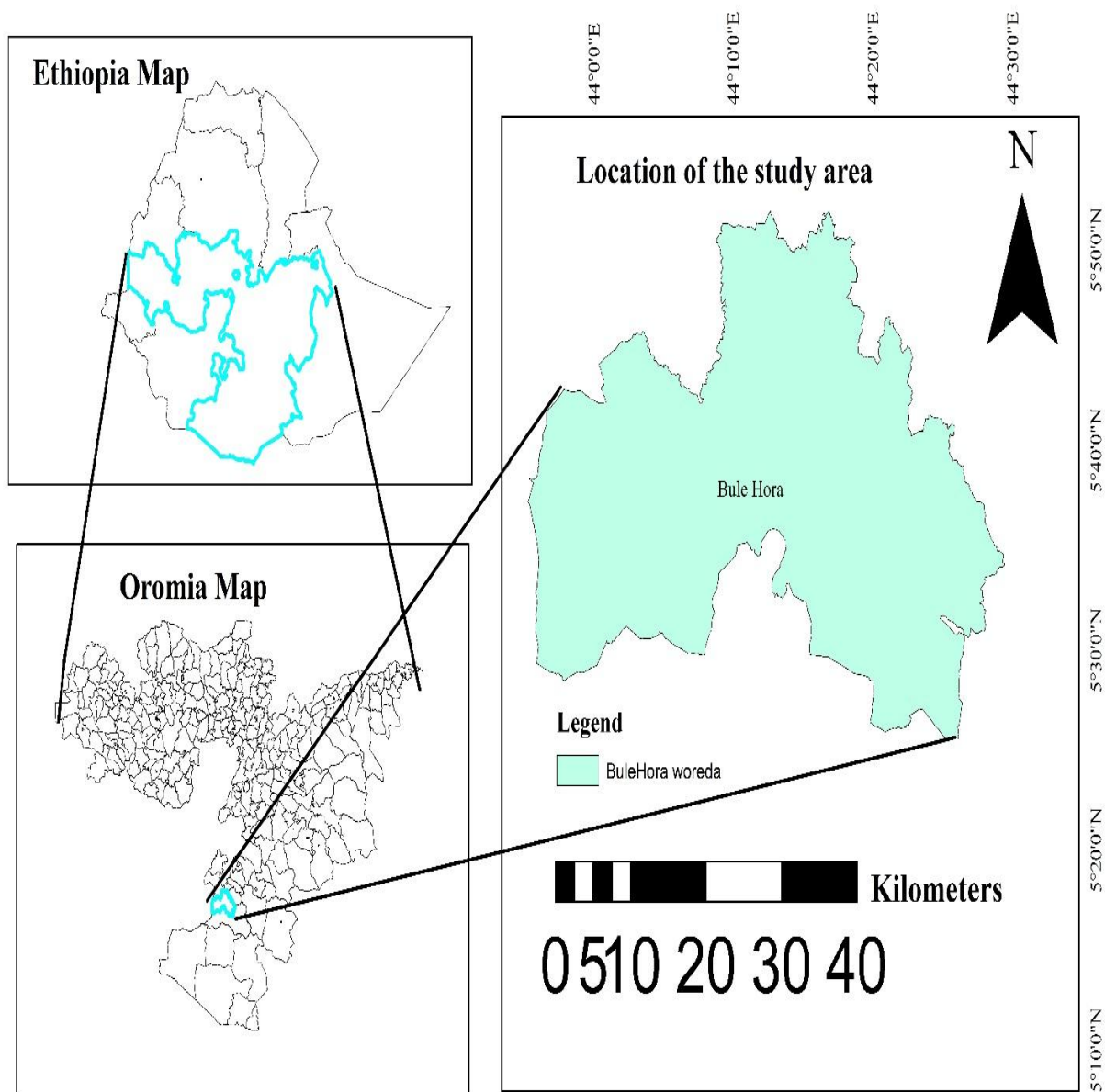


Figure 7.1:- Map of the Study site

Source: Map draw from geographical information system (ARC GIS) version 10.1.