EFFECT OF TURMERIC SUPPLEMENT ON MAXIMUM OXYGEN INTAKE AND LACTATE THRESHOLD IN CASE OF THIRD YEAR SPORT SCIENCE STUDENTS OF DEBER BIRHAN UNIVERSITY; NORTH SHOWA ZONE, AMHARA REGIONAL STATE, ETHIOPIA.

MSc THESIS

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NOVEMBER, 2018

HARAMAYA UNIVERSITY, HARAMAYA

Effect of Turmeric Supplement on Maximum Oxygen Intake and Lactate Threshold in Case of Third Year Sport Science Students of Deber Birhan University; North Showa Zone, Amhara Regional State, Ethiopia.

A Thesis Submitted to Department of Sport Science
Postgraduate Program Directorate
Haramaya University

In Partial Fulfillment of the Requirements for the Degree of
MASTER OF SCIENCE IN SPORT NUTRITION

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November, 2018
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As a research Advisor, I hereby certify that I have read and evaluated this thesis entitled **Effect of Turmeric Supplement on Maximum Oxygen Intake and Lactate Threshold in Case of Third Year Sport Science Students of Deber Birhan University; North Showa Zone, Amhara Regional State, Ethiopia** Prepared by Mrs. **Sosina Tamene Tegegne** I recommend that it can be submitted as fulfilling the thesis requirements.

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DEDICATION

This thesis manuscript is dedicated to my Husband, Kirubile Shiferaw who had committed with strong prayer for the betterment and 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 the Thesis. Any scholarly matter that is included in the Thesis has been recognition through citation.

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BIOGRAPHICAL SKETCH

The Author was born in East Gojjam, Banja Town in July 1992 from her Father, Tamene Tegegne and her Mother Belaynesh Shiferawu. She completed her primary school education in Kesa and her secondary school and preparatory education at Tillie Preparatory School. After successfully passing the Ethiopian Higher Education Entrance Examination (EHEEE), she joined Debre Birhan University in 2013 and graduated in 2015 with BSc Degree in Sport Science. After her graduation, she was employed in Deber Birhan University as Graduate Assistant for one year and in 2016/17 she joined Haramaya, University Sport Science Academy to pursue her postgraduate studies in Sport Nutrition.

ACKNOWLEDGEMENTS

No one is like you, the Almighty God. Thank you for giving me the chance, courage and strength to enjoy the fruits of my endeavor and to overcome all the problems.

I am grateful to my Major Advisor Dr. Desta Enyew, \Assistant professor\ and Co-Advisor Dr. Shemelis Mekonnen, \Assistant professor\ for their willingness to advise and guiding me from the very beginning of the proposal development up to the successful accomplishment of the actual research. My special thanks also go to all Debre Birhan University Sport Science and Haramaya University sport science academy staffs for their moral encouragement and giving valuable suggestions by reading the research proposal, support in data collection and management.

Words fail to convey my deepest thanks to all Debre Birhan University 3rd year Sport Science students those who have participated in my research as study subjects. Special thanks to my friend's sister Alemnshe Mekonnen, Huluager Abebe and Elsabet Gebeyehu with her family for their unforgettable and consistent encouragement.

I would like to express my gratitude to my Father, Tamene Tegegne, husband Kirubile Shiferaw and all friends without their support my research work could not be achievable.

ACRONYMS AND ABBREVIATIONS

ATP	Adenosine Triphosphate
AV-O_2	Arteriovenous Oxygen
CO	Cardiac Output
DBU	Debre Berhan University
DNA	Deoxyribonucleic Acid
HIIT	High Intensity Interval Training
LDL	Low Density Lactate
LSDR	Long Slow Distance Running
LT	Lactate Threshold
MD	Mean Difference
MHR	Maximum Heart Rate
MLSS	Maximum Lactate Steady State
PoT	Post- test
PT	Per –test
ROS	Reactive Oxygen Species
SSPS	Statistical Package For Social Sciences
VO_2 MAX	Maximum Oxygen Intake

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Effect of Turmeric Supplement on Maximum Oxygen Intake and Lactate Threshold in Case of Third Year Sport Science Students of Deber Birhan University; North Showa Zone, Amhara Regional State, Ethiopia.

ABSTRACT

The purpose of this study was to investigate the effect of 8-week turmeric supplement combined with aerobic exercise on VO_2max and lactate threshold of third year sport science students of Debre Birhan University. Thirty-two (32) under graduate third year sport science students free from any health problems, with age group between 20 – 25 years were selected by random sampling technique from the total population of 59. Hence, only 32 subjects were complete the study and purposive sampling was used to select sex and department of subjects in relation with the study site. The selected subjects were divided into 2 groups i.e. control (16) and experimental (16) groups randomly each group consisting 16 students (8 males and 8 females). The experimental group of the subjects underwent 8 weeks' turmeric supplement within aerobic excises, three days per week and the duration was 45-minutes while, the control group continued with only aerobics excises for 8 weeks, three days per week for 45-miuntes. Pre-test, and post tests were conducted on both variables such as12 minutes cooper test and 30-minutes time trial test each subject was tested at the same time of day. The data collected from subjects were analyzed by SPSS version 20.0 and the comparison of mean value results was carried out by paired sample t-test. The level of significance was $p<0.05$. The finding of the present study showed 12 miunte cooper test from pre to post test was showed significant change for experimental group (Mean Difference 6.75) for *male and (MD5.37) for female in experimental group and little change for control group (MD ,0.5) for male and (MD,0.5) for female in control group, also 30 miunte time trial test pre to post test showed significant change (MD,* 6.76*) for male and (MD,4.93) for female in experimental group and little change showed (MD,0.43) for male and (MD ,0.43) for female in control group. So this study concluded that 8-weeks turmeric consumption in combined aerobic exercise have a positive effect on improving of vo2max and lactate threshold of sport science students of DBU. Based on the above test result alterative hypothesis was accepted while, null hypothesis was rejected.*

Key words; Turmeric supplement, Aerobic exercise, Maximum oxygen intake, Lactate threshold

1. INTRODUCTION

1.1. Background of the Study

Sports science is a discipline that studies how the healthy human body works during exercise, and how sport and physical activity promote health from cellular to whole body perspectives. Nutritional ergogenic aids are aimed primarily at enhancing performance (either by affecting energy metabolism or by an effect on the central nervous system), at increasing lean body mass or muscle mass by stimulation of protein synthesis and at reducing body fat content (Thein *et al*., 1995). Ergogenic aids are any substance or phenomenon that enhances performance. Excellent physique and good psychological health are important for performance in sport. Previous study has reported the use of ergogenic aids combined with training, mechanical device, nutritional practice, pharmacological approach, or physiological technique to improve sports performance. (Porrini and Del Bo, 2016).

All athletes want to reach their peak performance in order to gain a highest achievement from all competition they compete in sport. Therefore, utilizing ergogenic aids as an agent to enhance their performance is necessary. In fact, some ergogenic substances or phenomena's actually can impair performance. These are usually drugs that some people believe that it has any side effect as a consequence of the utilization. Hence, using a natural food as an ergogenic aid is more suggested. Because, not only the nutritional contents but also it is valuable to our health. Despite of natural food (e.g. fruits and vegetables), it has been thoughtfully considered that spices also have an ergogenic effect. And one of them is turmeric. Turmeric (the common name for Curcuma longa) is an Indian spice derived from the rhizomes of the plant and has a long history of use in Ayurvedic medicine as a treatment for inflammatory conditions. Turmeric is a plant and it is a spice and has a warm, bitter taste and is frequently used to flavor or color curry powders, mustards, butters, and cheeses. (Kenney *et al*, 2011.)

Lactate threshold is the point in exercise intensity at which blood lactate concentrations rise exponentially. Lactate threshold has been identified in research as the best predictor of running or endurance performance (McGehee, 2005).

It is one of the more important measurements that will be obtained during testing of an endurance athlete. Lactate threshold is obtained are probably the most important to remember when planning training the lactate Threshold is also very valuable relative to training and competition. Training at the threshold has been found to improve performance and the capacity of the aerobic system. Interval training and "over distance" training should thus consider the running speed at which the lactate threshold is attained. (Allen *et al.*, 1985*).*

Maximal oxygen consumption, also known as VO_2max, has long been considered the "gold-standard" for determining cardiorespiratory fitness level. During exercise, increase in metabolism is expressed as the whole-body oxygen uptake that increases with exercise intensity to reach a maximum (VO_2max). VO_2max is the maximum volume of oxygen that the body can consume during intense, whole-body exercise. As exercise intensity increases so does oxygen consumption. (Saltine and Åstrand 1967; Rusko *et al*., 1978). In this manner, this study aims to evaluate the effect of turmeric consumption on cardiorespiratory endurance performance and lactate threshold. Therefore, the researcher was hypothesizing that the consumption of turmeric supplement in combined with exercise on improving maximal oxygen intake and lactate threshold of the subjects.

1.2. Statements of the Problem

Turmeric is horticultural plant that many of it has grown in some region of Asia. Besides the nutritional content of turmeric has also a typical chemical substance named curcumin (Davis et *al.,* 2007*).* Through the research, some experts have proved the advantage of turmeric, those findings prove that cur cumin has many advantages which can support physiological aspects during or post exercise. Physiological aspects which related to sport or exercise are much Several of it are VO_2Max and Lactate Threshold (LT). As we know that VO_2Max is the maximal capacity for oxygen consumption by the body during maximal exertion (Kenney *et al.,* 2011*).* It is also known as aerobic power, maximal oxygen intake, maximal oxygen consumption, and cardiorespiratory endurance capacity" and LT is "the point during exercise of increasing intensity at which blood lactate begins to accumulate above resting levels, where lactate clearance is no longer able to keep up with lactate production" Consequently, plenty of studies have completed to figure out the effect of various type of ergogenic aids to the improvement of VO_2ax and LT (Takahashi *et al.*,2014).

Turmeric found in our country especially in southern Ethiopia. Most of the time Ethiopian. People use turmeric as a form of powder than supplement and they use its powder as a color of food. In addition, they do not know its nutritional value in improving athletic performance and medical purposes for health. And also turmeric for sport performances peoples is used as ergogenic aid not only turmeric but also their different types of supplement like carbohydrate, protein and vitamin etc. beneficial for performance. Ray Hamidie (2017) was conduct on effect of turmeric consumption on maximum oxygen uptake and lactate threshold in case of sport sciences student athletes of Indonesia. but the result was not significant because of the treatment time duration was short i.e. only four weeks. So, he recommended duration of time may increase i.e. from 6 to 8 weeks, it influences on aerobic exercise in order to gain the best result for improving cardiorespiratory endurance but this hypothesis has not yet been tested. As a result, conducting this study is necessary to test the hypothesis and to see the effect of the supplement on athletic performance by maximizing treatment time duration practically as well as to minimize the gap. Also, in our country especially in DBU research was not conducted at this area. Hence, the investigator of this study planned to conduct a research on this area. As a result, this study was expected to investigate the effect of turmeric supplement on VO_2 max and Lactate threshold of 3rd year sport science student of DBU.

Research Hypothesis: (H0 =Null Hypothesis H1= Alternative)

H^0: Turmeric consumption has no significant effect on VO_2Max of 3rd year Sport Science Students of Deber Birhan University.

H^0: Turmeric consumption has no significant effect on LT of 3rd year sport science students of Deber Birhan University.

H^0: Turmeric consumption has the same effect on male and female of 3rd year sport science students of Deber Birhan University.

1.3. Scope of the Study

This study was conducted on 3rd year sport science students of DBU with the aim of examining the effect of turmeric supplement in combined with aerobic exercise on VO_2max and lactate threshold. This study was only focus on turmeric supplement combined with aerobic exercise. Thus from this consumption of turmeric the study was use exercises which help to improve VO_2max and lactate threshold of 3rd year Sport Science Students of DBU.

1.4. Significance of the Study

The finding of this study was helpful to fill the gap of research on this area in our country especially in DBU. The output of the study was also beneficial to examine the effect of eight weeks' turmeric consumption on VO_2 max and lactate threshold of 3rd year sport science students of DBU. It helps to maximize additional knowledge about supplement for coach, sport or exercise science professionals and sport sciences students. Also, it helps to understand whether turmeric supplement has effect before exercise has significant difference on Vo_2 max and lactate threshold or not. If the study does show any negative result they were remove turmeric intake before training. On the other hand, the study was show significance result the subject was use turmeric as an ergogenic aid to boost their endurance performance. On this study the test result was significant. From this understanding the researcher was motivated to contribute her own finding on the effect of turmeric supplement in combined with exercise on VO_2max and lactate Threshold. Mover ever, this study was also expected to give basis or hint for future investigation to any interested researcher in this area.

1.5. Objective of the study

1.5.1. General objective

The general objective of this study was to examine the effect of turmeric supplement on maximum oxygen intake and lactate threshold of Sport Science students.

1.5.2. Specific objective

1. To examine the effect of turmeric supplement on VO_2Max of 3rd year Sport Science Students of Deber Berhan university.
2. To examine the effect of turmeric supplement on LT of 3rd year Sport Science Students of Deber Berhan university.
3. To compare the effect of turmeric supplement on male and female of 3rd year Sport Science Students of Deber Berhan University.

2. RELATED REVIEW LITERATURE

This chapter was discussing current studies on the topic of effects of effect of turmeric consumption on maximum oxygen intake and lactate threshold. Subject matter to be addressed was include nature of turmeric, composition of turmeric vo_2 max improving training, normal value of VO_2 max, and training of VO_2 max and lactate threshold influence factor. In addition, medical purposes of turmeric and nutritional values of turmeric and dosage was addressed in the main part of the research.

2.1. Turmeric

Turmeric is a mild digestive, being aromatic, a stimulant and a carminative. The active ingredient in turmeric is curcumin. Turmeric has been used for over 2500 years in India, where it was most likely first used as a dye. The medicinal properties of this spice have been slowly revealing themselves over the centuries. Long known for its anti-inflammatory properties, recent research has revealed that turmeric is a natural wonder, proving beneficial in the treatment of many different health conditions from cancer to Alzheimer's disease. An ointment base on the spice is used as an antiseptic in India. Turmeric water is an Asian cosmetic applied to impart a golden glow to the complexion. (Ammon, *et al.,* 1991)**.** Turmeric has long been used in both Ayurveda and Chinese medicine as an anti-inflammatory, to treat digestive and liver problems, skin diseases, and wounds. The curcumin in turmeric has been shown to stimulate the production of bile by the gallbladder. Curcumin is also a powerful antioxidant; antioxidants scavenge damaging particles in the body known as free radicals, which damage cell membranes, tamper with DNA, and even cause cell death. Antioxidants can neutralize free radicals and may reduce or even help prevent some of the damage they cause. (Miyazawa, 2001).

Use of cur cumin as a folk remedy continues today. As part of the ancient Indian medical system, Ayurveda, a poultice of turmeric paste is used to treat common eye infections, and to dress wounds, treat bites, burns, acne and various skin diseases in Northern India, women are given a - tonic of fresh turmeric paste with powder of dried ginger roots and honey in a glass of hot milk to drink twice daily after childbirth. A poultice of turmeric is also applied to the perineum to aid in the healing of any lacerations in the birth canal. Powdered turmeric is taken with boiled milk

to cure cough and related respiratory ailments and roasted turmeric is an ingredient used as an ant dysenteric for children (Pandey, 2005*).*

Turmeric (Curcuma longa) and several other species of the curcuma genus grow wild in the forests of Southern Asia including Indonesia nearby Asian countries, and some Pacific Islands including Hawaii. All of these areas have traditional culinary and medicinal uses going back to pre-history. In the Indian Ayurveda system of herbal medicine, turmeric is known as strengthening and warming to the whole body. Traditional uses in India include to improve digestion, to improve intestinal flora, to eliminate worms, to relieve gas, to cleanse and strengthen the liver and gallbladder, to normalize menstruation, and also used to for swelling, as a blood purifier, promote proper metabolism correcting both excesses and deficiencies, for local application on sprains, burns, cuts, bruises, insect bites and itches, for soothing action in cough and asthma, as antibacterial and anti-fungus, and in any condition of weakness or debility .

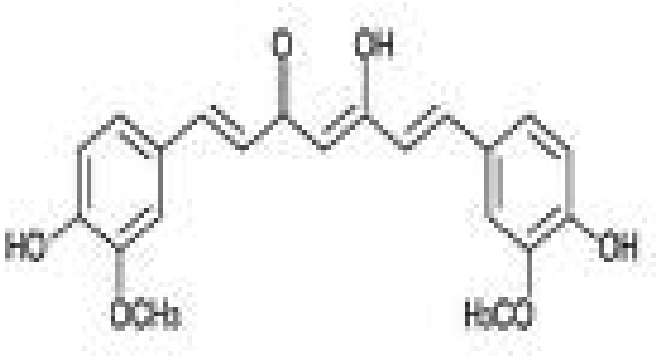


Figure 1. Chemical structure of turmeric

(Miyazawa, 2001)

2.2. Chemical Composition of Turmeric

Turmeric contains a number of phytoconstituents namely protein (6.3%), fat (5.1%), minerals (3.5%), carbohydrates (69.4%) and moisture (13.1%). The essential oil (5.8%) obtained by steam distillation of rhizomes has *a*-phellandrene (1%), asinine (0.6%), cineol (1%), borneol (0.5%), zingiberene (25%) and sesquiterpines (53%). Curcumin (diferuloylmethane) (3–4%) is responsible for the yellow color, and comprises curcumin I (94%), curcumin II (6%) and curcumin III (0.3%). Turmeric may contain well over a hundred chemical species, most of these originating from the essential oil part of turmeric. A complete analysis of all these constituents has not so far been undertaken. However, the major and characteristic components of turmeric are the three curcuminoids and volatile compounds of turmeric. Curcuminoids: Curcumin, Desmethoxy curcumin, Bisdesmethoxy curcumin. Curcuminoids exist as a mixture of the keto- and enol tautomeric forms, their relative composition dependent on the pH of the medium. (Sumbilla *et al.*, 2002).

2.3. Maximal Oxygen Uptake or Consumption (VO_2max)

The term "VO_2" is derived from V-volume of O_2-oxygen. However, a point is reached where exercise intensity can continue to increase without the associated rise in oxygen consumption. The point at which oxygen consumption plateaus defines the VO_2 max or an individual's maximal aerobic capacity. This volume is expressed either as an absolute rate in liters of oxygen per minute (l/min) or as a relative rate in milliliters of oxygen per kilogram of bodyweight per minute (ml/kg/min). Maximal oxygen uptake or consumption (VO_2max) means the maximal capacity of an individual to perform aerobic work. It is the product of cardiac output (CO) and arteriovenous oxygen ($AV\text{-}O_2$) difference at exhaustion, and the golden standard measure for a person's aerobic fitness (ACSM, 2010).

It refers to the maximal amount of oxygen the individual can utilize typically over one minute during an intense, maximal effort. Whole body maximal oxygen uptake (maximum aerobic power, aerobic capacity, VO_2max) of human beings has interested researchers for many years and regular reviews have been published. Its absolute magnitude and malleability with physical training has practical interest for elite soldiers, for the sports elite, and for anyone involved in

physical exercise. Important for the interest in the topic is also that determination of oxygen uptake not only is a measure of aerobic energy turnover, but also offers precise measure of the capacity to transport and utilize oxygen, i.e., the functional capacities of the lungs, cardiovascular system and muscle mitochondria combined. In general, aerobic power has been recognized as one of the fundamental components of physical performance and health (Kaminski, 2005).

Previously, it was mentioned that the point at which oxygen consumption plateaus defines the VO_2 max or an individual's maximal aerobic capacity. It was also mentioned that VO_2max value can determine an athlete's capacity to perform sustained exercise and is linked to peak performance (Billat, V *et.al*.,1999). One can think of VO_2 max as an athlete's aerobic potential and the lactate threshold as the marker for how much of that potential they are tapping into during an endurance event. This threshold can improve and increase numerically with appropriate training. In theory, an individual could exercise at any intensity up to their VO_2max indefinitely. However, this is not the case even amongst elite athletes. While a high VO_2max may be a prerequisite for performance in endurance events at the highest level, another marker such as lactate threshold is more predictive of performance (Wilmore, J. and Costill, D 2005).

2.4. VO2max Improvement Training Method

(Helgerud *et al.*, 2007) analyzed the effect of four different training methods on VO_2max and stroke volume. The four groups ran three sessions per week for eight weeks on a treadmill with 5.3% upward incline. Each session started with 10 min warm up at 60% of VO_2max, and ended with three minutes of cool down. Each session comprised warm up, exercise, and cool down. "Long slow distance running" (LSD) at 60% of VO_2max for 45 min. Hence warm up and cool down have the same VO_2max percentage as the exercise. "Lactate threshold running" (LT) at 80% of VO_2max for 24.25 min, "15/15 interval training" (15/15) at 87.5% of VO_2max, 47 times, each period lasting 15 sec. Exercise proceeded at 60% of VO_2max during the 46 rest periods, each lasting 15 sec., "4x4 min interval training" (4x4) at 87.5% of VO_2max, four times, each period lasting 4 min. Exercise proceeded at 60% of VO_2max during the rest periods, each lasting three min.

2.5. Normal VO_2max Value

VO_2max values can vary greatly between individuals with untrained individuals typically have a VO_2max in the range of 25-45ml/kg/min. Following a period of intensive aerobic training this can increase significantly by approximately 10-25 ml/kg/min. However, the level of increase can vary greatly between individuals with some individuals showing little increase and some showing much larger increases. This variation in response is believed to be primarily due to genetic factors in which some individuals gain greater benefit from aerobic training than others (Smith and O'Donnell, 1984; Green *et al*., 1995; Gormley *et al.*, 2008).

According to Jones (2006) reported elite endurance athletes typically record much higher VO_2max values than those recorded for untrained or even trained individuals. Typically, elite endurance athletes may have a VO_2max in the region of 60-85ml/kg/min – 60-75ml/kg/min in women and 70-85ml/kg/min in men – with some athletes recording values of greater than 90ml/kg/min. Most of the improvements in VO_2max appear to occur fairly early on in training and in the case of well-trained endurance athletes there appears to be little subsequent increases in VO_2max following increased training intensity or volume. In fact, improvements in performance of well-trained endurance athletes tend to be more associated with an increased ability to race at higher percentages of VO_2max, improved lactate threshold profile and exercise economy. Research in cross country skiers found that there was no significant change in VO_2max across a training season even though there were significant changes in both volume and intensity across the season (Losnegard et *al*., 2012).

2.6. VO_2max Training

Increases in VO_2max tend to occur in the untrained with any form of aerobic training whilst significant increases in well trained elite athletes are unlikely. The current recommendations for maximizing VO_2max are:

2.6.1. Adequate training volume

VO_2max increases in response to increased training volume, however, training more than 6-7hours of aerobic training per week is not believed to result in further increases in VO_2max but can lead to improvements in exercise economy and the sustainable %VO_2max. It is important that an adequate amount of the training is performed at low/moderate intensity (approximately 50% of total training volume) and should be performed at approximately 70-80%HRmax .Interval training – training at between 90 and 100% VO_2max – often referred to as high intensity interval training is believed to be one of the best training methods for placing the greatest physiological stress on aerobic energy systems. This type of training involves performing repeated intervals (e.g. 5*3minute intervals with 60-90seconds recovery) at speeds or intensities that correspond with 90-100% VO_2max (Millet *et al*., 2010).

2.6.2. Altitude training/simulated altitude

Altitude training has been popular amongst elite endurance athletes looking to enhance performance at sea level mainly due to the increased stimulation of red blood cell production following exposure to altitude. However, the benefits of living and training at altitude are controversial mainly due to the decrease training intensity at altitude. Research suggests that a better approach is to either, live at altitude whilst training at sea-level, or, to utilize simulated altitude tents (Levine and Stray-Gunderson, 1997; Bonetti and Hopkins, 2009)

2.7. Factors Affecting VO_2 Max

There are many physiological factors that combine to determine VO_2 max but one of these are most important. Two theories have been proposed: first utilization theories. This theory maintains that aerobic capacity is limited by lack of sufficient oxidative enzymes within the cell's mitochondria. It is the body's ability to utilize the available oxygen that determines aerobic capacity. Proponents of this theory point to numerous studies that show oxidative enzymes and the number and size of mitochondria increase with training. This is coupled with increased differences between arterial and venous blood oxygen concentrations (a-vO_2 difference) accounting for improved oxygen utilization and hence improved VO_2max. second Presentation theory suggests that aerobic capacity is limited not predominantly by utilization, but by the ability of the cardiovascular system to deliver oxygen to active tissues. Proponents of this theory

maintain that an increase in blood volume, maximal cardiac output (due to increased stroke volume) and better perfusion of blood into the muscles account for the changes in VO_2max with training (Wilmore JH and Costill DL. (2005).

2.8. Lactate Threshold

The lactate threshold is a point during exhaustive, all-out exercise at which lactate builds up in the blood stream faster than the body can remove it. Anaerobic metabolism produces energy for short, high-intensity bursts of activity (lasting no more than a few minutes) before the lactate build-up reaches a threshold where it can no longer be absorbed and, therefore, accumulates. This point is known as the lactate threshold and is usually reached between 50 to 80% of an athlete's VO_2 max. The lactate threshold/maximum lactate steady state (MLSS) corresponds to the exercise intensity at which there is a measurable increase in blood lactate levels above baseline values. During relatively low level aerobic activity, blood lactate levels remain low and will not differ significantly from resting values. As exercise intensity increases there comes a point at which blood lactate levels begin to rise above baseline levels. This rise in blood lactate is believed to occur due to increased rates of glycogen break-down (glycogenosis's) and increased conversion of glucose to pyruvate (glycolysis). In essence the lactate threshold represents a point at which the rate of lactate formation exceeds the utilization of lactate during oxidative-phosphorylation (Philip *et al*., 2005).

Perhaps the greatest factor altering threshold is training with values (expressed as % VO_2 max) of 65-80% in endurance athletes and at 50-60% in sedentary individuals. Training for endurance as aerobic athletes do, tends to stimulate oxygen-dependent (i.e. aerobic) metabolic pathways. Adaptations are evidence in elevated VO_2 max values and enhanced LT values. When training principally stimulates oxygen independent metabolic pathways, predictably, changes enhance those pathways. Threshold values of athletes whose training and competitions are dominated by oxygen independent or 'anaerobic' metabolic pathways *(*Boston *et al.,* 2010*).*

According to Philip *et al*. (2005) report as exercise intensity is increased above the lactate threshold the production of lactate continues to increase with increasing exercise intensity peaking at around 4-7 higher than baseline levels. When exercising above the lactate threshold

blood lactate levels tend to be unstable and will often continue to rise over time, even if the work intensity is kept constant. As lactate levels rise there is an associated increase in hydrogen ions. If the concentration of hydrogen ions increases significantly it can lead to a reduction in cellular pH, which at a certain level may start to interfere with cellular enzymes, metabolism and may lead to fatigue. It is important to remember that lactate itself does not cause fatigue, and is actually used as a fuel within aerobic metabolism, where it can be oxidized directly or converted to pyruvate or glucose for oxidation. In addition, lactate ions appear to have a protective effect that helps to preserve force production rather than diminish force production. So while lactate levels correlate highly with endurance exercise performance, the traditional view, amongst coaches and athletes, that lactate negatively interferes with performance is incorrect, and rather than causing fatigue it appears to be a marker for other processes occurring within the muscle that are the real culprits of fatigue (Nielsen *et al*., 2001).

2.9. Factors that Influence the Lactate Threshold

Although once viewed as a negative metabolic event, increased lactate production occurring exclusively during high-intensity exercise is natural (Robergs *et al.*,2004). Even at rest a small degree of lactate production takes place, which indicates there must also exist lactate removal or else there would be lactate accumulation occurring at rest. The primary means of lactate removal include its uptake by the heart, liver, and kidneys as a metabolic fuel (Brooks, 1985). Within the liver, lactate functions as a chemical building block for glucose production (known as gluconeogenesis), which is then released back into the blood stream to be used as fuel (or substrate) elsewhere.

Additionally, non-exercising or less active muscles are capable of lactate uptake and consumption. At exercise intensities above the lactate threshold, there is a mismatch between production and uptake, with the rate of lactate removal apparently lagging behind the rate of lactate production (Katz and Sahlin ,1988).

2.9.1. Increased fast –twitch motor unit recruitment

According to (Anderson and Rhode 1989) reported at low levels of intensity, primarily slow-twitch muscles are recruited to support the exercise workload. Slow-twitch muscle is characterized by a high aerobic endurance capacity that enhances mitochondrial respiration,

which is the aerobic ATP energy production system. With increasing exercise intensity there is a shift towards the recruitment of fast-twitch muscles, which have metabolic characteristics that are geared towards glycolysis (an anaerobic energy pathway). The recruitment of these muscles will shift energy metabolism from mitochondrial respiration more towards glycolysis, which will eventually lead to increased lactate production.

2.9.2. Imbalance between glycolysis and mitochondrial

At increasing exercise intensities, there is an increased reliance on the rate in the transfer of glucose to pyruvate through the reactions of glycolysis. This is referred to as glycolytic flux. Pyruvate, which is the final product of glycolysis, can either enter the mitochondria for further biological breakdown (for eventual synthesis of energy) or be converted to lactate. There are some researchers who believe that at high rates of glycolysis, pyruvate is produced faster than it can enter into the mitochondria for mitochondrial respiration (Wasserman *et al.,* 1986). Pyruvate that cannot enter the mitochondria will be converted to lactate, which can then be used as fuel elsewhere in the body such as the liver or other muscles.

2.10. Lactate Threshold and Endurance Exercise performance

At rest and under steady-state exercise conditions, there is a balance between blood lactate production and blood lactate removal (Brooks, 2000). The lactate threshold refers to the intensity of exercise at which there is an abrupt increase in blood lactate levels (Roberts and Robergs 1997). Traditionally, maximal oxygen uptake (VO_2max) has been viewed as the key component to success in prolonged exercise activities (Bassett and Howley 2000). However, more recently scientists have reported that the lactate threshold is the most consistent predictor of performance in endurance events. Studies have repeatedly found high correlations between performance in endurance events such as running, cycling, and race-walking and the maximal steady-state workload at the lactate threshold (McKardle and Katch 1996).

2.11. Lactate Threshold Training Programs and Workouts

Although the optimal training for lactate threshold improvement has yet to be fully identified by researchers, there are still some excellent guidelines you can follow in generating training programs and workouts in order to optimize the endurance performance of clientele. Research has indicated that training programs that are a combination of high volume, maximal steady-

state, and interval workouts have the most pronounced effect on lactate threshold improvement (Roberts and Robergs 1997, Weltman 1995). The major benefit of increased training volume is an increased capacity for mitochondrial respiration, which is imperative to improvements in lactate threshold. (Bompa, 1999)

2.11.1. Maximal steady-state training

Steady-state training at the lactate threshold is often referred to as "maximal steady-state" exercise or "tempo runs." Research has shown that the lactate threshold occurs at 80-90% of heart rate reserve (HRR) in trained individuals and at 50-60% HRR in untrained individuals (Weltman, 1995). Without access to an exercise physiology laboratory to get actual lactate threshold measurements for your clients, the RPE scale will be the most accurate way to determine training intensity for maximal steady-state exercise sessions. Research has shown that RPE is strongly related to the blood lactate response to exercise regardless of gender, training status, type of exercise being performed, or the intensity of training (Weltman,1995). Following the build-up in training volume described above, your client may begin maximal steady-state exercise sessions. Collectively, these sessions should consist of no more than 10% of the total weekly volume. In our case study, 10% of 200 minutes is 20 minutes, which is the upper limit of total time accumulated during maximal steady-state exercise sessions in one week. While this approach may appear conservative, it will help to prevent over training and injuries and is a wonderful starting place. (Foran ,2001).

2.11.2 High intensity interval training

High intensity interval training (HIIT) involves training above the lactate threshold and typically involves 3-4minute efforts at around 95-100% of VO_2max with 90-120 second active recoveries. Training at this intensity can lead to increases in the velocity or power output at the VO_2max which in turn leads to improvements in the speed or power output at the lactate threshold. Training at these intensities is very hard and places the greatest risk of overtraining and therefore this type of training should typically make up no more than 5-10% of your training volume. Most athletes find that one of these sessions per week is sufficient and certainly regularly completing two of these sessions per week, greatly increases the risk of overtraining (Marciniket *al et.,* 1991). Strength/resistance training – including strength training as part of your endurance training program is an important technique for improving the lactate threshold .This type of

training appears to be important because it increases the strength and fatigue resistance of muscle fibers as well as improving exercise efficiency, this in turn can lead to improvements in the speed or power output at which the lactate threshold occurs. Resistance training appears to be most beneficial when performed 1-2 times weekly –if you are also using high intensity interval training then 1 resistance training session should be sufficient (Marcinik *et al.*, 1991.)

2.12. Turmeric and Strength, Endurance, Recovery

Turmeric is gaining scientific recognition as having performance enhancing properties. In a recent study on turmeric's main compound, curcumin, scientists found that it increased the amount of mitochondria in muscle cells. Since mitochondria are the powerhouses of the body, turmeric may revolutionize the sports industry, enabling athletes to maximize their performance. Turmeric is highly regarded as being a safe and health-promoting spice that also has the highly sought after effect of increasing mitochondrial density. Mitochondria are organelles within cells in the body. They are the power plants of the cell, generating energy for the body to use for cellular functions. Mitochondria use oxygen and nutrients (carbohydrates, proteins and fats) to produce ATP (Adenosine Triphosphate). ATP is a potential energy molecule, similar to money in energy form, that your body 'spends' to fuel biological functions like powering the brain, pumping the heart, exchanging oxygen and carbon dioxide, contracting muscles, along with many other processes. In today's highly competitive world of sports, elite athletes are focused on maximizing strength, endurance and recovery to get an extra edge, all of which start with the mitochondria. Dietary changes can increase the amount of mitochondria in muscle cells. Increasing cellular mitochondria, referred to as mitochondrial biogenesis, leads to substantial and sustainable performance. (Takahashi *et al.*, Mar 2016.)

For years the only known methods to increase mitochondrial density was through chronic endurance and strength training. Boosting the density of mitochondria in muscle cells is similar to upgrading the engine in a car, it increases the rate at which the body converts fuel to usable energy. Many scholars found that curcumin by itself increased mitochondrial density, and when paired with exercise, the benefits were compounded. That makes turmeric somewhat of an athletic Holy Grail, especially to an elite athlete like an Olympic runner or swimmer, who are focused on shaving hundredths of a second off their time. Given that there are no known toxic

levels of turmeric, it combines fundamental and highly sought after performance enhancing properties with unique health-promoting mechanisms that protect athletes from years of intensive training. Other befits associated with increase turmeric intake relevant to athletes (to be covered in later features) are: -increased strength and endurance, increased muscle growth and faster recovery (anabolic), prevents muscle breakdown (anti-catabolic), increased testosterone/decreased estrogen, anti-fatigue, increased nitric oxide, reduced muscle damage and soreness, raised metabolism, increased blood flow (Takahashi *et al.*, June 2014 and Apr 2017).

In other study stated that increase in muscle mitochondrial content is one of the most important factors responsible for improved endurance-exercise performance in response to training. These typical doubling of muscle mitochondria that occurs during training plays an important role in the increase in maximal Oxygen uptake (VO2max). The more mitochondria muscle cells have, the more nutrients they can convert into energy. Endurance capacity increases, as does calorie expenditure. The utilization of this substrate has the ability to increase oxidation of fat relative to carbohydrate, increase lactate threshold, and fatigue resistance. (no relationship with your finding (Davis *et al*.,2010; Calvo *et al*., 2008; Holloszy and Coyle, 1984).

According to Marcinik*et et al.* (2000) reported about health benefit of turmeric in our daily life are the following. It is a natural antiseptic and antibacterial agent, useful in disinfecting cuts and burns. When combined with cauliflower, it has shown to prevent prostate cancer and stop the growth of existing prostate cancer. Prevented breast cancer from spreading to the lungs in mice. And May prevent melanoma and cause existing melanoma cells to commit suicide. And also Reduces the risk of childhood leukemia, for natural liver detoxifier and also may prevent and slow the progression of Alzheimer's disease by removing amyloid plaque Buildup in the brain, prevent metastases from occurring in many different forms of cancer. It is a potent natural anti-inflammatory that works as well as many anti-inflammatory drugs but without the side effects.it has shown promise in slowing the progression of multiple sclerosis in mice and natural painkiller. May aid in fat metabolism and help in weight management. And used in Chinese medicine as a treatment for depression Because of its anti-inflammatory properties, it is a natural treatment for arthritis and Rheumatoid arthritis.

2.13. Turmeric for Exercise-Induced Oxidative Stress

When we exercise, our body produces free radicals called reactive oxygen species (ROS). What's more, exercise also impairs the natural antioxidant repair systems that combat these. Oxidative stress is a condition where the levels of ROS are higher than the levels of the body's naturally occurring antioxidants can deal with. Strenuous exercise often causes the body to enter a state of oxidative stress. This can cause damage to cells, impairs the immune system and delays our ability to recover from exercise. Curcumin in turmeric has antioxidant properties and can therefore neutralize free radicals and ROS, therefore reducing the effects of oxidative stress. Participants were encouraged to walk or run for an hour at 65% of their VO2max. They did this three separate times – once with no curcumin supplementation (a placebo instead), once with supplements two hours before exercise and once with supplements two hours before plus after exercise. Blood samples were taken pre-exercise, immediately after exercise and two hours after exercise. Levels of ROS in the blood were significantly higher immediately after exercise than before exercise in the placebo trial but not in either supplemented trial. Proof then, that ROS build up in the blood during exercise, and that curcumin supplementation suppresses them. Furthermore, antioxidant levels in the blood immediately after exercise were significantly higher in both supplemented trials compared to levels before exercise. The study concluded that "curcumin supplementation can attenuate (reduce) exercise-induced oxidative stress by increasing blood antioxidant capacity". (Takahashi *et al.*, June 2014 and Apr 2017).

2.14. Use of Turmeric as Medicinal Purpose

From many years' awareness of turmeric and its use as medicine is continuously increasing. A flowering plant, Turmeric, in the ginger family, is commonly used as a food coloring and is one of the basic ingredients in curry powder. To heal many health disorders like liver problems, digestive disorders, treatment for skin diseases and wound healing turmeric has long been used in Medicinal as an anti-inflammatory. Curcumin is the active ingredient in turmeric which has been shown to have a wide range of therapeutic effects (Brinkman, 2000).

Turmeric is considered as a digestive bitter and a carminative. It can be added into foods including rice and bean dishes to improve digestion, reduce gas and bloating. It is a stimulating bile production in the liver and encouraging excretion of bile via the gallbladder. This improves

the body's ability to digest fats. For chronic digestive weakness and/or congestion turmeric is recommended. It can be taken as a single extract or in the form of digestive bitters, which combine turmeric with other bitter and carminative herbs. Turmeric is beneficial for people who feel tired after consuming meals or who experience gas and bloating. Whatever way turmeric is consumed it is beneficial to both the digestive system and the liver. Turmeric is beneficial for its influence on the liver. In spring more consumption of herbs and foods can strengthen the liver. Turmeric shares similar liver protectant compounds that milk thistle and artichoke leaves contain. It is said to shrink engorged hepatic ducts, so it can be useful to treat liver conditions such as hepatitis, cirrhosis, and jaundice (Davis *et al.,* 2007).

Cancer is treated used turmeric is possible recent scientific research confirm that turmeric can cure host of diseases, also they found that turmeric restrains the growth of various types of cancer. Turmeric is used for the treatment of skin cancer or pre-cancerous skin conditions. Both topical and internal uses are beneficial (Johnson *et al.*, 2007*).*

Turmeric may helpful in preventing the blockage of arteries that can gradually cause a heart attack or stroke in one of two ways. Turmeric makes cholesterol levels low and inhibited the oxidation of LDL (bad cholesterol). Oxidized LDL deposits in the walls of blood vessels and contributes to the formation of atherosclerotic plaque. Turmeric may also prevent platelet buildup along the walls of an injured blood vessel. Platelets collecting at the site of a damaged blood vessel cause blood clots to form and blockage of the artery as well (Ramirez *et al.,* 1999). Osteoarthritis benefit of turmeric may help relieve the symptoms of osteoarthritis because of its ability to reduce pain and disability (Frye *et al.,*2006).

Menstrual problems of Woman use turmeric who experience monthly menstrual cramps, try using turmeric extract or bitters twice daily for two weeks prior to expected menstruation. Turmeric is an antispasmodic to smooth muscles so it reduces digestive and menstrual cramping. It should reduce the severity of pain, if Not ease them completely. Certainly, diet and standard of living have a reflective influence on the menstrual cycle, but turmeric is a great addition (Davis *et al.,* 2007). Bacterial Infection / Wounds turmeric is useful as an external antibiotic in preventing bacterial infection in wounds (Pizzorno *et al.,* 1999***).***

Table 1 Nutrient Values of Turmeric

Nutrient Values of Turmeric per 100g				
Calories	Energy Value	Total Fat	Carbohydrates	Protein
354kcal	1481kcal	9.88mg	65g	8g
Dietary Fiber	Sugars	Sodium	Zinc	Potassium
21g	3g	38mg	4.35mg	2525mg
Vitamin C	Magnesium	Copper	Calcium	Iron
25.9mg	193mg	0.603mg	183mg	41.42mg
Vitamin E	Vit. B3	Vitamin B6	Vit. B1	Vit. B2
3.1mg	(Niacin)	1.8mg	(Thiamine)	(Riboflavin)
	5.14mg		0.152mg	0.233mg

Source: Bhowmik *et al.,* 2009

3. MATERIALS AND METHODS

In this chapter the description of the study area that shows where the study was conducted and where the study area was located and also the general feature of the study area was explained. The study design which shows the number of participants, the experiment period, the parameters were studied and the exercises and tests were used also discussed. The source of study population, the sample and sampling techniques, the inclusion and exclusion criteria of the study participants are described. Although, the source of data, the method and procedures in which the researcher used to collect data, the aerobic fitness test analysis, the data quality control and the protocol and ethical considerations were also included.

3.1. Description of the Study Area

The study was conducted at Debre Birhan University which is located in the Semen Shewa Zone Amhara Regional state, about 150 km in North East of Addis Ababa on the paved highway to Dessie, the town has a latitude and longitude of 9°41′N 39°32′E, respectively and an elevation of 2,840 meters. Debre Berhan town is one of the coolest city which is found at sub-tropical zone of Ethiopia. The average annual temperature of the city during day and night hour is 17.8°C and 8.83°C respectively with precipitation 66.17mm.

https://www.meteoblue.com/en/weather/forecast/modelclimate/debre birhan_ethiopia_339734

Debre Birhan University (DBU) offers courses and programs leading to officially recognized higher education degrees such as Bachelor Degrees in several areas of study. DBU also provides several academic and non-academic facilities and services to students including a library, as well as administrative services. It is located in Amhara Region, North Showa Zone, in the town of Debre Berhan. The study was conducted at Debre Berhan University, which is located between latitudes of 9° 40´ 46.3440" N and longitude 39° 31´ 57.4320" E at a distance of 128km and 622.3 km from Addis Ababa and Harer respectively. The altitude on the campus is 2830 meter above sea level with a mean annual temperature of 14.84°C (FAO, 2006). (The map of study site is placed on page 76. Appendix- VIII).

3.2. Definition of Terms

- **Aerobi**c – means oxygen or in the presence of oxygen (Wolach and Harold, 2000).
- **Aerobic exercise**- Aerobic exercises are any activity that uses large muscle groups can be maintained continuously for long period of time (Wolach and Harold, 2000).
- **Dependent variables**- maximum oxygen intake and lactate threshold
- **Exercise**- is an activity that are planned and structured, and has been known to improve mood, motor function, and cognitive processing (Mayo Clinic, 2014).
- **Independent variable** – Aerobic exercise and turmeric supplement
- **Sport science**- is a discipline that studies how the healthy human body works during exercise, and how sport and physical activity promote health from cellular to whole body perspectives (https://en.m.wikipedia.org>wiki>sport...)

3.3. Research Design

The research was aimed to examine the effect of turmeric consumption before and after exercise on VO_2 max and lactate threshold of third year Sport Science Students of Debre Birhan University. The study was followed pre-posttest experimental study design with control group. For this study 32 third year sport science students with age of 20-25 years was selected from Deber Berhan University sport science department after completed the health status questionnaire. The samples were selected by random sampling method and divided into 2 groups i.e. control (16) and experimental (16) groups, each group consisting of 16 subjects (8 males and 8 females), whereas their sex and the study place in relation with their department were selected by purposive sampling. The experimental group underwent eight-week turmeric consumption with aerobic exercise program, three days per week and the duration was 45 minutes while, the control group continued with only aerobic exercises. This study was used pre and post test result, pretest-posttest design is the preferred method to compare participant groups and measure the degree of change occurring as a result of treatments or interventions. Dependent variables of these study were VO_2max and lactate threshold however, the independent variables were also turmeric supplement and aerobic exercises.

3.4. Sources of Data

The researcher used primary source of data. The researcher obtained primary source of data by collecting a data through the administration of experimental process (recording pretest result and post test result) to the sample taken from 3rd year Sport Science Students of Deber Berhan University.

3.5. Study Population

Since the researcher was interested to conduct research on both sex Students, the study population was under graduate third year sport science of Deber Berhan University. The Total population of 3rd year sport sciences students in Deber Berhan University was 59 (female 30 and male 29). From that 52 subjects (26 females and 26 males) within the age of 20- 25years old were selected as a sample for this study.

3.6. Sampling and Sampling Technique

Simple random sampling technique was used to select subjects as well as to assign subjects for control and experimental groups, while purposive sampling was used to select the samples sex and the study place in relation with their department. Fifty-two (52), 26 males and 26 females 3rd year sport science students of DBU were filled the health status questionnaire while selecting by random sampling technique. The questionnaire was prepared with the aim of identifying subjects who are free from any known cardiovascular disease, smoking, taking regular medication or psychiatric disorder and any recent physical injury. Hence, the subjects' health statues were used as one of study subject's selection criteria, twenty (20), 10 males and 10 females sport science students were eliminated from the study because of the factors mentioned above. Finally, thirty-two (32) 16 male and 16 females from those 8 male and 8 females for experimental and also, for control group 8 males and 8 females respectively by using random sampling technique. The sample size which was taken from total population for this study was calculated by slovins formula ($n= N/ (1+Ne^2)$) where, n= sample size, N= total population and e= significance difference or P-value$\leq$0.05 that means, ($n=59\div (1+59\times0.05^{2)} = 52$

3.7. Inclusion and Exclusion Criteria

All of selected 3rd year sport sciences students of Debre Birhan University with the age of 20-25 years were included as the study subjects after completing their health history and fitness status questionnaire that helped the researcher to obtain information on the health status and readiness of physical activity of the subjects participating in the study (ASCM, 1997). Subjects with any known cardiovascular disease, smokers, taking regular medication or psychiatric disorder where excluded from experimental trial and also Subjects were instructed to be free from taking any nutritional supplements or other ergogenic aids where asked to avoid doing from taking any additional supplement during the time of the study. Subject with the age of above 25 and below 20 were exclude from this study.

3.8. Method and Procedure of Data Collection

3.8.1. Method of data collection

Quantitative data were collected through the appropriate maximum oxygen intake and lactate threshold Test measurements like 30Minutes time trials and maximum oxygen intake test is cooper test the data collected before and after giving aerobic exercise with combined turmeric consumption and only aerobic exercise for 8 consecutively weeks of 3rd year Sport Science Students of Deber Berhan University. The data were recorded by the investigator with the help of assistant data recorder. The appropriate aerobic training in combined with turmeric consumption was given by the researcher for experimental group.

3.8.2. Procedure of data collection

First the researcher meeting the participants of the study, during the familiarization session, participants was informed of all procedures and familiarized with all performance measures to reduce the possibility of a learning effect. Next to these Subjects were instructed by a researcher to give additional idea on sport nutrition by preparing lecture notes and advices participants not to exercise for at least 24 hours prior to each trial, (i.e., well rested, consuming carbohydrate diet) and to refrain from consuming other supplements for one day before each trial of experiments. Also they instructed give supplement after meal and to maintain their fluid intake the day of the trial and to keep this similar for each test. Turmeric was orally consumed in

the dose of (2 capsules (@ 500 mg) per day during the treatment period and aerobic exercise was scheduled 3 times in a week. Then,12min running and 30-miuntes time trial /races test were demonstrated following the producer, one hour after consumed turmeric, the distance covered by subjects was recorded and also the record of this covered distance helped the researcher to calculate the VO_2 max and average heart rate over last 20 minutes LT of the subjects.

3.8.3. (12 Minutes running measures)

This study was used 12- minute time trial test to get more reliable assessment. The subjects were involving in the first 12 minutes' test without consumption of turmeric and the distance covered by those subjects with in the given time was recorded. The next trial (posttest) was given after eight week of pretest, during the posttest the subjects were consumed turmeric one hour prior to the test and the distance they cover within 12 minutes were recorded, at the end the recorded distance goes for data analysis. The researcher was motivating the subjects to use their full potential to cover the distance during the tests. For the direct VO_2max measurement, the Cooper 12minutes test were applied, in which a subjects can run/walk in 12 minutes and the total distance covered was recorded. Based on the distance covered an estimate of the athlete's VO_2max can be calculated as follows: VO_2max = (Distance covered in meters – 504.9) / 44.73 (Mackenzie, 2005). This test was take place twice for both groups, the first test was taken after the subjects finished their health statues questioner without consumption of turmeric and underwent exercise, the test results (distance covered) were recorded and VO_2 max was calculated, the next test was taken after the subjects finished their consumption of turmeric combined with aerobic exercises and also the control group underwent only aerobic exercise ,then the distance covered was recorded and VO_2 max was calculated. Their VO_2 max of pretest was compared to posttest results.

3.8.4. (30 Minutes Time trial test)

Athletes use 30 minutes' time trial tests as a means of estimating their heart rate or speed at the lactate threshold. A better option is to undertake a 30minutes time trial in a non-competitive situation whilst recording the heart rate throughout. Research has found the 30-minutes time trial method to be a good predictor of HR at the Lactate threshold (McGhee et al., 2005). 30-minutes time trial test helps to monitor the subjects lactate threshold. To perform this test, the following

procedures are used, first the subjects were involving in the first 30 minutes' time trial test without consumption of turmeric and aerobic exercise for experimental group and only aerobic exercise for control group they perform this test by using stationery bike bicycle. Warm up for 15 minutes. Subjects begin exercise and work up to peak, sustained intensity within the first 10 minutes. Next, to record the heart rate each minute for the last 20 minutes using standardized heart rate monitor. To calculate subjects lactate threshold, through average heart rate over last 20 minutes. The next trial (posttest) was take place after finished eight weeks consumed turmeric supplement and underwent aerobic exercise for both groups but control group involving only exercise by using stationary bike bicycle to recorded test results for last 20-minutes and to calculate subjects lactate threshold, average heart rate over last 20 minutes. Their lactate threshold of pretest was compared to posttest results.

3.9. Method of Data Analysis

The data was gathered through field workouts (fitness test) coded and arranged for analysis. The coded data were analyzed by using Statistical Package for Social Science version 20.0 and paired sample T-test to summarize the change. Level of significance was < 0.05%.

3.10. Data Quality Control

To ensure quality of the data of VO_2 max and lactate threshold they selected standardized fitness test was used with appropriate tools. To reduce the mistakes which can be occurred during data collection and to collect the appropriate data the assistant fitness test recorder was trained among technical assistance of sport science department of Debre Birhan University

4. RESULT AND DISCUSSION

4.1 Overview

In this chapter, the results of the study were presented and discussed in detail to address the objectives of the research. The research was aimed to examine the Effect of 8-week Turmeric supplement in combined with Exercise and only aerobic Exercise on VO_2max and lactate Threshold in Case of 3rd year sport Science Students of Debre Birhan University. To achieve the purpose of this study 32 participants from those 16 male and 16 female students of Debre Birhan University sport science department were selected as Study subjects and their age was 20-25 years. The participants were engaged in a designed Turmeric supplement with aerobic exercise and only aerobic exercise program for 8 weeks and 3 days per week for 45 minutes. Under this, two physiological aspects of fitness tests had been evaluated by 12-minutes cooper tests and 30-minutes time trial test respectively. The collected data were analyzed by paired sample t-test using SPSS version 20. The results of those variables are discussed below in the tables and figures.

4.2. Demographic Characteristics of the Study Subjects

A total of 52 (26 males and 26 females) 3rdYear Sport Science Students of Debre Birhan University were selected as study subjects and divided in to two groups,26 experimental and 26 control groups. From the total number of the study subjects; 20 of participants (10 males and 10 female) was eliminated due to different health problems. So finally a total of 32 subject participated from initial till end.

4.3. VO_2 max Test Results and Discussions for Both Sex

Table 2:Mean and standard deviation values of 12 minute run cooper test results of the study subjects (ml/kg/min).

Group	N	sex	Variable	Pre test	Post test	MD	SIG
EG	8	male	Vo2max	45.75±2.0523	52.5±2.34	6.75	.000
	8	female		41.76±1.98	47.1±1.5	5.34	.001
CG	8	male		45.86±2.795	46.4±2.67	0.54	.004
	8	female		41.86±1.6	42.36±1.464	0.5	.004

Values (mean + SD), Vo2max, maximum oxygen uptake, EG: Experimental group, CG: Control group, MD, mean difference, SIG: Significance.

As the above table showed there was significant difference observed between pretest and post test results on the experimental group for both sex rather than control group while, in the control group there was showed little difference from pre to post test result but not that much significance when compared to the experimental group within 8 weeks' aerobics in VO_2max of the study subjects. Thus, as it is indicated on the table the average value of VO_2 max was significantly increased for the experimental group after eight-weeks turmeric supplement in combined with exercise, the mean value of VO_2max for experimental group was 45.75±2.053 male and 41.8 ± 1.98 female before they underwent to take supplement and aerobic exercise in Gymnasium and 52.5±2.39 and 47.1±1.5 for male and female respectively after 8-week treatment with supplement and aerobic exercise training when compared to the mean value of VO_2 max for control group 45.86±2.795 and 46.4±2.67 for male and 41.86±1.6 and 42.36±1.464 for female which was taken as pre and posttest result respectively with the mean value difference were considered statically significant at $p \leq 0.05$. So, from the above table we can say that there is significance change in VO_2 max of posttest result on experimental group due to 1000mg turmeric supplement with 8-week aerobic exercise. Also in the control group there was showed little difference from pre to post test result but not that much significance when compared to the experimental group within 8 weeks' aerobics exercise. Hence, based on this result 8-week turmeric supplement with aerobic exercise have a better positive effect on VO_2 max of 3rd year

sport science student of DBU that means the null hypothesis was rejected while the alternative hypothesis was accepted.

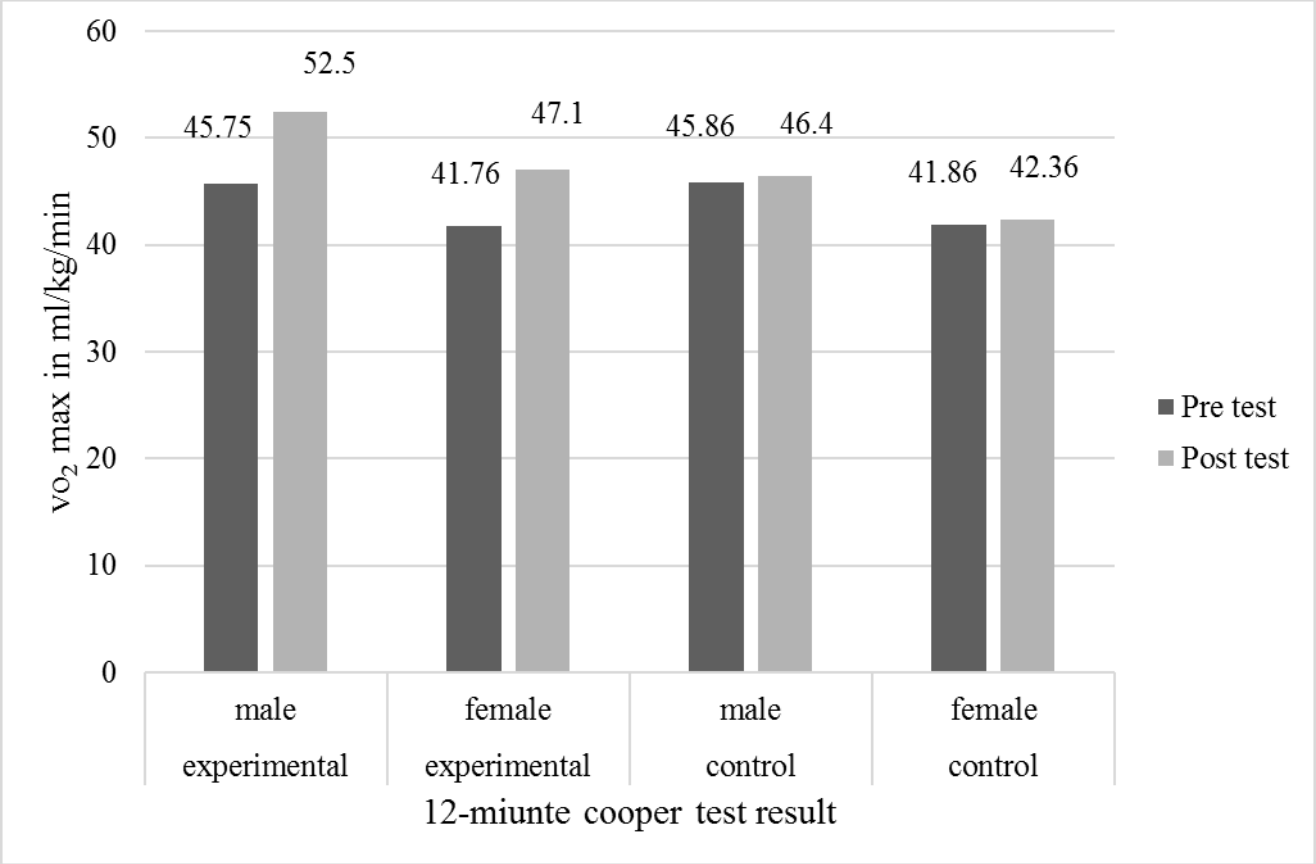
This finding directly argument with the pervious study finding of Ronald D Ray Hamidie, et al (2017) six-week turmeric supplement with combined of aerobic exercise was significant effect on vo2max with the mean value of per test 47.44 ml/kg/min to 53.41 ml/kg/min posttest these indicate that six weeks' turmeric treatment increase vo_2max. (McFarlin et al., 2016) was reported turmeric is a spice from the rhizomes belonging to a ginger family (Zingiberaceae) component. it has antitumor, ant arthritic, antioxidant, and anti-inflammatory properties. This were shown that anti-inflammatory properties of curcumin have ability to reduce muscle damage to improve sport performance.

Even if the finding of this study was contradicted with the previous studies which have reported that supplement i.e. turmeric supplement does not lead to significantly increase in vo2 max, according to Ray Hamidie, 2017 found that turmeric supplement combined with aerobic exercise has no effect on vo2 max within four weeks of the study subjects, in this study the consumption and training period is doubled and the result is positive.

The 12-minute cooper test result was compared with an international 12-miunte cooper test result among similar age groups and both sex that range from 19 to 29 years (Heywood ,2006). The international 12-minute running test result for male is >51 and female 44 for this age groups while the 12-miunte running test result mean value result of this study for experimental group was 52.5 and 47.1 for both sex respectively. Hence, the study result has fallen in excellent standard. (norms found on Appendix VI).

As a result, improvement of the rate of this data was one indicator of the enhancement of the participant's cardiovascular endurance or maximum oxygen consumption. The reason behind this change was supplement plus aerobic exercise that they were participating in well-designed training program.

Figure 1.Showing the mean comparison of 12-miunte cooper test results of the Study subjects pre and posttests



The above figure clearly showed that there was a significant difference observed between pretest and post test results on the experimental group rather than control group in VO_2 max of the study subjects. Although in the control group there was showed little difference from pre to post test result but not that much significance when compared to the experimental group within 8 weeks' aerobics exercise.

4.4. (30-Minute Time Trial Test) Results and Discussions

Table 3 : Mean and standard deviation values of 30-minute time trial test results of the study subjects (beat per minute).

Group	N	sex	variable	Pre test	Post test	MD	SIG
EG	8	male	Lactate threshold	143.3±7.18	136.6±5.44	-6.7	.000
	8	female		146.5±7.43	141.6±6.94	-4.9	.044
CG	8	male		143.1±5.99	142.7±6.3	-0.4	.016
	8	female		144.14±4.91	143.7±5.03	-0.44	.045

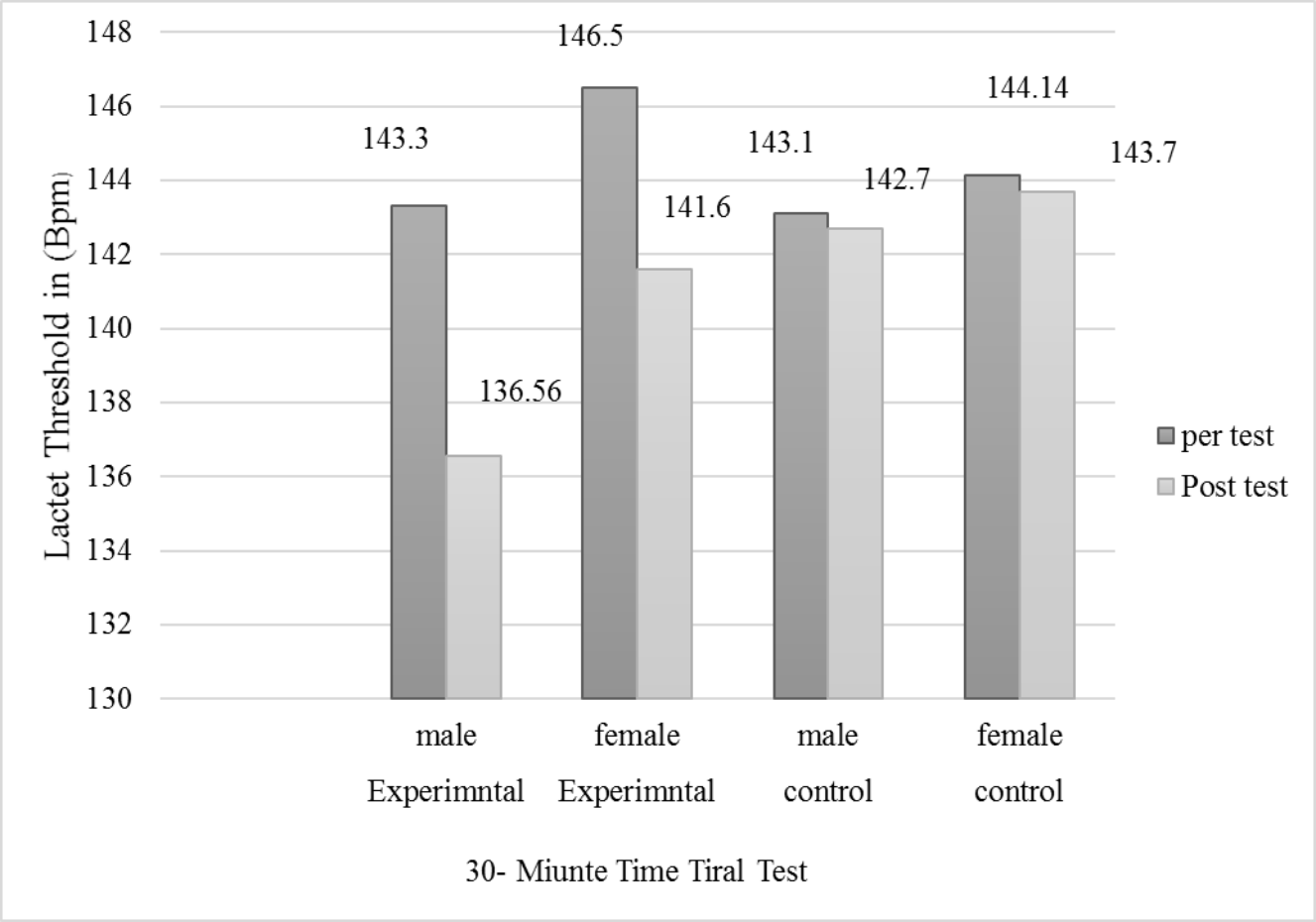
Values (mean + SD), EG: Experimental group, CG: Control group, MD: mean difference, SIG: Significance.

As the above table shows there was significance difference for both sex on 30-minute time trial test after the subjects consumed treatment with in exercise. As it is indicated on the table the average value of 30-minute time trial test was significantly lower (decreased) the heart rate during the test time for the experimental group after eight-weeks turmeric ingestion within aerobic exercise training that the Mean value of lactate threshold for experimental group was 143.3±7.18 for male pretest and 136.56±5.44 posttest and 146.5±7.43 for female pretest and 141.6±6.94 posttest when compared to control group mean value of the subject's lactate threshold 143.1±5.99 pretest for male and 142.7±6.3 posttest and 144.14±4.91 pretest for female and 143.7±5.03 posttest. Thus, the finding showed that turmeric supplement in combined with aerobic exercise has a significant improvement on lactate threshold of experimental subjects at difference between mean values were considered statically significant at $p \leq 0.05$ and also, in the control subjects of the study there was little change seen due to eight week aerobics exercise from pre to post test result but not that much change when compared to the experimental group. So, based on this result the null hypothesis of the study was rejected while the alternative hypothesis accepted.

Like VO_2max these finding directly argument with the pervious study finding of Ronald D Ray Hamidie, et al (2017) six-week turmeric supplement combined with aerobic exercise was significant effect on lactate threshold due increase in muscle mitochondrial content through treated by treatment. And also these study was contradicted with the previous studies which have

reported that supplement i.e. turmeric supplement does not lead to significantly raise the time of occurring lactate threshold according to Ray Hamidie, 2017 found that turmeric supplement with a combined of aerobic exercise has no effect on lactate threshold within four weeks of the study subjects.

Figure 2.: Showing the mean comparison of 30-miunte time trial test results of the study subjects pre and posttests.



The above figure showed that there was significance difference on 30-miunte time trial test before and after the experimental subjects underwent in 8-week ingestion of turmeric and aerobic exercise. As its indicated on the table, the average value of test was significantly lower (decreased) for the experimental group after eight-week treatment and also, there is some significance difference observed in the control group aerobic exercise training.

Table 4:Compression of Mean value result on Vo2 max and Lactate threshold in Both sex for experimental.

Group	N	sex	variable	Pre test	Post test	MD	SIG
EG	8	male	Vo2max	45.75±2.053	52.5±2.391	6.75	.000
	8	female		41.76±1.98	47.1±1.5	5.34	.001
	8	male	Lactate threshold	143.3±7.2	136.6±5.44	-6.7	.000
	8	female		146.5±7.43	141.6±6.94	-4.9	.004

Values (mean + SD), Vo2max, maximal oxygen intake, EG: Experimental group, MD: mean difference, SIG: Significance.

As the above table shows that compression mean value of males and female in both parameter (45.75±2.0529 pre and 52.5±2.3905 posttest) for males and (41.76±1.98 pre and 47.1±1.5 posttest) of Vo2max for females and Although (143.3±7.18 pre and 136.56±5.44 posttest for males and 146.5±7.43 and 141.6±6.94 pre and posttest Lactate Threshold for females. Hence, when we compared to the experimental group of pre and posttest for both parameter males are more significant than females. Due to the above result null hypothesis of the study was rejected while the alternative hypothesis accepted.

4.5. The Mean Difference Values and Significance Level of Variables

Table 5: The mean difference values and significance levels of pre and post test result of subject *in those variables i.e. maximum oxygen intake and lactate threshold.*

variables	Group	sex	Parameter (A)	Parameter (B)	MD(A-B)	SIG
Vo2max	Experimental Group	Male	PoT(52.5)	PT(45.75)	6.750	.000
		Female	PoT(47.1)	PT(41.76)	5.34	.001
	Control Group	Male	PoT(46.4)	PT(45.86)	0.54	.004
		Female	PoT(42.36)	PT(41.86)	0.5	.004
Lactate threshold	Experimental Group	Male	PoT(136.56)	PT(143.3)	-6.7	.000
		Female	PoT(141.6)	PT (146.5)	-4.9	.044
	Control Group	Male	PoT(142.7)	PT(143.1)	-0.4	.016
		Female	PoT(143.7)	PT(144.14)	-0.44	.045

MD: Mean difference, SIG: Significance level, PoT: Post Test, PT: Pre Test, EG: Experimental Group, CG: Control Group, Vo2max, Maximum oxygen intake.

As the above table indicated that both variables (VO_2 max and lactate threshold) showed positive improvement on the experimental subjects of the study because of 8-week turmeric supplement consumed with aerobic exercise, however there was also little change or improvement showed on the control group in case of 8-week aerobic exercise of the study in both parameters. As a result, 8- week treatment was significant in order to improve these physiological aspects of the study variables.

5. SUMMARY, CONCLUSIONS AND RECOMMENDATION

5.1. Summary

This study assessed and tried to investigate the Effect of turmeric supplement on vo2 max and lactate threshold in case of 3rd Year Sport Science Students of Debre Birhan University. To achieve the purpose of this study, 32 (16 males and 16 females) sport science students with age of 20-25 years were selected by random sampling method (lottery method) and divided into 2 groups i.e. control(16) and experimental(16) students that both groups participant (underwent) 8-week treatment period i.e. consumed supplement one hour before training and aerobics exercise program three days per week for experimental group and only exercise for control group and the duration was 45 minutes for three days per week. Purposive sampling was used to select the samples sex and the study place in relation with their department.

The sample size which was taken from total population for this study were calculated by slovins formula ($n=N/(1+Ne^2)$). Thus, fifty-two (52) 3rd year sport science students of DBU were filled the health status questionnaire while selecting randomly and twenty (20) 10 male and 10 females 3rd year sport science students were eliminated from the study because of health related factors. So, finally Thirty (32) form those 16 males and 16 female subjects were participated on this study. In this study, the influence of turmeric supplement and aerobics exercise on vo_2 max and lactate threshold have been seen. The dependent variables selected for this study were vo_2 max and lactate threshold tests used were; 12-miunte cooper and 30-minute time trial test within two intervals (pre-test, and post-test) each.

The data were collected by using the appropriate fitness tests before the starting of eight-week treated through treatments and after eight-week taking of turmeric supplement and aerobic exercise training. Paired T-test was used for comparisons of means and data were analyzed by SPSS version 20 with significance level of 0.05%. Final result of the study summarized and demonstrated that the result of posttest to pretest showed significant improvement in the experimental group in both parameters for both sex (VO_2 max and lactate threshold) while, in the control group there was little change but not that much significant. Generally, the improvement was seen in the experimental group of the study as all variables were tested. As a result, we can conclude that 8-week turmeric supplement in combined with aerobic exercises have a positive effect on DBU 3rd year sport science student's fitness performance.

5.2. Conclusions

Based on the major finding of the study the following points are stated as conclusions.

- The result of the study indicated that 8-week turmeric supplement in combined with aerobic exercise showed significance improvement on performance of the study subjects.
- The cardiovascular endurance (VO_2 max) of the subject increase after the consumption of 8-week turmeric supplement in combined with aerobic exercise showed significance improvement on performance of the study subjects based on this result the null hypothesis of the study was rejected while the alternative hypothesis accepted.
- Eight-week turmeric supplement with aerobic exercise showed significance improvement on performance of the study subjects lactate threshold. the null hypothesis of the study was rejected while the alternative hypothesis accepted.
- The study result showed that 8-week turmeric supplement in combined with aerobic exercise gains more significance result on males than females on both parameters (lactate Threshold and VO_2 max) the null hypothesis of the study was rejected while the alternative hypothesis accepted.

5.3. Recommendations

The result of this study indicates that the consumption of 8-week turmeric supplement in combined with aerobic exercise improves the VO_2 max and lactate threshold of the experimental subjects. By considering the result, discussions and the finding of the research, it is important to state the following points as a recommendation to investigate more on the ergogenic effect of turmeric supplement. The consumption of 8-week turmeric supplement combined with exercises on VO2 max and lactate threshold was showed significate changes for experimental groups on male and female although the test result of male better than female subjects. But little change was showing for control group for both sex.

Based on the major finding of the study the following points are stated as recommendations.

- It is expected from professionals of sport sciences and related fields to guide and evaluate the importance of turmeric supplement as form of capsules in combined with aerobic exercise on sport performance.

- It is necessary for sport science students to consume Turmeric supplement in combined with aerobic exercise to gain the ergogenic benefit of the supplement on their endurance ability.
- Considering the importance of turmeric supplement on improving VO_2 max and lactate threshold sport science teachers of DBU and nutrition professionals should make the supplements as additional nutritional ergogenic aid with in exercise in order to improve sport performance of their students and clients.
- Further study may be conducted by other scholars who want to conduct research by selecting more study subjects to see the effect of turmeric supplement on athletes and sport person.

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7. APPENDIXES

APPENDIX -I

Health History and Physical Activity Readiness Questionnaires

This questionnaire is designed to obtain information on the health status and physical readiness of the subjects participating for the research study. The information will be kept strictly confidential.

For subjects: please read the following question carefully and indicate your correct response to each question by encircling with on the choice letter given

1. Sex A. male ____ B. female_____

2. Age: - _____

3. Do you have recent physical injury such us bone, muscle, joint etc. will be aggravated by physical exercise?

A. yes B. No

If your response is yes indicating the type of injury that you had before

_____

4. Do you have suffered with heart problem before?

A. yes B. No

5. Have you ever suffered from shortness of breath at rest with mild exercise?

A. Yes B. No

6. Are you taking any prescription medicine recently?

A. Yes B. No

If your response is yes name them below.

Name of drug

_____.

_____.

Dosage

_____

_____

7. Identify any medical problems that you had before

A. Cardiovascular
B. Respiratory
C. Neuromuscular
D. None

8. Identify any physical problems you had before

A. Leg bone broken
B. Head skull broken
C. Knee dislocation
D. Backbone dislocation
E. None

9. Do you ever feel feint, spells of dizziness or loss of consciousness?

A. Yes
B. No

10.Do you exercise regularly? A. Yes B. No

11. How many hours per week do you train or participate in your sport? _____ (hours per week)

I hereby state I have read, understood and answered honestly the questions above. I also state that I wish to participate in this research project.

Investigator's full name: _____ subject's full name: _____

Investigator's signature: _____ subject's signature: _____

Date: _____ Date: _____

(American College of Sport Medicine, 1997)

APPENDIX - II

Consent to Participate Voluntarily in This Research Study

Researcher Name**: Sosina Tamene Tegegene**

Supervisor Name: **Desta Enyew (PhD) and Shemelis Mekonnen (PhD)**

Thesis title: - The Effect of Turmeric Supplement on Maximum Oxygen Intake and Lactate Threshold in Case of third year Sport Science Students of Debre Birhan university; North Showa Zone, Amhara Regional State, Ethiopia.

You are being asked to participate in this study as described below. All this like research study carried out are governed by the regulation for research on human beings. These regulations require that the researcher should obtain a signed agreement (consent) from you to participate in this research project. The researcher was explaining to you in detail the purpose of the project, the procedure to be used, the potential benefits and the possible risk of participation in this study. You can ask the researcher any questions that you may have about the study. The basic explanation of the project is summarized below.

After discussion, if you agree to participate in the study, please sign this form in the presence of the researcher. You may discontinue at any time from the study if choose to do so.

1. Purpose and procedure

The purpose of this research project is to investigate the effect of turmeric supplement on maximum oxygen intake and lactate threshold of 3rd year Sport Science Students of DBU with age of 20-25 years. The subjects to be involved in this study were 32 in number and participation on this study was require you to perform a certain test to measure the fitness variables.

2. Risk and the safeguards

The risks of this research study are small, while administering the tests and during test you may experience localized muscle fatigue in your thigh, you might feel some muscle soreness and fatigue during the tests. But we do not expect any unusual risks as a direct result of the study, if any unexpected physical injury occurs, appropriate first aid was provided, but no financial compensations were given.

3. Confidentiality

The information obtained about you were kept in confidence, although you are free to release it to your own trainer. The information was being used only for scientific purpose without identifying you as an individual.

4. **Contact Address:**

Sosina Tamene Tegegene_____0931792830

Desta Enyew (PhD)_____ 0938310940

Shemelis Mekonnen (PhD)_____ 0913893850

I certify I have read and fully understand the above project. I willingly consent to participate

Name of subject: _____

Signature of subject: _____

Address: _____

Date: _____

I certify that I have explained fully to the above subject the nature, the purpose, the potential benefits and the possible risks involved in this research study.

Date: _____

Signature of the investigator: _____

APPENDIX –III

Description of the Study Subjects and Training for the Two Months

The students of sport science need fitness as they are involved in various vigorous practical activities during their practical class. As a result, the research was done at Debre Birhan University sport science third year student. they have practical class they don't involve in regular exercise mainly in aerobic exercise with supplement for the purpose of improving their vo_2 max and lactate threshold and research was not conducted on this topic. The sample size which was taken from total population for this study were calculated by slovins formula ($n=N/ (1+Ne^2)$). Thus, fifteen two (52) third year sport science students of DBU were filled the health status questionnaire while selecting randomly and twenty (20) male sport science students were eliminated from the study because of health related factors. So, finally thirteen-two (32) subjects were participated on this study. Random sampling technique was used to minimize complain and error by giving equal chance for the total population.

Training protocol

Two Months of Training Schedule: According to Jakl (2008) 8 to 12 weeks of training program is essential to maximize individual's physiological fitness abilities. Based on this idea the investigator purposively prepared 8 weeks training program. Thus, the subjects underwent 2 months (8weeks) of training, which is December 2017 and February 2018).

The Training Days per Week: according to ACSM (1990) 3-5 days per week and 20-60 minutes is needed for developing and maintaining fitness through aerobic exercise. So, the investigator took a minimum of 3 days (45 minutes per session) that are Monday morning 12:30am- 01:15am, Wednesday afternoon 4:00pm- 4:45pm and Friday afternoon 10:00pm-10:45 pm since they are student the schedule was prepared by considering their convenient time for them. The researcher was under taken pre and posttest to know the change that occurred due to the 8-week aerobic exercise within supplement and the dependent variables for this study were maximum oxygen consumption and lactate threshold, independent variable is also aerobic exercise and turmeric supplement. The tests used for the study were 12 miunte cooper test and 30-minute time trial test respectively. So, the following table includes different types of aerobic exercise which was performed by the subjects within 8 weeks in order to improve their VO_2 and

lactate threshold. The exercises involve in this study were warming up exercise, Running, Stationary bicycle, Treadmill running, jumping rope, aerobics, strength exercise like sit up and push up, brisk walking, stair climbing and finally cooling down exercise which helped to develop athletes' fitness level. Also FITT (Frequency, Intensity, Time and Type of Exercise) principle of training was applied in the schedule;

1. **Frequency of training**: the repetition of exercise in one set. The training schedule was completed 3 days per week that is Monday, Wednesday and Friday.

2. **Intensity of training**: is how hard the body exercising or how much energy is expended when exercising. It can be defined on either an absolute or a relative scale. Absolute intensity refers to the amount of energy expended per min of activity, while relative intensity takes a person's level of exercise capacity or cardio respiratory fitness into account to assess the level of effort. Either scale can be used to monitor the intensity of aerobic exercises • In this study the researcher was used mainly moderate intensity to adapt the exercise to high intensity for increasing load in the consecutive two months. There were ways to measure intensity of training;

- Heart rate - Heart rate can be an indicator of the challenge to the cardiovascular system that the exercise represents.
- VO_2max- the amount of oxygen consumed by the body during exercise

Exercise is categorized into three different intensity levels. These levels include **Low** (40-50% MHR), **Moderate** (50-65% MHR), and **Vigorous** (65-85% MHR) for aerobic exercise and are measured by the metabolic equivalent of task. The effects of exercise were different at each intensity level (i.e. training effect). Recommendations to lead a healthy lifestyle vary for individuals based on age, weight, and existing activity levels. "Published guidelines for healthy adults' state is that 20-60 minutes of medium intensity continuous or intermittent aerobic activity 3-5 times per week is needed for developing and maintaining fitness" (ACSM, 1990).

3. **Duration of training**: the subjects perform the exercise for 45 minutes per day in this study. Duration is dependent on the intensity of the activity, thus, medium-intensity activity should be conducted over a longer period of time (25 min or more) and conversely individuals training at higher levels of intensity should train at least 10min or longer (ACSM, 1990).

4. **Type of activity**: any activity that uses large muscle groups, which can be maintained continuously, and is rhythmical and aerobic in nature, e.g., walking-hiking, running, jogging,

bicycling, cross-country skiing, aerobic dance/group exercise, rope skipping, rowing, stair climbing, swimming, skating, and various endurance game activities or some combination thereof (ACSM, 1990).

5. **Load and Effort:** Within the area of aerobic exercise, intensity is generally considered to represent the effort required by the body at a given velocity, incline, and resistance (or other variable) at a given work rate and is typically expressed relative to quantities such as heart rate (HR), % of heart rate maximum blood lactate or oxygen uptake (VO_2). With regard to muscular effort, however, the percentage of one repetition maximum is purely a representation of **load**. Whilst increasing or decreasing a given load might indeed require greater or lesser effort, it should never be considered a measure of the effort or intensity that the body is working at. It is surely not acceptable that terminology can be used with different meanings based on differing modalities of exercise being performed (Fisher and Smith, 2012). **Workload can have three components:**

1. The amount of weight lifted during an exercise.
2. The number of repetitions completed for a particular exercise.
3. The length of time to complete all exercises in a set or total training session

The table of training schedule of this study for two months is listed in the next pages.

Table 1. Training Schedule for First Month (December, 2017)

Day	Types of exercise	Time /min during session	Repetition / rest	Intensity	Total Duration
Monday (12:30am-1:15am)	**Warming up** – jogging -static stretching which involves holding a position - dynamic stretching -slow walking	5min 4min 3min 3min	3rep/1min rest	Low to moderate (40-65%)	45.00 minute
	Main part- Running -Stationary bicycle -Treadmill running -step-up	7min 6min 4min			
	Cool down- stretching and relaxation exercise	5min 5min			
Wednesday (4:00pm-4:45pm)	**Warming up**- walking - jogging -Static stretching -dynamic stretching	4min 4min 3min 3min	3rep/1min rest	Low to moderate (40-65%)	45:00 minute
	Main part -Stationary Cycling -Treadmill running -jumping rope	7min 7min 4min			
	Cool down- stretching exercise	10min			
Friday (10:00am-10:45am)	**Warming up**- walking - jogging -static stretching	5min 5min 4min	4rep/1min rest	Low to moderate (40-65%)	45:00 minute
	Main part- Tread mill running -Stationary Cycling -squat jumping	6min 7min 4min			
	Cool down- stretching and relaxation exercise	5min 5min			

The above training schedule was performed every week of the month of (December, 2017)

Table 2. Training Schedule for Second Month (January, 2018)

Day	Types of exercise	Time/min /session	Frequency /rest	Intensity	Total duration
Monday (12:30pm-1:15pm)	**Warming up**- walking jogging dynamic and static stretching	 5min 5min	3rep/1min rest	Moderate to High (65- 85%)	45:00 minute
	Main part- tread mill running stationary cycling -aerobics dance -jumping rope	7min 6min 6min 3min			
	Cool down- slow stretching and relaxation exercise	5min 5min			
Wednesday (4:00pm-4:45pm)	**Warming up**- slow walking -jogging -stretching exercise	 5min 5min	3rep/1min rest	Moderate to High (65-85%)	45:00 minute
	Main part- Tread mill running -stationary bicycling -brisk walking -strength exercise sit up	8min 7min 4min 3min			
	Cool down- slow stretching and relaxation exercise	5min 5min			
Friday (10:00pm-10:45pm)	**Warming up**- slow walking -jogging - stretching exercise	 5min 5min	3rep/1min rest	Moderate to High (65-85%)	45:00 minute
	Main part- Tread mill running -stationary bicycling -jumping rope -brisk walking	7min 6min 4min 5min			
	Cool down- slow stretching and relaxation exercise	5min 5min			

The above training schedule was performed every week of the month of January, 2018

APPENDIX - V

Physiological Fitness Test Result Record Sheet of Subjects

Group _____ (Control or Experimental Group)

Name: _____

Initial Height/m: _____

Initial Wight/kg: _____

Age: 20-25

Sex: Both_____

No	Parameters to be measured	Types of Test	Sex	Experimental Group		Control Group	
1	12-miunte cooper test(ml/kg/min)	VO_2 max	Male	per test	post-test	per-test	post-test
			Female				
2	30-miunte time trial test(bpm)	Lactate Threshold	Male				
			Female				

The raw data which was recorded for the selected motor fitness variables in 8 weeks (pre and post) on the target subjects was listed in the following tables.

Table 3. Raw data for the study variables of experimental and control group

VO_2 max (12miunte in ml/kg/min

group	subject code	sex					
		Male			Female		
		Age	PT	POT	Age	PT	POT
Experimental	S1E	20	48	55	21	45.7	47.5
	S2E	23	47	56	21	40	50
	S3E	25	43	50	22	40	46.5
	S4E	24	48	54	23	42	47
	S5E	23	45	52	24	43	48
	S6E	21	47	53	25	41	45
	S7E	22	45	50	24	42.5	46
	S8E	23	43	50	22	40	46.7
Control	S1C	25	48	48.5	22	43	43.5
	S2C	23	49	49.5	23	42	42.5
	S3C	24	42	42	21	41	41
	S4C	25	47	47.8	23	43.5	44
	S5C	23	48	48.5	22	43	43.5
	S6C	22	43	44.5	22	39	40
	S7C	22	44	43	23	41.5	42
	S8C	23	43	43	21	41.5	41

LT(30-minute time trial test in bpm)

Group	Subject code	sex					
		Male			Female		
		Age	PT	POT	Age	PT	POT
Experimental	S9E	21	128	125	20	138	133.8
	S10E	23	150	142.5	25	155	145
	S11E	25	140	135.5	21	137	129
	S12E	22	140.5	135.5	23	150	145
	S13E	20	144.5	134.5	25	156	150
	S14E	21	148	142	25	140	144.8
	S15E	22	148	140	24	147	140
	S16E	23	147.5	140	22	149	145
Control	S9C	24	143	142.5	20	138	137.5
	S10C	23	148	148	24	150	149.5
	S11C	21	146	145.5	21	140	139.5
	S12C	25	145.5	145	21	145	144.5
	S13C	23	145	144.5	22	146	145.5
	S14C	21	130	129	22	150	149.5
	S15C	22	144.8	144	23	140	139.5
	S16C	20	130	129	22	140	149.5

APPENDIX - VI

Paired Sample T- Tests of Parameters

Table 4.VO_2 Max test for Male for Experimental and Control Group (pre and post test result)

Parameters		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Per and post EG for male	-6.75000	1.16496	.41188	-7.72393	-5.77607	-16.388	7	.000
Pair 2	Per and Post CG for male	-.50000	.28868	.10911	-.76698	-.23302	-4.583	6	.004

Table 5.VO_2 Max test for Female for Experimental and Control Group (Pre and Post test result)

Paired Samples Test

Parameters		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	pre and post EG for female	-5.31250	2.47412	.87473	-7.38091	-3.24409	-6.073	7	.001
Pair 2	pre and post CG for female	-.50000	.28868	.10911	-.76698	-.23302	-4.583	6	.004

Table 6. Lactate threshold test Male for Experimental and Control Group (Pre and Posttest result)

Paired Samples Test

Parameters	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 per and post EG for male	6.75625	2.49792	.88315	4.66794	8.84456	7.650	7	.000
Pair 2 per and post CG for male	.42857	.44615	.16863	.01595	.84119	2.542	6	.044

Table 7.Lactate threshold test Female for Experimental and Control Group (Pre and Posttest result)

Paired Samples Test

parameters	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 per and post GC for female	4.9250	4.41806	1.56202	1.23141	8.61859	3.153	7	.016
Pair 2 per and post CG for female	.42857	.44987	.17003	.01251	.84463	2.521	6	.045

APPENDIX - VII

Norms of VO_2max Test Analysis

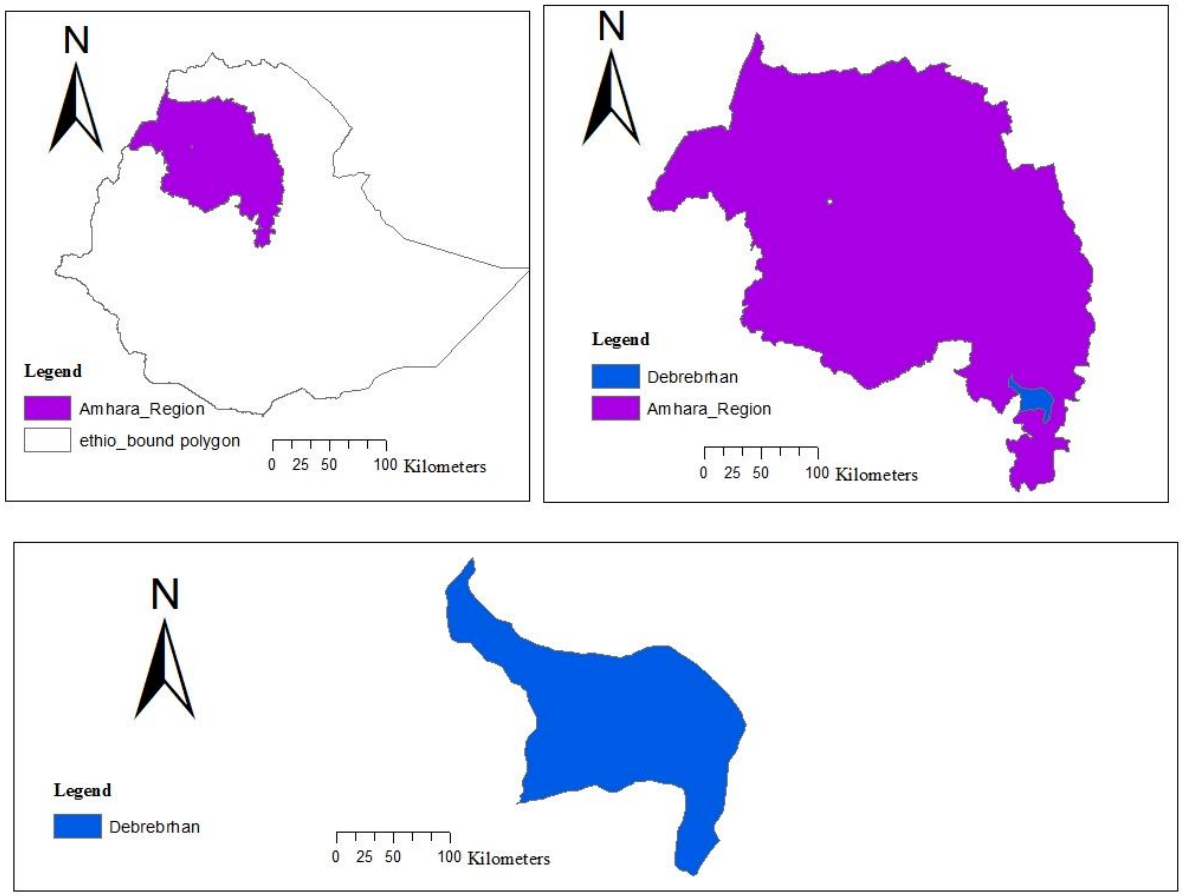
Table 8. Normative data of VO_2 max test for male (12-minute cooper test) in ml/kg/min

Age	Sex	Superior	Excellent	Good	Fair	Poor
20-29	Male	>55	51-55	46-50	42-45	<42
	Female	>49	44-49	40-43	36-39	<36

Source: Heywood (2006)

APPENDIX - VIII

Figure 1: Map of the Study Site



Source: Geographical Information System Software version 10

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