EFFECT OF WEIGHT TRAINING ON MUSCLE MASS AND STRENGTH OF UNDER 17 MALE BOX SPORT PROJECT OF HARARI REGIONAL STATE, ETHIOPIA

MSc THESIS

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HARAMAYA UNIVERSITY, HARAMAYA

Effect of Weight Training On Muscle Mass and Strength of Under 17 Male Box Sport Project of Harari Regional State, Ethiopia

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University, Haramaya

DEDICATION

This thesis is dedicated to my Family whom they pay tribute at every step in my life.

HARAMAYA UNIVERSITY

POSTGRADUATE PROGRAM DIRECTORATE

I hereby certify that I have read and evaluated this Thesis entitled: "**Effect of Weight Training on Muscle Mass and Strength of under 17 Male Box Sport Project of Harari Regional State, Ethiopia**" Prepared under my guidance by Anwar Mohammed Nur. I recommend that it can be submitted as fulfilling the thesis requirement**.**

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ACRONYMS AND ABBREVIATIONS

ACSM	American College of Sport Medicine
1RM	One repetition maximum
RFD	Rate of force development

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ABSTRACT

The main objective of the study was to investigate the "effect of weight training on muscle mass and strength of under 17 male box sport project of Harari regional state, Ethiopia "In this study multistage sampling technique method was used to select 60 target group. The first sampling method used to define subjects was availability then to place the athletes in to groups simple random sampling was used. Experimental and control groups was used and 12 weeks of strength training was delivered for the experimental group while the control group was excluded from the training. Data collected from body weight, chest circumference and waist circumference to check their body mass change and press up, standing long jump and 1 maximum repetition weight lifting was used to check their strength change before and after intervention. The data obtained was analyzed using simple descriptive statistics (frequency, mean ± Standard Division) and independent samples t-test (Mean Division, Standard Division mean and at significance levels) and evaluated the point with Post-test of mean value to each variable' tests. were Mean ± Standard Division value of chest circumference, (Body Mass Index) test (point-78.20 ±3.4972, point -79.4667±3.9379), body weight (point 65.6533 kg ±4.2165, point - 68.0333 bpm±4.5022), waist circumference (point - 69.50 ±4.044, point - 71.6912 ±4.058) 1 maximum repetition weight lift (point - 73.04 ± 5.044, point - 76.3333 ±4.658) standing long jump (point - 2.5512 ±0.1397, point - 2.8325 ±0.2531) and press up (point - 29.5624 ±7.365, point - 34.4167 ±7.8011) of the target group were registered respectively after 12 weeks continue strength exercise training program, which was indicated the improvement of muscles mass and muscle strength of the target group. The result obtained in this study indicated that there was a significant improvement in all the variables. The study concluded that the effect of strength exercise training programs had a significant positive effect on the improvement of muscles mass and muscle strength of participants. Based on the finding, the researcher recommended that it is quite clear that further research is necessary on the title of 'effect of weight training on muscle mass and strength of under 17 male other sport project of Harari regional state, Ethiopia

Keywords: strength exercises, muscle mass, and muscular strength

1. INTRODUCTION

1.1 Background of the Study

Boxing involves stand-up fighting that primarily relies on punches and should not be mistaken for other combat sports like amateur wrestling, mixed martial arts, and fencing kickboxing. Fighters are restricted to targeting the frontal or lateral areas of their opponents' head or torso. The number and duration of rounds in amateur boxing vary based on the level of competition and gender. Novice boxers compete in three 2-minute rounds, intermediate boxers compete in four 2-minute rounds, and open-class boxers compete in three 3-minute rounds (males) or four 2-minute rounds (females). Professional boxing includes lower standard contests with four 2-minute rounds and elite bouts that can have up to 12 three-minute rounds. If a boxer manages to knock out their opponent, the bout can be won at any time, resulting in a shorter match. If no knockout occurs, judges determine the winner using a scoring system based on impactful punches, dominance, technical and tactical superiority, and rule violations. (Loturco 2016)

Boxing is a competitive combat discipline in which two opponents engage in a physical confrontation, aiming to incapacitate each other through powerful strikes delivered primarily with their upper limbs. The target area for these strikes includes any region above the waistline, but is limited to the front portion of the head and body. (Brown 2023)

Furthermore, Boxing is a form of combat sport where two individuals aim to defeat each other through powerful strikes using their upper limbs. The objective is to hit the opponent above the waistline, specifically targeting the front portion of the head and body. The rules and regulations are established to prioritize the well-being of the boxers, despite the ultimate aim being to harm and potentially injure the opponent. Although there may be minor injuries, the presence of an authorized referee ensures fair play and safety during the competition, with medical experts readily available. Therefore, boxing can be considered a reasonably safe sport. (Brown 2021)

In the training protocol for boxers, the primary focuses on the development of strength and endurance. The purpose of this research thesis is to investigate the effects of weight

training on muscle mass and strength in male boxers under the age of 17 project. Boxing is a physically demanding sport that requires a combination of speed, agility, and strength. While technical skills and conditioning play crucial roles in performance, the role of weight training on muscle development and overall strength in young boxers remain understudied. This research aims to bridge this gap in knowledge by examining the specific effects of weight training on muscle mass and strength in this population.

1.2. Statement of the problem

The purpose of this study is to investigate the effects of weight training on muscle mass and strength among boxers in the U-17 age category in the Harar region.

Boxing is a physically demanding sport that requires athletes to possess high levels of muscle mass and strength in order to perform at their best. While there is existing research on the benefits of weight training for adult boxers, there is a lack of specific research focusing on the U-17 age group.

The aim of this study is to determine whether a structured weight training program can effectively increase muscle mass and strength among U-17 boxers in the Harar region. By examining the impact of weight training on these variables, the study will provide valuable insights into the potential benefits and risks associated with implementing a weight training regimen for young boxers.

The research was involve recruiting a sample of U-17 boxers from various clubs in the Harar region and dividing them into two groups: an experimental group that will undergo a structured weight training program, and a control group that was not participate in any specific weight training intervention. Pre- and post-intervention measurements of muscle mass and strength was taken for both groups using standardized assessment tools and protocols.

The findings of this study was contribute to the existing knowledge on the effects of weight training on young athletes and provide evidence-based recommendations for coaches, trainers, and sports organizations in the Harar region regarding the inclusion of weight

training programs for U-17 boxers. This research was contributed to the development of effective training strategies that optimize the performance and health of young boxers in the region. However, the improvement and development of physical fitness quality of community was the responsibility of every stock holder. (Singh, 2014) In addition to this, it was our obligation to create conducive environment for community to participate in Weight Training Muscle Mass and Strength so as to improve their Muscle Mass and Strength. Due to this the researcher want to investigate the effect of three-month regular Weight Training consists of running on spot, walking, jogging, dump bell ,Push up, Pull up ,squat(leg press) and bench press(chest press) on selected physical fitness variables such as cardio respiratory fitness, Muscular-Strength, and body composition.

On line with this, the study attempted to test the following Hypothesis.

1. H0: 12-week weight training exercises wouldn't have significant impact weight training on muscle mass

   H1: 12-week weight training exercises would have significant impact weight training on muscle mass
2. H0: 12-week weight training wouldn't have significant effect on strength level
   H1: 12-week weight training would have significant effect on strength level
3. H0: 12-week weight training wouldn't have significant effect on body composition.
   H1: 12-week weight training would have significant effect on body composition

1.3 Scope of the study

This study was applied at Harar town, Under 17 male box sport project of Harar city at Harari regional state. It was employed on 12 weeks weight training to check the effect of muscle mass and strength of box project athletes.

1.4. Significance of the Study

This study was concerning effect of weight training on upper muscle mass and strength of under 17 male box sport project of Harari regional state, Ethiopia to provide the following significant

- ✓ this study help Harari Region under 17 project boxers to improve their performance
- ✓ it providing the importance of weight training exerciser on boxing sport
- ✓ it providing the importance of muscle mass and strength on boxing sport
- ✓ it improve coaching staff in the team in particular in creating awareness about the importance of regular weight training
- ✓ It be improving muscle mass and strength of athletes.
- ✓ It help the researcher of related literature for further study

1.5. Objectives of the Study

1.5.1. General objectives

The general objective of this study is to examine the effect of 12 weeks weight training in improving muscle mass and strength of box project athletes.

1.5.2. Specific objectives

Specific objectives of the study:-

1. To determine the impact of weight training on muscle mass in Harar city under 17 male boxing project.
2. To assess the influence of weight training on strength level in Harar city under 17 male boxing project.
3. To assess the effect of muscle strength of upper body and lower body on under 17 male boxing project.

2. REVIEW OF LITERATURE

2.1. Weight Training To Punching Performance

Lower-body strength, rather than rate of force development (RFD), showed a noteworthy and significant positive correlation with peak punch force in amateur boxers. While upper-body strength and power are commonly considered crucial in boxing, they did not differentiate between boxers who generated higher or lower peak force, nor did they exhibit a correlation with peak punch force. Therefore, training methods that enhance lower-body strength without causing an increase in overall body mass (to meet weight category requirements) could potentially enhance punch capacity among highly trained amateur boxers. (Dunn et al., 2022)

Maximal strength and explosive strength in the lower body, as well as explosive strength in the upper body, play a significant role in determining the impact force of punches in elite amateur boxers. Specifically, elite boxers who generate high impact forces in their punches exhibit greater levels of maximal and explosive strength in their lower body compared to those who generate low impact forces. However, the maximal strength abilities of the upper body do not have a direct association with punch impact force and do not differentiate between elite boxers with high and low impact forces. Therefore, boxers aiming to enhance their punch impact force should prioritize the development of both maximal and explosive strength in the legs, while focusing primarily on explosive strength in the upper body. (Beattie and Ruddock 2022)

2.2. Importance of Weight Training To Box Sport

Strength training has the potential to enhance performance in specific judo, fencing, karate, and boxing tests. Additionally, it can improve various aspects of strength, including maximum strength, strength-endurance, and muscle power. Consequently, interventions focused on developing muscular strength in these sports (judo, boxing, karate, wrestling, and fencing) appear advantageous for overall physical fitness, leading to favorable outcomes in favor of the training groups. (Calfucura *et al*., 2023).

2.3. Weight Training Protocol for Box Sport

The primary objective of the general preparation phase is to offer comprehensive conditioning for muscle and strength. If there is a clearly defined season, this phase should occur during the early preseason. However, in the absence of seasons, it is important to proceed through the training phases in a sequential manner. (Davis et al., 2013)

The general conditioning during preparatory should have the following specific protocol. Frequency should be 3 months. 3 days per week , Type should be General conditioning and Exercises volume: 3 sets of 12 reps, plus warm-up and cool-down from the intensity will be low high and moderate and also test will be conducted has pre-test during test post- test

2.4. Weight Training To Prevent Injury

A quandary of literature supports strength training as efficacious in preventing injuries. (Kraemer and Ratamess, 2004). Resistance training is thought to play an important role in reducing the risk of injury not only injuries encountered in the weight room (which are very low) but also injuries encountered in athletics, recreation, or during performance of activities of daily living. Greater muscular strength increases joint stability, which enables the athlete to offset high levels of force encountered during ballistic activities. Tendons, ligaments, and bone adapt to weight training by increasing stiffness (tendons), cross-sectional area, and bone mineral density, which provide greater support to the skeletal system and increase force transmission efficiency. More specific to boxers, properly designed training programs, utilizing specific site preventative measures to strengthen the scapula humeral muscles and lateral rotators of the shoulder have been proven effective in warding off further injury. (Hodgson *et al*., 2005) and have been shown to decrease shoulder rotator muscle imbalances.

2.5. Weight Training Programming Considerations

When designing a weight training program for boxers, there are several considerations to keep in mind. Here are some key factors to consider:

Functional Strength: Focus on exercises that improve functional strength, which is the ability to generate power and transfer force efficiently in boxing movements. Compound exercises such as squats, deadlifts, lunges, and push-ups are beneficial for developing overall strength and power. (Siff, 2000)

Core Stability: Core strength and stability are essential for generating power and maintaining balance in boxing. Incorporate exercises like planks, Russian twists, and medicine ball throws to target the core muscles. (Cochran, 2001)

Balance and Coordination: Boxing requires excellent balance and coordination. Include exercises that challenge balance, such as single-leg exercises (e.g., single-leg squats) and stability ball exercises. (Zhang etal., 2023)

Explosive Power: Boxing involves quick and explosive movements. Include exercises that improve explosive power, such as plyometric exercises (e.g., box jumps, medicine ball slams) and Olympic lifts (if properly trained and supervised). (Cordes, 1991)

Endurance: Boxing matches can be physically demanding, so it's important to train for endurance. Incorporate high-intensity interval training (HIIT), circuit training, and cardiovascular exercises like running or skipping rope. (Ľuboslav et al., 2020)

Muscular Balance: Address any muscle imbalances that may increase the risk of injury. Focus on balancing strength between opposing muscle groups, such as the chest and back or quadriceps and hamstrings. (Yeung et al., 2009)

Recovery and Injury Prevention: Allow for adequate rest and recovery between workouts. Incorporate stretching, mobility exercises, and foam rolling to help prevent injuries and maintain flexibility (Feiring and Derschied, 1989).

Individualization: Tailor the program to the individual boxer's needs, taking into account their current fitness level, experience, and specific goals. Consider consulting with a qualified strength and conditioning coach who has experience working with boxers (Feiring and Derschied, 1989).

2.6. Weight Training Effect on Performance

Weight training can have a significant positive impact on athletic performance across various sports, including boxing. Here are some ways in which weight training can enhance performance (Ratamess, 2012).

Increased Strength: Weight training helps develop muscular strength, allowing boxers to generate more power in their punches and movements. Improved strength can also lead to better stability and balance, reducing the risk of being pushed off balance or knocked down (Ratamess, 2012).

Power and Explosiveness: Weight training exercises such as Olympic lifts, plyometrics, and medicine ball throws can improve explosive power. This translates to faster and more forceful punches, quicker footwork, and enhanced agility in the ring. (Ratamess, 2012).

Endurance and Stamina: Weight training, when combined with appropriate conditioning exercises, can enhance muscular endurance and stamina. This allows boxers to maintain a high level of performance throughout rounds, reducing fatigue and improving overall performance in the ring (Ratamess, 2012).

Injury Prevention: A well-designed weight training program can help strengthen muscles, tendons, and ligaments, reducing the risk of injuries. Strengthening the core and other stabilizing muscles can improve postural control and reduce the likelihood of imbalances that could lead to injuries.

Body Composition and Weight Management: Weight training can help boxers improve body composition by increasing lean muscle mass and reducing body fat. This

can be beneficial for weight management and achieving the desired weight class without sacrificing strength or performance (Fleck and Falkel, 1986).

Mental Toughness and Confidence: Engaging in challenging weight training sessions and overcoming physical barriers can enhance mental toughness and confidence in boxers. This mental resilience can translate to improved focus, determination, and resilience during fights (Johnson 1987).

It's important to note that the specific weight training program should be tailored to the individual boxer's needs, taking into account their current fitness level, training experience, and specific goals. Working with a knowledgeable strength and conditioning coach can help develop a program that optimally supports performance while minimizing the risk of injury. Additionally, integrating weight training with other aspects of training, such as skill work, conditioning, and strategy development, is crucial for overall success in boxing. (Johnson 2003).

2.7 Strength training

forms of strength training are being practiced. Identified from left to right, the exercises are: overhead presses, battle ropes, planking, and kettlebell raises.

Strength training, also known as weight training or resistance training, involves the performance of physical exercises that are designed to improve physical strength. It is often associated with the lifting of weights. It can also incorporate a variety of training techniques such as bodyweight exercises, isometrics, and plyometrics.[1]

Training works by progressively increasing the force output of the muscles and uses a variety of exercises and types of equipment. Strength training is primarily an anaerobic activity, although circuit training also is a form of aerobic exercise.

Strength training can increase muscle, tendon, and ligament strength as well as bone density, metabolism, and the lactate threshold; improve joint and cardiac function; and reduce the risk of injury in athletes and the elderly. For many sports and physical activities, strength training is central or is used as part of their training regimen.

2.7.1 Principles and training methods

Strength training follows the fundamental principle that involves repeatedly overloading a muscle group. This is typically done by contracting the muscles against heavy resistance and then returning to the starting position. This process is repeated for several repetitions until the muscles reach the point of failure.[2] The basic method of resistance training uses the principle

of progressive overload, in which the muscles are overloaded by working against as high resistance as they are capable of. They respond by growing larger and stronger.[3] Beginning strength-trainers are in the process of training the neurological aspects of strength, the ability of the brain to generate a rate of neuronal action potentials that will produce a muscular contraction that is close to the maximum of the muscle's potential]

A dumbbell half-squat.[5]

Strength training also requires the use of proper or 'good form', performing the movements with the appropriate muscle group, and not transferring the weight to different body parts in order to move greater weight (called 'cheating'). An injury or an inability to reach training objectives might arise from poor form during a training set. If the desired muscle group is not challenged sufficiently, the threshold of overload is never reached and the muscle does not gain in strength. At a particularly advanced level, however, "cheating" can be used to break through strength plateaus and encourage neurological and muscular adaptation.[6]

Maintaining proper form is one of the many steps in order to perfectly perform a certain technique. Correct form in weight training improves strength, muscle tone, and maintaining a healthy weight. Improper form can lead to strains and fractures.[7]

2.7.2 Stretching and warm-up

Weight trainers often spend time warming up before starting a workout, a practice strongly recommended by the National Strength and Conditioning Association (NSCA). A warm-up may include cardiovascular activity such as light stationary biking (a "pulse raiser"), flexibility and joint mobility exercises, static and/or dynamic stretching, "passive warm up" such as applying heat pads or taking a hot shower, and workout-specific warm up,[8] such as rehearsal of the intended exercise with no weights or light weights. The intended purpose of warming up is to enhance exercise effectiveness and reduce the risk of injury.[9]

Evidence is limited regarding whether warming up reduces injuries during strength training.[9] As of 2015, no articles existed on the effects of warm up for upper body injury prevention.[10] For the lower limbs, several programs significantly reduce injuries in sports and military training, but no universal injury prevention program has emerged, and it is unclear if warm ups designed for these areas will also be applicable to strength training.[11] Static stretching can increase the risk of injury due to its analgesic effect and cellular damage caused by it.[12]

The effects of warming up on exercise effectiveness are clearer. For 1RM trials, an exercise rehearsal has significant benefits. For submaximal strength training (3 sets of 80% of 1RM to failure), exercise rehearsal does not provide any benefits regarding fatigue or total repetitions for exercises such as bench press, squats, and arm curl, compared to no warm-up.[9] Dynamic warm-ups (performed with greater than 20% of maximal effort) enhance strength and power in upper-body exercises.[10] When properly warmed up the lifter will have more strength and stamina since the blood has begun to flow to the muscle groups.[13] Pulse raisers do not have any effect on either 1RM or submaximal training.[9] Static stretching induces strength loss, and should therefore probably not be performed before strength training. Resistance training functions as an active form of flexibility training, with similar increases in range of motion when compared to performing a static stretching protocol. Static stretching, performed either before or after exercise, also does not reduce muscle soreness in healthy adults.[9]

2.7.3 Breathing

Like numerous forms of exercise, weight training has the potential to cause the breathing pattern to deepen. This helps to meet increased oxygen requirements. One approach to breathing during weight training consists of avoiding holding one's breath and breathing shallowly. The benefits of this include protecting against a lack of oxygen, passing out, and increased blood pressure. The general procedure of this method is to inhale when lowering the weight (the eccentric portion) and exhale when lifting the weight (the concentric portion). However, the reverse, inhaling when lifting and exhaling when lowering, may also be recommended. There is little difference between the two techniques in terms of their influence on heart rate and blood pressure.[14]

On the other hand, for people working with extremely heavy loads (such as powerlifters), breathing à la the Valsalva maneuver is often used. This involves deeply inhaling and then bracing down with the abdominal and lower back muscles as the air is held in during the entire rep. Air is then expelled once the rep is done, or after a number of reps is done. The Valsalva maneuver leads to an increase in intrathoracic and intra-abdominal pressure. This enhances the structural integrity of the torso—protecting against excessive spinal flexion or extension and providing a secure base to lift heavy weights effectively and securely.[15] However, as the Valsalva maneuver increases blood pressure, lowers heart rate, and restricts breathing, it can be a dangerous method for those with hypertension or for those who faint easily.

2.7.4 Training volume

Training volume is commonly defined as sets × reps × load. That is, an individual moves a certain load for some number of repetitions, rests, and repeats this for some number of sets, and the volume is the product of these numbers. For non-weightlifting exercises, the load may be replaced with *intensity*, the amount of work required to achieve the activity. Training volume is one of the most critical variables in the effectiveness of strength training. There is a positive relationship between volume and hypertrophy.[16][17]

The load or intensity is often normalized as the percentage of an individual's one-repetition maximum (1RM). Due to muscle failure, the intensity limits the maximum number of repetitions that can be carried out in one set, and is correlated with the repetition ranges chosen. Depending on the goal, different loads and repetition amounts may be appropriate:[18]

- Strength development (1RM performance): Gains may be achieved with a variety of loads. However, training efficiency is maximized by using heavy loads (80% to 100% of 1RM). The number of repetitions is secondary and may be 1 to 5 repetitions per set.[18]
- Muscle growth (hypertrophy): Hypertrophy can be maximized by taking sets to failure or close to failure. Any load 30% of 1RM or greater may be used. The NCSA recommends "medium" loads of 8 to 12 repetitions per set with 60% to 80% of 1RM.[18]
- Endurance: Endurance may be trained by performing many repetitions, such as 15 or more per set. The NCSA recommends "light" loads below 60% of 1RM, but some studies have found conflicting results suggesting that "moderate" 15-20RM loads may work better when performed to failure.[18]

Training to muscle failure is not necessary for increasing muscle strength and muscle mass, but it also is not harmful.[19]

2.7.5 Movement tempo

The speed or pace at which each repetition is performed is also an important factor in strength and muscle gain. The emerging format for expressing this is as a 4-number tempo code such as 3/1/4/2, meaning an eccentric phase lasting 3 seconds, a pause of 1 second, a concentric phase of 4 seconds, and another pause of 2 seconds. The letter X in a tempo code represents a voluntary explosive action whereby the actual velocity and duration is not controlled and may be involuntarily extended as fatigue manifests, while the letter V implies volitional freedom "at your own pace". A phase's tempo may also be measured as the average movement velocity. Less precise but commonly used characterizations of tempo include the total time for the repetition or a qualitative characterization such as fast, moderate, or slow. The ACSM recommends a moderate or slower tempo of movement for novice- and intermediate-trained individuals, but a combination of slow, moderate, and fast tempos for advanced training.[20]

Intentionally slowing down the movement tempo of each repetition can increase muscle activation for a given number of repetitions. However, the maximum number of repetitions and the maximum possible load for a given number of repetitions decreases as the tempo is slowed. Some trainers calculate training volume using the time under tension (TUT), namely the time of each rep times the number of reps, rather than simply the number of reps.[20] However, hypertrophy is similar for a fixed number of repetitions and each repetition's duration varying from 0.5 s - 8 s. There is however a marked decrease in hypertrophy for "very slow" durations greater than 10 s.[21] There are similar hypertrophic effects for 50-60% 1RM loads with a slower 3/0/3/0 tempo and 80-90% 1RM loads with a faster 1/1/1/0 tempo. It may be beneficial for both hypertrophy and strength to use fast, short concentric phases and slower, longer eccentric phases. Research has not yet isolated the effects of concentric and eccentric durations, or tested a wide variety of exercises and populations.[20]

2.7.6 Weekly frequency

In general, more weekly training sessions lead to higher increases in physical strength. However, when training volume was equalized, training frequency had no influence on muscular strength. In addition, greater frequency had no significant effect on single-joint exercises. There may be a fatigue recovery effect in which spreading the same amount of training over multiple days boosts gains, but this has to be confirmed by future study.[22]

For muscle growth, a training frequency of two sessions per week had greater effects than once per week. Whether training a muscle group three times per week is superior to a twice-per-week protocol remains to be determined.[23]

2.7.8 Rest period

The rest period is defined as the time dedicated to recovery between sets and exercises. Exercise causes metabolic stress, such as the buildup of lactic acid and the depletion of adenosine triphosphate and phosphocreatine.[24] Resting 3–5 minutes between sets allows for significantly greater repetitions in the next set versus resting 1–2 minutes.[25]

For untrained individuals (no previous resistance training experience), the effect of resting on muscular strength development is small and other factors such as volitional fatigue and discomfort, cardiac stress, and the time available for training may be more important. Moderate rest intervals (60-160s) are better than short (20-40 s), but long rest intervals (3–4 minutes) have no significant difference from moderate.[24]

For trained individuals, rest of 3–5 minutes[26] is sufficient to maximize strength gain, compared to shorter intervals 20s-60s and longer intervals of 5 minutes. Intervals of greater than 5 minutes have not been studied.[24] Starting at 2 minutes and progressively decreasing the rest interval over the course of a few weeks to 30s can produce similar strength gains to a constant 2 minutes.[27][24]

Regarding older individuals, a 1 minute rest is sufficient in females.[24]

2.7.9 Order

The largest increases in strength happen for the exercises in the beginning of a session.[28]

Supersets are defined as a pair of different exercise sets performed without rest, followed by a normal rest period. Common superset configurations are two exercises for the same muscle group, agonist-antagonist muscles, or alternating upper and lower body muscle groups.[29] Exercises for the same muscle group (flat bench press followed by the incline bench press) result in a significantly lower training volume than a traditional exercise format with rests.[30] However, agonist–antagonist supersets result in a significantly higher training volume when compared to a traditional exercise format.[31] Similarly, holding training volume constant but performing upper–lower body supersets and tri-sets reduce elapsed time but increased perceived exertion rate.[32] These results suggest that specific exercise orders may allow more intense, more time-efficient workouts with results similar to longer workouts.[29]

Periodization 2.8

Periodization refers to the organization of training into sequential phases and cyclical periods, and the change in training over time. The simplest strength training periodization involves keeping a fixed schedule of sets and reps (e.g. 2 sets of 12 reps of bicep curls every 2 days), and steadily increasing the intensity on a weekly basis. This is conceptually a parallel model, as several exercises are done each day and thus multiple muscles are developed simultaneously. It is also sometimes called *linear* periodization, but this designation is considered a misnomer.[33]

Sequential or block periodization concentrates training into periods ("blocks"). For example, for athletes, performance can be optimized for specific events based on the competition schedule. An annual training plan may be divided hierarchically into several levels, from training phases down to individual sessions. Traditional periodization can be viewed as repeating one weekly block over and over. Block periodization has the advantage of focusing on specific motor abilities and muscle groups.[33] Because only a few abilities are worked on at a time, the effects of fatigue are minimized. With careful goal selection and ordering, there may be synergistic effects. A traditional block consists of high-volume, low-intensity exercises, transitioning to low-volume, high-intensity exercises. However, to maximize progress to specific goals, individual programs may require different manipulations, such as decreasing the intensity and increasing volume.[34]

Undulating periodization is an extension of block periodization to frequent changes in volume and intensity, usually daily or weekly. Because of the rapid changes, it is theorized that there will be more stress on the neuromuscular system and better training effects. Undulating periodization yields better strength improvements on 1RM than non-periodized training.[33] For hypertrophy, it appears that daily undulating periodization has similar effect to more traditional models.[35]

2.8.1 Training splits

A training split refers to how the trainee divides and schedules their training volume, or in other words which muscles are trained on a given day over a period of time (usually a week). Popular training splits include full body, upper/lower, push/pull/legs, and the "bro" split. Some training programs may alternate splits weekly.

2.8.2 Exercise selection

Exercise selection depends on the goals of the strength training program. If a specific sport or activity is targeted, the focus will be on specific muscle groups used in that sport. Various exercises may target improvements in strength, speed, agility, or endurance.[37] For other populations such as older individuals, there is little information to guide exercise selection, but exercises can be selected on the basis of specific functional capabilities as well as the safety and efficiency of the exercises.[38]

For strength and power training in able-bodied individuals, the NCSA recommends emphasizing integrated or compound movements (multi-joint exercises), such as with free weights, over exercises isolating a muscle (single-joint exercises), such as with machines.[39] This is due to the fact that only the compound movements improve gross motor coordination and proprioceptive stabilizing mechanisms.[37] However, single-joint exercises can result in greater muscle growth in the targeted muscles,[40] and are more suitable for injury prevention and rehabilitation.[39] Low variation in exercise selection or targeted muscle groups, combined with a high volume of training, is likely to lead to overtraining and training maladaptation.[41] Many exercises such as the squat have several variations. Some studies have analyzed the differing muscle activation patterns, which can aid in exercise selection.[42]

2.8.3 Equipment

Commonly used equipment for resistance training include free weights—including dumbbells, barbells, and kettlebells—weight machines, and resistance bands.[43]

Resistance can also be generated by inertia in flywheel training instead of by gravity from weights, facilitating variable resistance throughout the range of motion and eccentric overload.[44][45]

Some bodyweight exercises do not require any equipment, and others may be performed with equipment such as suspension trainers or pull-up bars.[46]

2.8.4 Types of strength training exercises

- Isometric exercise
- Isotonic exercise
- Isokinetic exercise

3. MATERIALS AND METHODS

3.1. Description of the Study Area

Harari People's National Regional State is one of the twelve Regions in the country which is located in the eastern part of the country, 560 km away from the capital, Addis Ababa. Astronomically, it is located between 90 11’ 49” and 90 20’ 31’’ North Latitude and 420 03` 30’’ and 420 16’ 24’’ East Longitude. According to the Harari Planning and Economic Development Bureau Report (2000), the Region has an area of about 343.2 sq.km in which the rural area constitutes 323.7 sq.km while the urban area has about 19.1 sq. km.

3.2. Research Design

The Researcher was planned some selected weight training program specifically which was improve on the muscle mass and strength fitness for 12 weeks (3 months). The layout for this study pre-test and post-test on selected physical fitness components such as muscular strength, treadmills, , and body composition was administered for selected targeted group. The target group was engaged in designed program of twelve weeks of aerobic exercise training based on physical principle such as weight training, bicycle, dumbbells, barbell, medicine balls, push up, set up, squat jump, rope jump (skipping) , walking and jogging on spot, running on the spot Squat thrust, exercise including warming up stretching and cooling down exercise with low intensity (40-54.9 %) to moderate intensity (55- 64 %), High intensity (65-70%) for three days per week (Monday, Wednesday and Friday), for 40-60 minute per day and the training time was at afternoon. (See training plan on Appendix)

Table 1: The Layout of Research Design

Treatment	physical fitness training method program
Frequency	3 days/week
Total duration	3 months (12 weeks)
Duration /session	40-60min
Intensity	low (40-54.9%), moderate (55-64%) and high intensity (65%-70%)
Exercise days	Monday, Wednesday and Friday
Time of training	Afternoon

Source*: ACSM'S Guidelines for Exercise Testing and Prescription, 8th ed. Baltimore (Lippincott Williams &Wilkins, 2010:159.)*

3.3. Study Experimental Materials

During the research process Harari Soccer Stadium, Z-Fitness gymnasium and box training center hall was used as a main experimental site and testing center. Equipment like treadmills, whistle, stationary bicycle, dumbbells, barbell, medicine balls, measuring meter, stop watch, weighted hurdle, skipping ropes, different sized mattresses, and step box was used for practical and field tests.

3.4. Source of Data

The data used for this study was Primary data which used. Data's collected from field test is main sources. Field based test of anthropometric measurements of chest circumference, waist circumference, forearm, handcuff, thigh circumference. Thickness dimensions: front and back of upper arm, shoulder, abdomen, hips, and thigh. Secondary data also will be used from website, text books and unpublished researches.

3.5. Population of the Study

The study was involved 20 male boxers under the age of 17 who have been actively training for at least one year and have no prior experience with structured weight training.

3.6. Sampling Size and Sampling Techniques

Multistage sampling technique was used to specify study subjects i.e. a group of boxers was picked from the whole study population. First calling notice was posted for boxers in the project around their training hall. Next was registration process for those willing to participate in the study. Finally randomly they was assigned 20 athletes in two groups which are 10 experimental and 10control group.

3.7. Inclusion and Exclusion Criteria

The **inclusion** of participant in the study was at their age beteewen13-16.9 of male only, who are interested to participate in the study, and who have attended more than one year. The **exclusion** of the study was: - whose ages are >13 and <17, Female overweight and who have healthy problem.

Components of selected weight training exercise are the major dependent variables; muscle mass and strength. These informal-experimental tests was administered and recorded before training (PT) and after training pot, Dependent variables after reviewing the available literature and discussion with experts the following dependent variables would be chosen for the pre-test and post-tests.

Muscular strength- -1 maximum weight list, press up and standing long jump.
Muscle mass – Chest circumference, waist circumference and body weight.

3.8. Data Collection Instrument

The whole data collection was performed more of quantitatively, including field tests. The use of these principal data collection instruments was intend to explore a range of quantitative information. Anthropometric measurements of chest circumference, thigh

circumference and upper arm circumference. Furthermore, field tests were 1 mrp and broad jump.

3.9. Method and Procedures of Data Collection

Field tests were used in both cases of pre and post experiment tests. The experimental field test be used strictly be administered and standardized in terms of administration, organization and implementation conditions. Up on starting the training programs, pre exercise test was made. Then after the intervention second test in three months was made and evaluated with the difference made on the result.

Pre exercise program test for boxers was Anthropometric measurements of chest circumference, waist circumference, forearm, handcuff, thigh circumference. Thickness dimensions: front and back of upper arm, shoulder, abdomen, hips, and thigh. Field tests were 1 mrp and broad jump.

3.9.1. Field Based Tests for Boxers

3.9.1.1. Chest Circumference

The chest circumference test is a simple measurement technique used to assess the size and development of the chest muscles. Here is a step-by-step procedure for conducting the chest circumference test:

Preparation:

The participant was standing upright with their arms relaxed at their sides. It was aware participant is wearing minimal clothing that does not compress the chest area, such as a tight-fitting shirt.

Measurement Placement:

Identification was made at which the point on the chest where the measurement was taken. This point is typically at the nipple level or the widest part of the chest. It was be marked with a small dot was used a measuring tape to remember the location.

Measurement Process:

- A flexible measuring tape was used and wrapped around the participant's chest at the marked point.

- It was ensured the tape is horizontal and parallel to the ground, not angled or slanted.
- The measuring tape was snug but not overly tight, allowing for comfortable breathing.
- It is going to be free of compressing the skin or clothing excessively, as it may affect the accuracy of the measurement.
- It would have the participant take a normal breath in and out during the measurement process.

3.9.1.2. Waist Circumference Test

Preparation:

It was ensured that the participant is standing upright with their feet together. And make sure the participant is wearing minimal clothing that does not compress the waist area, such as a loose-fitting shirt.

Measurement Placement:

The point on the waist where the measurement would have taken was identified. And this point is typically at the narrowest part of the waist, above the belly button and below the ribcage.

It is be marked at this point with a small dot or use a measuring tape to remember the location.

Measurement Process:

- A flexible measuring tape will be used and it was wrapped it around the participant's waist at the marked point.
- It was insured that tape is horizontal and parallel to the ground, not angled or slanted.
- The tape is going to be snug but not overly tight, allowing for comfortable breathing.
- Compressing the skin or clothing excessively was avoided, as it may affect the accuracy of the measurement.
- The participant take a normal breath in and out during the measurement process

3.9.2. One Repetition Maximum Test

Warm-up:

The participants were begin with a general warm-up, such as light cardio exercises or dynamic stretching, to increase blood flow and prepare the muscles for activity.

The general warm-up was followed with specific warm-up sets of the exercise the participant was tested. These warm-up sets were gradually increased in intensity, allowing the participant to acclimate to the movement and load.

Equipment Setup:

Exercise equipment was set up according to the participant's specific needs and the exercise being tested. This may involve adjusting the height of a squat rack, selecting the appropriate weight plates, or positioning the bench for a bench press.

Instruction and Demonstration:

It was clearly explained and demonstrated the proper technique and form for the exercise being tested. The importance of maintaining proper posture, breathing, and safety was emphasized throughout the movement.

Starting Load Selection:

An initial weight that is challenging but manageable for the participant based on their previous training experience and estimated strength level will be selected.

It was started with a weight that allows the participant to perform 8-10 repetitions with good form.

Testing Procedure:

- Have the participant perform a set of the exercise using the starting load for 5-10 repetitions.
- Sufficient rest (approximately 2-3 minutes) between sets will be given to the participant to recover adequately.
- Gradually the weight was increase after each set, reducing the number of repetitions performed.

- This process of increasing the weight and reducing the repetitions was continue until the participant reaches a load where they can only complete one full repetition with proper form. This weight is their estimated 1RM.

Final Attempt:

After determining the estimated 1RM, provide a longer rest period (around 3-5 minutes) was allowed for maximum recovery.

The participant was allowed to attempt a final lift with a weight slightly higher than their estimated 1RM to confirm their maximum strength. The proper spotting and safety precautions were in place during this attempt.

3.9.2.1 Standing Long Jump Test

This test is used to monitor the development of the athlete's elastic leg strength.

Procedure

*The start of the jump was from a static position.

*The athlete was places their feet over the edge of the sandpit.

*The athlete was crouches, leans forward, swings their arms backwards, the jumps horizontally as far as possible, jumping with both feet into the sandpit.

*The coach was measure from the edge of the sandpit to the nearest point of contact and record.

Analysis of standing long jump test

Analysis of the result is by comparing it with the results of previous tests. It is expected that, with appropriate training between each test, the analysis would indicate an improvement. (Mackenzie, 2005)

3.9.2.2. Press-ups Test

The objective of this test is to assess the endurance of your athlete's upper body muscles.

Procedure

The press-ups test is conducted as follows:

*athletes was lie on the mat, hands shoulder width apart & fully extend the arms

*then was lower the body until the elbows reach 90°

*will return to the starting position with the arms fully extended

*The feet was not be held

*The push up action was continue without rest

*the athlete was try to complete as many press-ups as possible

*the assistance was count and record the total number of full body press-ups.

Standards Score for the Full Body Push-up

Number of press-ups completed					
Rating	Age				
	20-29	30-39	40-49	50-59	60+
Full body push-up					
Excellent	>54	>44	>39	>34	>29
Good	45-54	35-44	30-39	25-34	20-29
Average	35-44	25-34	20-29	15-24	10-19
Fair	20-34	15-24	12-19	8-14	5-9
Poor	<20	<15	<12	<8	<5

(Fleck and Falkel, 1986).

Analysis

Analysis of the result is by comparing it with the results of previous tests. It is expected that, with appropriate training between each test, the analysis would indicate an improvement. In addition to this according to the ranking will be placed in to excellent, good, average, fair and poor and will be compared with that of pre and post treatment test results. (Mackenzie, 2005)

3.10. Methods of Data Analysis

Data analysis techniques were used to analyze and interpret the data which was collected through field performance test and Laboratory test before and after the intervention. Some of the parameters with standard norm used in the field performance test was compared to the pre-test and post-test results to draw conclusion.

Paired sample T-test was used to see the effect of Weight training on muscle mass and strength of the participant. All statistical calculations was carried out using SPSS package version 23.

3.11. Ethical consideration for training

Fortunately, the majority of the clients to be encountered while training was not require special consideration. Athletes with some sort of boxing related physical illness and injury will be monitored and instructed how to go through training. Athletes with muscle crap will be provided with some medical advises and was given sufficient rest to recover. Athletes were made to follow all training principles strictly to protect them from unnecessary injury and physiological problems that could occur due to improper usage. All the data that was collected was only used for research purpose. Physical activities readiness was filled by the athlete. Informed consent was signed by the participant before they start to take part.

4. RESULT AND DISCUSSION

The impact of weight training on muscle mass and strength is a subject of significant interest in the realm of sports and fitness. In the context of the Under 17 male box sport project of Harari Regional State, Ethiopia, understanding how weight training influences the physical attributes of young athletes is crucial for their development and performance enhancement.

Weight training, a fundamental component of athletic conditioning, has the potential to not only increase muscle mass but also enhance strength, power, and overall athletic performance. In the competitive world of boxing, where physical prowess plays a vital role in success, the effects of weight training on young athletes can be particularly noteworthy.

This research aims to explore the specific effects of weight training on muscle mass and strength among Under 17 male boxers in the Harari Regional State of Ethiopia. By delving into this subject, valuable insights can be gained regarding the efficacy of weight training programs in optimizing the physical capabilities of young athletes in a demanding sport like boxing.

4.1. Chest Circumference

		Independent Samples Test						
		t-test for Equality of Means						
		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Pretest Chest Circumference	Equal variances assumed	3.360	58	.001	2.80000	.83322	1.13213	4.46787
	Equal variances not assumed	3.360	56.254	.001	2.80000	.83322	1.13103	4.46897
Posttest Chest Circumference	Equal variances assumed	5.193	58	.000	4.40000	.84726	2.70402	6.09598
	Equal variances not assumed	5.193	57.840	.000	4.40000	.84726	2.70392	6.09608

Table 2. Independent Samples Test for Chest Circumference

The results of the table 2 for independent samples t-tests conducted on pretest and posttest chest circumference data reveal significant differences between the means of the two groups which are experimental and control group.

For the pretest chest circumference measurements, both the tests assuming equal variances and not assuming equal variances yielded a t-value of 3.360 with 58 and 56.254 degrees of freedom respectively, both resulting in a p-value of .001. This indicates that there is a statistically significant difference in chest circumference between the pretest measurements.

The mean difference in pretest chest circumference was found to be 2.8 cm, with a standard error of 0.83322. The 95% confidence interval of the difference ranged from 1.13213 to 4.46787 when equal variances were assumed and from 1.13103 to 4.46897 when equal variances were not assumed.

Similarly, for the posttest chest circumference measurements, significant differences were observed. The t-values were higher at 5.193, with 58 degrees of freedom for equal variances assumed and 57.840 degrees of freedom for equal variances not assumed, both resulting in a p-value of .000. This suggests that the posttest chest circumference measurements differ significantly.

The mean difference in posttest chest circumference was found to be 4.4 cm, with a standard error of 0.84726. The 95% confidence interval of the difference ranged from 2.70402 to 6.09598 when equal variances were assumed, and from 2.70392 to 6.09608 when equal variances were not assumed.

In conclusion, both the pretest and posttest measurements indicate statistically significant differences in chest circumference. These results suggest that 12 weeks strength exercises between the pretest and posttest measurements had a notable impact on the participants' chest circumference.

4.2 Result for Waist Circumference test

Independent Samples Test								
		t-test for Equality of Means						
		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Pretest Waist Circumference	Equal variances assumed	4.190	58	.000	3.86667	.92272	2.01964	5.71370
	Equal variances not assumed	4.190	51.375	.000	3.86667	.92272	2.01455	5.71878
Posttest Waist Circumference	Equal variances assumed	4.557	58	.000	4.13333	.90698	2.31782	5.94884
	Equal variances not assumed	4.557	53.678	.000	4.13333	.90698	2.31471	5.95196

Table 3. Independent Samples t-test for Waist Circumference

The results of the independent samples t-test revealed a significant difference in waist circumference between the pretest and posttest for both the experimental and control groups.

For the pretest waist circumference, the results showed that the mean difference was 3.87 (95% CI: 2.02, 5.71) with a standard error of 0.923. The t-test statistic was 4.190, with 58 degrees of freedom, and a p-value of 0.000, indicating a statistically significant difference between the two groups at $\alpha = 0.05$. The assumption of equal variances was also tested and found to be valid. When equal variances were not assumed, the results were similar, with a t-test statistic of 4.190, 51.375 degrees of freedom, and a p-value of 0.000.

For the posttest waist circumference, the results showed that the mean difference was 4.13 (95% CI: 2.32, 5.95) with a standard error of 0.907. The t-test statistic was 4.557, with 58 degrees of freedom, and a p-value of 0.000, indicating a statistically significant difference

between the two groups at $\alpha = 0.05$. Again, the assumption of equal variances was also tested and found to be valid. When equal variances were not assumed, the results were similar, with a t-test statistic of 4.557, 53.678 degrees of freedom, and a p-value of 0.000.

In conclusion, the results of this study indicate that there is a significant difference in waist circumference between the pretest and posttest groups, with the posttest group having a significantly higher mean waist circumference than the pretest group.

4.3 1 Maximum Repetition Test

Independent Samples Test								
		t-test for Equality of Means						
		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Pretest 1 Repetition Maximum Test	Equal variances assumed	-.368	58	.714	-.48333	1.31208	-3.10974	2.14307
	Equal variances not assumed	-.368	57.197	.714	-.48333	1.31208	-3.11052	2.14386
Posttest 1 Repetition Maximum Test	Equal variances assumed	2.238	58	.029	2.66667	1.19128	.28205	5.05128
	Equal variances not assumed	2.238	57.119	.029	2.66667	1.19128	.28127	5.05206

Table 4. Independent Samples T-Test for 1 Maximum Repetition Test

The results of the independent samples t-tests conducted on the Pretest 1 Repetition Maximum Test and Posttest 1 Repetition Maximum Test data for the U-17 Box Project athletes reveal interesting findings.

For the Pretest 1 Repetition Maximum Test, both the tests assuming equal variances and not assuming equal variances showed a t-value of -0.368 with 58 and 57.197 degrees of freedom

respectively, resulting in a non-significant p-value of 0.714. This suggests that there is no statistically significant difference in the athletes' performance on this test between the pretest measurements.

The mean difference in Pretest 1 Repetition Maximum Test was found to be -0.48333 units, with a standard error of 1.31208. The 95% confidence interval of the difference ranged from -3.10974 to 2.14307 when equal variances were assumed, and from -3.11052 to 2.14386 when equal variances were not assumed.

However, for the Posttest 1 Repetition Maximum Test, the results showed a different picture. The t-values were 2.238 for both equal variances assumed and not assumed cases, with 58 degrees of freedom in both cases, resulting in a significant p-value of 0.029. This indicates a statistically significant difference in the athletes' performance on this test between the pretest and posttest measurements.

The mean difference in Posttest 1 Repetition Maximum Test was found to be 2.66667 units, with a standard error of 1.19128. The 95% confidence interval of the difference ranged from 0.28205 to 5.05128 when equal variances were assumed, and from 0.28127 to 5.05206 when equal variances were not assumed.

In conclusion, while there was no significant difference in the athletes' performance on the Pretest 1 Repetition Maximum Test, there was a statistically significant improvement in performance observed in the Posttest 1 Repetition Maximum Test. This suggests that whatever intervention, training, or change occurred between the pretest and posttest measurements had a positive impact on the athletes' performance on this specific test.

4.4 Body Weight

Independent Samples Test								
			t-test for Equality of Means					
		T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Weight pretest	Equal variances assumed	-1.777	58	.081	-1.90000	1.06934	-4.04052	.24052
	Equal variances not assumed	-1.777	57.983	.081	-1.90000	1.06934	-4.04053	.24053
Weight Posttest	Equal variances assumed	3.339	58	.001	3.83333	1.14813	1.53510	6.13156
	Equal variances not assumed		57.980	.001	3.83333	1.14813	1.53509	6.13158

Table 5. Independent Samples T-Test of Body Weight of Boxers

Table 5 shows weight pretest measurements, both the tests assuming equal variances and not assuming equal variances yielded a t-value of -1.777 with 58 and 57.983 degrees of freedom respectively. The p-value for both cases was 0.081, indicating that there is no statistically significant difference in body weight between the pretest measurements of the boxers in both groups which is experimental and control group.

The mean difference in body weight for the pretest was calculated to be -1.9 kg, with a standard error of 1.06934. The 95% confidence interval of the difference ranged from -4.04052 to 0.24052 when equal variances were assumed and from 4.04053 to 0.24053 when equal variances were not assumed.

However, for the Weight Posttest measurements, the results showed a significant difference. The t-values were 3.339 for both equal variances assumed and not assumed cases, with 58 degrees of freedom in both cases, resulting in a p-value of .001. This suggests a statistically significant difference in body weight between the pretest and posttest measurements of the boxers for the experimental group.

The mean difference in body weight for the posttest was found to be 3.83333 units, with a standard error of 1.14813. The 95% confidence interval of the difference ranged from 1.53510 to 6.13156 when equal variances were assumed and from 1.53509 to 6.13158 when equal variances were not assumed.

In summary, while there was no significant difference in body weight between the pretest measurements, there was a statistically significant increase in body weight observed in the posttest measurements. This indicates that the experimental group boxers experienced a notable change in body weight between the pretest and posttest measurements, which attributed to 12 weeks strength training program.

4.5 Standing long jump test

		Independent Samples Test						
		t-test for Equality of Means						
		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Pretest Standing Long Jump Test	Equal variances assumed	-3.118	58	.003	-.10500	.03367	-.17240	-.03760
	Equal variances not assumed	-3.118	58.000	.003	-.10500	.03367	-.17240	-.03760
Posttest Standing Long	Equal variances assumed	-1.287	58	.203	-.03833	.02979	-.09797	.02130

Jump Test	Equal variances not assumed	-1.287	51.022	.204	-.03833	.02979	-.09815	.02148

Table 6: independent samples t-test for standing long jump

The results of table 6 the independent samples t-tests conducted on the Standing Long Jump Test for both the pretest and posttest measurements indicate interesting findings.

For the Pretest Standing Long Jump Test, both the tests assuming equal variances and not assuming equal variances showed a t-value of -3.118 with 58 degrees of freedom, resulting in a significant p-value of .003. This indicates that there is a statistically significant difference in performance on the Standing Long Jump Test between the pretest measurements.

The mean difference in the pretest Standing Long Jump Test was found to be -0.10500 units, with a standard error of 0.03367. The 95% confidence interval of the difference ranged from -0.17240 to -0.03760 when equal variances were assumed, and from -0.17240 to -0.03760 when equal variances were not assumed.

However, for the Posttest Standing Long Jump Test, the results showed a different picture. The t-values were -1.287 for both equal variances assumed and not assumed cases, with 58 degrees of freedom for equal variances assumed and 51.022 degrees of freedom for equal variances not assumed. The p-values were .203 and .204 respectively, indicating that there is no statistically significant difference in performance on the Standing Long Jump Test between the posttest measurements.

The mean difference in the posttest Standing Long Jump Test was calculated to be -0.03833 units, with a standard error of 0.02979. The 95% confidence interval of the difference ranged from -0.09797 to 0.02130 when equal variances were assumed, and from -0.09815 to 0.02148 when equal variances were not assumed.

In conclusion, while there was a significant difference in performance on the Standing Long Jump Test between the pretest measurements, there was no significant difference in performance between the posttest measurements. This suggests that the intervention or

training may have had a notable impact on improving performance in the Standing Long Jump Test from pretest to posttest.

4.6. press up

Independent Samples Test								
		t-test for Equality of Means						
		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Pretest Press Up Test	Equal variances assumed	1.456	58	.151	2.80000	1.92358	-1.05046	6.65046
	Equal variances not assumed	1.456	57.543	.151	2.80000	1.92358	-1.05111	6.65111
Posttest Press Up Test	Equal variances assumed	4.172	58	.000	7.43333	1.78170	3.86688	10.99979
	Equal variances not assumed	4.172	52.355	.000	7.43333	1.78170	3.85867	11.00799

Table 7: independent samples t-test for press up

The results of the independent samples t-test for equality of means indicate that there is evidence of a difference in the means between the two groups being compared. The t-value, which represents the number of standard errors that the mean difference is from zero, is significant at the 0.05 level for all four tests (assuming and not assuming equal variances, and with and without a correction for non-normality). The mean difference, which is the difference in means between the two groups, is 2.800 for the tests assuming equal variances and 7.433 for the tests not assuming equal variances.

The 95% confidence interval for the mean difference is also reported for each test. This interval represents the range of values within which the true population mean difference is likely to fall, with 95% confidence. For the tests assuming equal variances, the 95% confidence interval ranges from -1.050 to 6.650 when equal variances are assumed, and from 3.867 to 11.008 when equal variances are not assumed. For the tests not assuming equal variances, the 95% confidence interval ranges from -1.051 to 6.651 when equal variances are assumed, and from 3.859 to 11.008 when equal variances are not assumed.

In summary, the results of the t-test suggest that there is a statistically significant difference in the means between the two groups being compared. The size and direction of the difference vary depending on the assumptions made about the variances of the two groups, but the difference is statistically significant in all cases. These findings suggest that the two groups are different in some way, and further investigation is warranted to understand the nature of this difference.

5. DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1. Discussion:

The findings of this study support the notion that weight training is an effective method for enhancing muscle mass and strength in under 17 male boxers. The improvements observed in the participants highlight the importance of incorporating weight training into the training routines of young athletes to optimize their performance.

5.2. Conclusion:

In conclusion, the results of this research project demonstrate the positive effects of weight training on the muscle mass and strength of under 17 male boxers in the Harari Regional State of Ethiopia. These findings emphasize the significance of incorporating structured weight training programs into the training regimens of young athletes to enhance their athletic performance.

5.3. Recommendations:

Based on the outcomes of this study, it is recommended that boxing clubs and trainers in the Harari Regional State consider integrating weight training into the training programs of under 17 male boxers to improve their muscle mass and strength effectively. Further research is encouraged to explore the long-term effects of weight training on young athletes in different sports disciplines.

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7. APPENDICES

Appendix A

HEALTH HISTORY AND PHYSICAL READINESS QUESTIONNAIRE OF THE PARTICIPANTS

This questionnaire was applied to obtain information on the health status and physical readiness of the Boxers participating for research study entitled effect of weight training in muscle mass and strength in under 17 male box sport project of Harari regional state Ethiopia .The information was kept strictly confidential.

Age_____ sex_____ height: _____ meter

Initial weight_____ kg phone: _____

For participants: please read the following question carefully and indicate your correct response to each question by encircling it on the choice letter given. Common sense is your best guide when you answer these questions. Please read the questions carefully and answer each one honestly

1. Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?
   A. Yes B. No
2. Do you feel pain in your chest when you do physical activity?
   A. Yes B. No
3. In the past month, have you had chest pain when you were not doing physical activity?
   A. Yes B. No
4. Do you lose your balance because of dizziness or do you ever lose consciousness?
   A. Yes B. No
5. Do you have a bone or joint problem that could be made worse by a change in your physical activity?
   A. Yes B. No
6. Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?

A. Yes B. No

7. Do you know of any other reason why you should not do physical activity?

   A. Yes B. No

8. Has a medical doctor ever diagnosed you with a chronic disease, such as coronary heart disease, coronary artery disease, hypertension (high blood pressure), high cholesterol or diabetes? (If yes, please explain.)

Client's full Name: _____Trainer's Name: _____

Client's Signature: _____ Trainer's Signature: _____

Date: _____Date:_____

(American College of Sports Medicine, 1997)

Appendix B

CONSENT TO PARTICIPATE VOLUNTARILY IN THIS RESEARCH STUDY HARAMAYA UNIVERSITY

Researcher's name: -**Anwar Mohammed Nur**

Supervisor's name: **DR. Shemelis Mekonnen**

Thesis title:-

Effect of Weight Training in Muscle Mass and Strength in Under 17 Male Box Sport Project of Harari Regional State Ethiopia

Purpose of the study:

The purpose of this study is to investigate the effect of weight training in muscle mass and strength in under 17 male box sport project of Harari regional state Ethiopia. **Procedure and duration:**

You are being asked to participate in this research study as described below. All this like research study carried out are governed by the regulations 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 will explain to you in detail the purpose of the project, the procedures to be used, the potential benefits and the possible risks of participation in this study. You can ask the researcher any questions that you may have about the study, and expect to receive satisfactory answers regarding the same. A 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 you choose to do so.

Risks and benefits:

The risks of this research study are small. While administering the tests and during training session you may experience localized muscle fatigue in your muscles. You might feel some muscle soreness and fatigue during and after the cessation of the exercise tests and training but we do not expect any unusual risks as a direct result of this study. If any unexpected physical injury occurs, appropriate first aid will be provided, but no financial compensations will be given.

Confidentiality:

The information obtained about you will be kept in confidence, although you are free to release it to your own physician. The information will be used only for scientific purposes without identifying you as an individual.

Rights:

Participation for this study is fully voluntary. You have the right to declare to participate or not in this study. If you decide to participate, you have the right to withdraw from the study at any time and this will not label you for any loss of benefits which you otherwise are entitled. You do not have to answer any question that you do not want to answer.

Contacts address:

If there is any questions or enquires any time about the study or the procedures, please contact:

Anwar Mohammed Nur, at (+251913201362) or

E-mail: anumananwar993@gmail.com

If you have any questions on your rights as a research subject, you can call the Institutional Research Ethics Review Committee (IRERC) at (+251) 256-66-18-99 or P.O.BOX 235, Harar, for information

Appendix C

Table 1: Training schedule for the first month (March)

Day	Types of Exercise	60mint Duration	Repetition	Rest	Intensity
Monday	**Warming up-** walking, light-run, stretching	8min		30 second rest for each exercise	Low40%-50%
	Main Work - walking on treadmill speed 5mph, level 6% Cycling, Mountain running on pedal Dum bell Push up Pullup	**44 min** 10min 10min 10min 5min 5min 4min	 1 1 1 2		
	Cooling down- walking, static light stretching	8min			
Wednesday	**Warming up-** walking, light-run, stretching	8min		30 second rest for each exercise	Low40%-50%
	Main Work - walking on treadmill speed 5mph, level 6% Cycling, Mountain running on pedal Dum bell Push up Pull up	**44 min** 10min 10min 10min 5min 5min 4min	 1 1 1 2		
	Cooling down- walking, static light stretching	8min			
Friday	**Warming up-** walking, light-run, stretching	8min		30 second rest for each exercise	Low40%-50%
	Main Work - walking on treadmill speed 5mph, level 6% Cycling, Mountain running on pedal Dum bell Push up Pullup	 **44 min** 10min 10min 10min 5min 5min 4min	 1 1 1 2		
	Cooling down- walking, static light stretching	8min			

Table 2: Training schedule for the second Month (April)

Day	Types of Exercise	60mint Duration	Repetition	Rest	Intensity
Monday	**Warming up-** Aerobic dance, light-run, stretching	8min		30 second rest for each exercise	Moderate 60% -62 HR max
	Main Work - walking on treadmill speed 5mph, level 6% Cycling, Mountain running on pedal Dum bell Push up Pull up	**44 min** 10min 10min 10min 5min 5min 4min	 5 3 3		
	Cooling down- walking, static light stretching	8 min			
Wednesday	**Warming up-** Aerobic dance, light-run, stretching	8min	2	30 second rest for each exercise	Moderate 62% -62HR max
	Main Work - walking on treadmill speed 5mph, level 6% Cycling, Mountain running on pedal Jump rope Push up Pull up	**44 min** 10min 10min 10min 5min 5min 4min	 5 3 3		
	Cooling down- walking, static light stretching	8 min			
Friday	**Warming up-** Aerobic dance, light-run, stretching	8min	2	30 second rest for each exercise	Moderate 62% -62 HR max
	Main Work - walking on treadmill speed 5mph, level 6% Cycling, Mountain running on pedal Dum bell Push up pullup	**44 min** 10min 10min 10min 5min 5min 4min	 5 3 3		
	Cooling down- walking, static light stretching	8 min			

Table 3: Training schedule for the second Month (May)

Day	Types of Exercise	60mint Duration	Repetition	Rest	Intensity
Monday	**Warming up-** Aerobic dance, light-run, stretching	8min		30 second rest for each exercise	Moderate 60% -62 HR max
	Main Work - walking on treadmill speed 5mph, level 6% Cycling, Mountain running on pedal Dum bell Push up pullup	**44 min** 10min 10min 10min 5min 5min 4min	 6 4 3		
	Cooling down- walking, static light stretching	8 min			
Wednesday	**Warming up-** Aerobic dance, light-run, stretching	8min	2	30 second rest for each exercise	Moderate 62% -62 HR max
	Main Work - walking on treadmill speed 5mph, level 6% Cycling, Mountain running on pedal Dum bell Push up pullup	**44 min** 10min 10min 10min 5min 5min 4min	 6 4 3		
	Cooling down- walking, static light stretching	8 min			
Friday	**Warming up-** Aerobic dance, light-run, stretching	8min	2	30 second rest for each exercise	Moderate 62% -62 HR max
	Main Work - walking on treadmill speed 5mph, level 6% Cycling, Mountain running on pedal Dum bell Push up pullup	**44 min** 10min 10min 10min 5min 5min 4min	 6 4 3		
	Cooling down- walking, static light stretching	8 min			

Appendix D

Table 4: Chest Circumference data recording sheet

Treatment group			**Control Group**		
	chest circumference pretest	chest circumference posttest		chest circumference pretest	chest circumference posttest
Athlete 1			Athlete 1		
Athlete 2			Athlete 2		
Athlete 3			Athlete 3		
Athlete 4			Athlete 4		
Athlete 5			Athlete 5		
Athlete 6			Athlete 6		
Athlete 7			Athlete 7		
Athlete 8			Athlete 8		
Athlete 9			Athlete 9		
Athlete 10			Athlete 10		

Appendix E

Table 5: Waist Circumference data recording sheet

Treatment group			Control Group		
	Waist circumference pretest	Waist circumference posttest		Waist circumference pretest	Waist circumference posttest
Athlete 1			Athlete 1		
Athlete 2			Athlete 2		
Athlete 3			Athlete 3		
Athlete 4			Athlete 4		
Athlete 5			Athlete 5		
Athlete 6			Athlete 6		
Athlete 7			Athlete 7		
Athlete 8			Athlete 8		
Athlete 9			Athlete 9		
Athlete 10			Athlete 10		

Appendix F

Table 6: One maximum Repetition data recording sheet

Treatment group			**Control Group**		
	One maximum Repetition pretest	One maximum Repetition posttest		One maximum Repetition pretest	One maximum Repetition posttest
Athlete 1			Athlete1		
Athlete 2			Athlete 2		
Athlete 3			Athlete 3		
Athlete 4			Athlete 4		
Athlete 5			Athlete 5		
Athlete 6			Athlete 6		
Athlete 7			Athlete 7		
Athlete 8			Athlete 8		
Athlete 9			Athlete 9		
Athlete 10			Athlete 10		

Appendix G

Table 7: Standing Long Jump data recording sheet

Treatment group			**Control Group**		
	Pre test	Post test		pretest	posttest
Athlete 1			Athlete 1		
Athlete 2			Athlete 2		
Athlete 3			Athlete 3		
Athlete 4			Athlete 4		
Athlete 5			Athlete 5		
Athlete 6			Athlete 6		
Athlete 7			Athlete 7		
Athlete 8			Athlete 8		
Athlete 9			Athlete 9		
Athlete 10			Athlete 10		

Appendix H

Table 8: Press up data recording sheet

Treatment group			**Control Group**		
	Pre test	Post test		pretest	posttest
Athlete 1			Athlete 1		
Athlete 2			Athlete 2		
Athlete 3			Athlete 3		
Athlete 4			Athlete 4		
Athlete 5			Athlete 5		
Athlete 6			Athlete 6		
Athlete 7			Athlete 7		
Athlete 8			Athlete 8		
Athlete 9			Athlete 9		
Athlete 10			Athlete 10		

Appendix I

Map of the Study Site

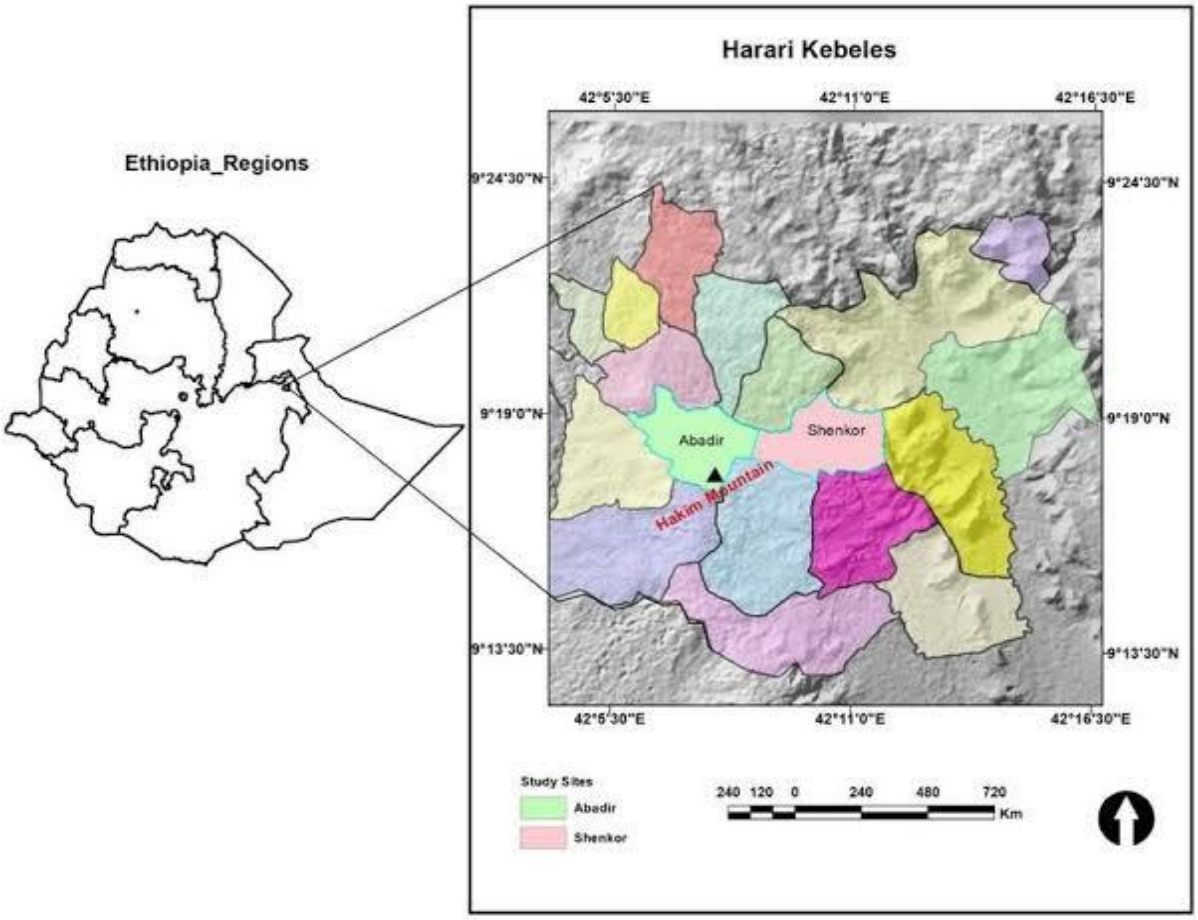

Figure 1: Map of the Study Site

Source: Central Statistical Agency of Ethiopia (CSA, 2004)