Vol. 4 No. 3 (2025)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Effect of Tribulus Terrestris on Athletes Testosterone Levels and Muscles Hypertrophy

Usman Umar
Government Associate College Boy's Bedian Road Lahore

Zafar Iqbal Butt
Department of Sport Sciences and Physical Education,
University of the Punjab, Lahore, Pakistan

Alamgir Khan
Department of Sport Sciences and Physical Education,
University of the Punjab, Lahore, Pakistan

Aqib Ashraf
Department of Sport Sciences and Physical Education,
University of the Punjab, Lahore, Pakistan

Hassan Kamran
Harrisburg University of Science and Technology

Abstract

Background: Tribulus Terrestris (TT) is a botanical specimen with a longstanding history of utilization in traditional medicinal practices such as Ayurveda and traditional Chinese medicine. Tribulus Terrestris (TT) improves the amount of testosterone levels of the body as well as and muscles hypertrophy.**Objectives :**This research study carried out for the purpose to strength training and Tribulus Terrestris (TT) on testosterone levels and muscles hypertrophy.**Methods and Materials:**The study used an experimental design with 20 athletes aged 20–40, randomly divided into control (10) and experimental (10) groups. The experimental group underwent eight weeks of self-designed strength training combined with Tribulus Terrestris supplementation. Testosterone levels were measured via blood samples, and muscle hypertrophy was assessed with a measuring tape. Pre- and post-test results were analyzed using SPSS (Version 26).**Result** The study found that strength training combined with Tribulus Terrestris supplementation did not significantly affect testosterone levels (p=0.979). However, it showed a positive impact on anthropometric measurements of the chest, arms, and thighs in the experimental group compared to the control group, though the differences were not statistically significant (chest p=0.839, arms p=0.272, thighs p=0.625).

Conclusion

Author Details

Keywords: Tribulus Terrestris, Athletes Testosterone Level, Muscles Hypertrophy

Received on 15 Aug 2025
Accepted on 10 Sep 2025
Published on 20 Sep 2025

Corresponding E-mail & Author*:
Usman Umar
Government Associate College Boy's Bedian Road Lahore

The study concluded that eight weeks of self-designed strength training with Tribulus Terrestris supplementation had no significant effect on testosterone levels but did show a significant impact on muscle hypertrophy

INTRODUCTION

Tribulus Terrestris (TT) is a botanical specimen with a longstanding history of utilization in traditional medicinal practices such as Ayurveda and traditional Chinese medicine [1]. Commonly recognized as puncture vine or goat's head [2], TT is a plant that thrives in warm and tropical regions globally [3]. Originally hailing from India and belonging to the Zygophyllaceae family encompassing approximately 20 species, TT is known by various names including "Tribulus," "puncture vine," "caltrop," "goat head," "puncture weed," "Mexican sandbur," "Texas sandbur," or "bullhead" [4]. It predominantly flourishes in countries bordering the Mediterranean Sea and in sub-tropical zones worldwide.

Herbal supplements consist of active botanical phytochemicals like phenolic acids, alkaloids, flavonoids, glycosides, saponins, and lignans, which are sourced from different parts of plants such as seeds, gums, roots, leaves, bark, berries, or flowers [5]. Sports supplements are essential for maintaining both physical and physiological functions [6]. Within the realm of herbal supplements, an extract from the exotic plant TT has become increasingly popular among consumers [7].

TT is a plant that has been used for a long time in Indian ayurveda practice as a tonic and a substance that can enhance sexual desire [8].Many sportsmen and non-athletes frequently utilize products containing TT extracts to enhance their testosterone levels and increase their strength performance [9]. Likewise TT extract can slightly increase hormone levels, but it keeps them within the normal range.

TT elevates Testosterone (T) levels via enhancing the secretion of Gonadotropin-releasing hormone (GNRH), which subsequently boosts the synthesis of Leuthizing hormone (LH) and Follicle-stimulating hormone (FSH) [10]. In addition to its role in promoting muscle growth and enhancing fertility and libido, testosterone is also recognized for its beneficial impact on bone marrow activity, specifically in the formation of red blood cells, as well as its good influence on the immune system [11].

This plant, with a taproot, acts as a summer annual in colder climates. The stems of this plant extend from the crown, varying in diameter from around 10 cm to over 1 m, and frequently branching out. Usually, the stems spread out horizontally, creating clusters, but they may grow more vertically in areas with less light or surrounded by taller plants. The leaves have a pinnately compound structure, with small leaflets measuring less than a quarter-inch in length. The flowers have five lemon-yellow petals, measuring 4 to 10 mm in width. After about a week of blooming, each flower produces a fruit that breaks apart into four or five individual nutlets. These small nutlets, or "seeds," have a tough exterior and are adorned with two to three pointed spines, each measuring 10 mm in length and 4 to 6 mm in width. This plant has a trailing and spreading growth pattern, and it is densely covered with tiny hairs. The compound leaves of this plant grow in opposite pairs, with 3 to 6 pairs of leaflets, each reaching a length of up to 8 cm. The flowers, typically smooth in texture, are either white or yellow and grow alone, appearing from the spaces between the leaves. The ovary is lively, with a compact and sturdy style. The fruits have a round shape and can be covered in spines or bumps. They may have a fine layer of hair or be mostly smooth. The fruits are made up of hard, woody sections with two sets of sharp spines. One set of spines is longer than the other [12].

Understanding the impact of sports nutrition on athletes' health and sports performance is crucial. When athletes' nutritional needs aren't fully met by regular recommendations, they turn to supplements to enhance their athletic performance [13].

The author also mentioned that dietary supplements are designed to address the specific nutritional requirements based on factors such as the intensity and duration of exercise, as well as the nature of the sport.

TT extracts are frequently utilized by individuals, both athletes and non-athletes alike, to enhance their testosterone levels and boost their strength performance [14]. TT is known to be appealing to athletes due to its potential to enhance sports performance [15].

These effects are due to the saponins included in TT [16].The saponins found in TT can boost the body's production of T and (LH). This can help in building muscle and promoting growth [17].

Testosterone (T) is a substance that can improve the amount of testosterone in the body. This could be appealing to competitive athletes who want to enhance their performance. It can be used as a substitute for illegal drugs like anabolic steroids. Many athletes praise and use TT. This plant is believed to have properties that can help improve athletic performance. It is thought to increase testosterone in the blood and help build stronger muscles.TT became popular in Bulgaria in the 1970s under the name Tribestan. It was recommended that Bulgarian athletes, particularly weightlifters, were able to improve their physical abilities because they used this product [18].

The importance of studying these topics is to learn about how TT, a supplement made from plants can affect different parts of the human body. It is often sold as a way to naturally increase testosterone, and its effects on exercise and fitness are of special interest.

Testosterone is very important for building muscles, having energy, and overall feeling good. Understanding how TT affects testosterone levels can have a significant impact on the fitness and health industries. If TT is found to improve testosterone levels, it could be seen as a natural option for people with low T, possibly reducing the need for man-made hormone treatments. If there are no big changes, it makes it clear that the supplement has its limits and should not be solely relied upon for fixing hormone imbalances.

TT has significant impact upon various parameters of health. But to till date, there is no such type of research work has been done related to TT upon testosterone levels and muscular hypertrophy in Pakistan. To discover the facts the researcher decided to carry a research study under the title “Effect of Tribulus Terrestris on Athletes Testosterone Levels and muscles hypertrophy”.

MATERIAL AND METHODS

Study Design

In this research, the researcher followed Double-blind, Placebo-controlled Randomized Trial for checking the effect of TT on athletes Testosterone levels. This research is based on quantitative research design so all the participant of study were gone through different experimental procedures.

Ethics

The study's protocols were undergone approval from the Ethical Review and Research Board of the University of the Punjab, Lahore, Pakistan. Furthermore, written informed consent was being obtained from all participants, ensuring that risks and benefits are clearly communicated. The confidentiality of participants' personal information was safeguarded both during and after the research's completion.

Participants

A research participant also called a human subject or an experiment, trial, or study participant or subject, is a person who voluntarily participates in human subject research after giving informed consent to be the subject of the research [21]. A research participant is different from individuals who are not able to give informed consent, such as children, infants, and animals. Such individuals are preferentially referred to as subjects [22].

The study's participants were consisting of male athletes registered at the Executive Fitness Center in Punjab University's new campus in Lahore. Consequently, these participants were divided into two groups, namely the control group (CG) and the experimental group (EG), each group were comprised of Ten (10) subjects.

The researcher gives 8 weeks exercise protocol to the Control Group and Experimental group. The Control Group was only given strength Training and Experimental Group was given strength training with supplement (Gonadil-f) Tribulus Terrestris. The researcher conducted Blood Serum Testosterone test and Muscular hypertrophy was evaluated using a measuring tape applied to specific body regions, including chest, bicep/triceps, and thigh muscles before and after the completion of exercise protocol. After the Exercise protocol of 8 weeks the researcher conducted post-test of both groups to identify the difference and the values were compared to find the better results to study the "Effect of Tribulus Terrestris on Athletes Testosterone Levels and Muscles Hypertrophy".

Study size

The evaluation of Testosterone Levels was conducted using the Blood Serum Testosterone examination. 5ml blood was collected from each subject and was marked with separate identification code.

Muscular hypertrophy was evaluated using a measuring tape applied to specific body regions, including chest, bicep/triceps, and thigh muscles.

Instrument and Instrumentation

Venipuncture, the act of drawing blood from a vein, is frequently performed on the inside of the elbow or the back of the hand. Blood is drawn from a vein using a needle and is then collected in an airtight vial or syringe. The normal range level of a Testosterone in male ranges from 260 to 1000 ng/dL The sample is then transported to a lab for additional processing, which is handled by experts

According to the "Health line Condition" first, they use an alcohol swab or antiseptic wipe to clean your skin. Then they tie a band around your upper arm to make your veins swell with blood. This helps them find a vein more easily. Once they find a vein, the healthcare provider inserts a needle that's attached to a vial and draws blood. They may fill one or more vials. Then they send your blood sample to a laboratory for analysis.

To examine Muscular hypertrophy a measuring tape was used and applied to specific body regions, including chest, bicep/triceps, and thigh muscles in order to measure the Anthropometric measurements.

Tribulus Terrestris Supplementation Protocol

Dosage:

The dosage of the participants under the protocol of testing was 600mg per/day. The one capsule of Gonadil-f consists of 300mg dosage of Tribulus Terrestris, so two capsules were given to the subjects.

Frequency:
The dosage of 600mg was divided into two phases, one capsule in the morning and one capsule 30 min before the training.
Duration:
The duration period of the study was 8 weeks.

Statistical analysis
The collected data was tabulated and analyzed through statistical package for social sciences (SPSS version 26), and similarly suitable statistical tools was applied according to the need and nature of the research objectives.

Results
This study was carried out to examine the effects of Tribulus Terrestris on Testosterone Levels of the participants. An experimental approach with pre and post-test examination of the study parameters was applied to 20 participants with random classification into CG and EG. Eight (8) week self-made exercise intervention was applied to the test subjects along with Tribulus Terrestris supplements provision to the EG. Participants of the study were selected from Punjab university executive club.
The researcher discusses the analysis and interpretation of the relevant data and divides them into two sections: Section I on Descriptive Statistics and Section II on Inferential Statistics.

Descriptive Statistics (Section I)

Table 1 Descriptive Analysis of Both CG and EG in Term of Testosterone Level during pre and posttest

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
TESTOSTERONE LEVEL PRE	20	193.48	799.00	470.6352	147.71570
TESTOSTERONE LEVEL POST	20	205.71	621.00	397.4446	122.75638
Valid N (listwise)	20				

The above table indicates the descriptive analysis of CG and EG regarding Testosterone levels. The total number of respondents was 20. Data were expressed as Mean, SD, Minimum and Maximum Range. Mean and SD of both groups during the pretest was 470.63±147.71. Minimum Range was 193.48, Maximum Range was 799. Mean and SD of both groups during the post-test was 397.44±122.75. Minimum Range was 205.71, Maximum Range was 621.

Table 2 Descriptive Analysis of Both CG and EG in Term of Anthropometric measurement of the Chest, Arms and Thigh muscles during pre and posttest

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
CHEST MEASURMENTS PRE	20	33.00	44.00	38.2605	2.90829
CHEST MEASURMENTS POST	20	33.40	43.40	38.9400	2.54401

ARMS MEASURMENT PRE	20	9.60	17.20	12.8900	2.09081
ARMS MEASURMENT POST	20	10.70	17.50	13.6700	1.78771
THIGH MEASURMENT PRE	20	19.00	25.00	22.2050	1.50769
THIGH MEASURMENT POST	20	20.20	31.60	23.4600	2.42040
Valid N (listwise)	20				

The above table indicates the descriptive analysis of both CG and EG in terms of Anthropometric measurement of the Chest. The total number of respondents was 20. Data were expressed as Mean, SD, Minimum and Maximum Range. Mean and SD of both groups during the pretest was 38.26±2.90. Minimum Range was 33, Maximum Range was 44. Mean and SD of both groups during the post-test was 38.94±2.54.

Minimum Range was 33.40, Maximum Range was 43.40.
In terms of Anthropometric measurement of Arm (Bicep/Triceps) Mean and SD of both groups during the pretest was 12.89±2.09. Minimum Range was 9.60, Maximum Range was 17.20. Mean and SD of both groups during the post-test was 13.67±1.78. Minimum Range was 10.70, Maximum Range was 17.50.

In terms of Anthropometric measurement of Thigh (Leg) Mean and SD of both groups during the pretest was 22.20±1.50. Minimum Range was 19, Maximum Range was 25. Mean and SD of both groups during the post-test was 23.46±2.42. Minimum Range was 20.20, Maximum Range was 31.60.

Inferential Statistics (Section II)

Table 1. Independent Sample T-Tests showing the Comparison of pre test results of both CG and EG in term of Testosterone Level.

The above table shows the Testosterone Levels of both CG and EG. Data were shown as Mean, SD, Df, T value and Sig . The total number of subjects was 10 in both CG and EG. The mean and SD of CG in terms of Testosterone Level during the pretest was 440.34±132.98, Df was 18, T value was -0.913, and Sig was 0.495. The mean and SD of EG in terms of Testosterone Level during the pre-test was 500.922±162.29, Df was 17.33, and T value was -0.913. The t-test revealed a statistically significant difference among CG and EG (p=0.495).

Table 2. Independent Sample T-Tests showing the Comparison of post test

Group Statistics

TESTOSTERONE LEVEL (PRE TEST)	GROUP	N	Mean	Std. Deviation	Std. Error Mean	Df	T	Sig.
	CONTROL GROUP	10	440.34 80	132.987 13	42.054 22	18	-.913	.495
	EXPERIMENTAL GROUP	10	500.92 24	162.296 77	51.322 74	17.33 0	-.913	

results of both CG and EG in term of Testosterone Level.

The mean and SD of CG in terms of Testosterone Level during the post-test were 410.48±123.76, Df was 18, T value was 0.465, and Sig was 0.979. The mean and SD of EG in terms of Testosterone Level during the post test was 384.40±126.95, Df was 17.98, and T value was 0.465. The t-test revealed a statistically significant difference among CG and EG (p=0.979).

Table 3. Independent Sample T-Tests showing the Comparison of pre test results of both CG and EG in term of Anthropometric Chest, Arms and Thigh muscles measurement.

Group Statistics

Group Statistics								
TESTOSTERONE LEVEL POSTTEST	**GROUP**	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**	**Df**	**T**	**Sig.**
	CONTROL GROUP	10	410.4860	123.76082	39.13661	18	.465	.979
	EXPERIMENTAL GROUP	10	384.4032	126.95635	40.14712	17.988	.465	

	GROUP	N	Mean	Std. Deviation	Std. Error Mean	df	t	Sig.
CHEST MEASURMENTS PRE	CONTROL GROUP	10	38.6110	3.65572	1.15604	18	.529	.107
	EXPERIMENTAL GROUP	10	37.9100	2.05397	.64952	14.167	.529	
ARMS MEASURMENT PRE	CONTROL GROUP	10	13.5700	2.47792	.78359	18	1.502	.042
	EXPERIMENTAL GROUP	10	12.2100	1.43562	.45398	14.430	1.502	
THIGH MEASURMENT PRE	CONTROL GROUP	10	21.7700	1.40400	.44398	18	-1.315	.839
	EXPERIMENTAL GROUP	10	22.6400	1.55149	.49062	17.823	-1.315	

The above table shows the Anthropometric Chest measurement of both CG and EG. Data were shown as Mean, SD, df, t value and Sig. The total number of subjects was 10 in both CG and EG. The mean and SD of CG regarding Anthropometric Chest measurement during the pretest was 38.61±3.65, df was 18, t value was 0.529, and Sig

was 0.107. The mean and SD of EG in terms of Anthropometric Chest measurement during the pre-test was 37.91±2.05, df was 14.16, and t value was 0.529.
In terms of Anthropometric Arms measurement of both CG and EG, The mean and SD of CG regarding Anthropometric Arms measurement during the pretest was 13.57±2.47, df was 18, t value was 1.502, and Sig was 0.042. The mean and SD of EG in terms of Anthropometric Arms measurement during the pre-test was 12.21±1.43, df was 14.43, and t value was 1.502.
In terms of Anthropometric Thigh measurement of both CG and EG. Data were shown as Mean, SD, df, t value and Sig. The mean and SD of CG regarding Anthropometric Thigh measurement during the pretest was 21.77±1.40, df was 18, t value was -1.315, and Sig was 0.839. The mean and SD of EG in terms of Anthropometric Thigh measurement during the pre-test was 22.64±1.55, df was 17.82, and t value was -1.315.

Table 4. Independent Sample T-Tests showing the Comparison of post test results of both CG and EG in term of Anthropometric Chest, Arms and Thigh muscles measurement.

Group Statistics

	GROUP	N	Mean	Std. Deviation	Std. Error Mean	df	t	Sig
CHEST MEASURMENTS POST	CONTROL GROUP	10	39.0600	3.34106	1.05654	18	.206	.009
	EXPERIMENTAL GROUP	10	38.8200	1.57113	.49683	12.795	.206	
ARMS MEASURMENT POST	CONTROL GROUP	10	14.1200	2.22201	.70266	18	1.134	.058
	EXPERIMENTAL GROUP	10	13.2200	1.16600	.36872	13.607	1.134	
THIGH MEASURMENT POST	CONTROL GROUP	10	23.3800	2.99881	.94831	18	-.144	.625
	EXPERIMENTAL GROUP	10	23.5400	1.83315	.57969	14.902	-.144	

The mean and SD of CG in terms of Anthropometric Chest measurement during the post-test was 39.06±3.34, df was 18, t value was 0.206, Sig was 0.009. The mean and SD of EG in terms of Anthropometric Chest measurement during the post test was 38.82±1.57, df was 12.79, and t value was 0.206. The t-test revealed a statistically significant difference among CG and EG.
The mean and SD of CG in terms of Anthropometric Arms measurement during the post-test was 14.12±2.22, df was 18, t value was 1.134, and Sig was 0.058. The mean and SD of EG in terms of Anthropometric Arms measurement during the post test was 13.22±1.166, df was 13.60, and t value was 1.134. The t-test revealed a statistically significant difference among CG and EG.
The mean and SD of CG in terms of Anthropometric Thigh measurement during the post test was 23.38±2.99, df was 18, t value was -0.144, and Sig was 0.625. The mean and SD of EG in terms of Anthropometric Thigh measurement during the post test

was 23.54±1.83, df was 14.90, and t value was -0.144. The t-test revealed a statistically significant difference among CG and EG.

Discussion

The result of the current study indicates statistical impact of strength training with Tribulus Terrestris supplementation on the Testosterone Levels of respondents. The mean and SD of Testosterone Level was (384.40±126.95), df was 17.98, t value was 0.465 and level of significance was 0.647.The t-test revealed a statistically significant difference among CG and EG (p=0.979). Such an emerging concept is supported by [23], by indicating that TT does not affect testosterone plasma levels in male boxers. In a study carried out by [24] also indicated that TT does not affect testosterone plasma levels in male rugby players. Furthermore, following a four-week supplementation regimen with TT (10 or 20 $mg.kg^{-1}.day\text{-}^{1}$) in young adults, there were no appreciable increases in testosterone [25]. Similarly, following three months of TT treatment (750 mg/day), there were no noticeable differences in adult testosterone levels [26]. In a study examined that the basal serum level of hormones had no effect on the hormonal response to supplementing with TT extract, according to the ANCOVA data [27]. In another study on Ergogenic effects of Tribulus terrestris supplementation in men the Research results indicates that testosterone level concentrations are high in young, physically active males and that Tribulus terrestris supplementation has no effect on these values [28]. According to research findings, young, physically active men have high amounts of testosterone, and supplementing with Tribulus terrestris has no influence on these values [29]. There is no direct or indirect impact of Tribulus terrestris extraction on young male testosterone production. Results of the study conducted by[30], indicated that testosterone level is not affected by the 770 mg/day^{-1} of TT used in men who have completed Cross Fit training. [31] observed that after four weeks of supplementation, there was no difference in blood levels of luteinizing hormone, androstenedione, or testosterone between a daily oral dose of 10 mg/kg and a higher dose of 20 mg/kg of TT.After taking TT (750 mg/day) for five days, [32] found no changes in blood testosterone and LH levels, and there was no change in the ratio of urine testosterone to epitestosterone. Similarly, other research done on athletes did not support the positive impact of supplementing with TT on physical performance.Rugby players who took a higher daily dosage of TT (450 mg) for five weeks during their training period did not experience any changes in their strength, body composition, or testosterone to estrogen ratio in their urine [33].Studies that support positive outcomes following treatment with pharmaceutical products containing TT and other ingredients, in contrast to these data, have been conducted. Youth men's blood testosterone levels and anaerobic and alactic muscle power dramatically increased after taking the dietary supplement "Tribulus" for 20 days [34].A preparation containing TT demonstrated very high effectiveness in a placebo-controlled double blind experiment involving older men with lowered blood total (8.0 nmol/L) and frees (0.19 nmol/L) testosterone levels and previously impaired erectile function. Over the course of two months, this product, called "Tradamixina," which contains TT, Alga Ecklonia, D-glucosamine, and N-acetylglucosamine, was taken daily and improved libido and testosterone fractions to an average of 23.3 and 0.42 nmol/l, respectively [35].

The current study indicates that strength training with Tribulus Terrestris supplementation has significant impact on the Anthropometric measurements of chest, arms and thigh muscles of the respondents. The mean and SD of EG in terms of Anthropometric Chest measurement during the post test was 38.82±1.57, df was 12.79, and t value was 0.206. The t-test showed significant difference that CG has lowers Anthropometric Chest measurement (p=0.839).

The mean and SD of EG in terms of Anthropometric Arms measurement during the post test was 13.22±1.166, df was 13.60, and t value was 1.134. The t-test showed significant difference that CG has lowers Anthropometric Arms measurement (p=0.272).The mean and SD of EG in terms of Anthropometric Thigh measurement during the post test was 23.54±1.83, df was 14.90, and t value was -0.144. The t-test revealed a statistically significant difference among CG and EG (p=0.625).Such an emerging concept is supported by following content that Multiple stimuli, including resistance training, extended stretching, synergist ablation, and continuous electrical stimulation, can cause skeletal muscle hypertrophy [36]. In another research conducted by [37] Training-induced hypertrophy is thought to occur gradually; it often takes 6-7 weeks for noticeable hypertrophic changes at the total muscle level to manifest. Muscle hypertrophy can be attained by a variety of resistance training regimens; however, the principle of specificity dictates that some regimens will promote more hypertrophy than others [38]. It turns out that resistance training (RT) is a very effective way to increase strength and cause muscular hypertrophy. Acute training factors, such as exercise order and selection, intensity, volume, duration, frequency, and rest intervals, can be varied to create variations in mechanical and metabolic stressors [39].

Resistance training regimens with high volume (6–12 repetitions) and moderate–high intensity (70–80% 1RM) have been suggested to be primarily focused on muscular hypertrophy, with secondary improvements in strength occurring concurrently. On the other hand, resistance training regimens characterized by high volume (1-4 repetitions) and low intensity (85-100% 1RM) tend to favor increases in muscle strength, with secondary benefits in muscle hypertrophy [40]. An enhanced anabolic hormone response to exercise is associated with higher training volume, and this is thought to provide a stronger stimulus for muscle growth [41].Higher resistance training (RT) volumes, specifically in the range of 28-30 sets per muscle group per week, are linked to more significant improvements in hypertrophy in both trained and untrained people than lower volumes (6-10 sets per muscle group per week) [42]. Compared to high-load training, training with moderate loads (60-80% 1RM), breaking down repetitions into many sets (3-6), and adding brief rest intervals (60 seconds) between sets results in increased metabolic stress. The development of muscle is strongly influenced by this elevated metabolic load. Studies show that in well-trained young men, resistance training with low loads (≤60% 1RM) to voluntary exhaustion and at moderate loads (>60% 1RM) greatly increases muscle hypertrophy [43].

Conclusion

After careful analysis, the researcher concluded that strength training of eight (8) weeks with supplementations of Tribulus terrestris (Gonadil-f, 600mg) may cause a decrease in the Testosterone level of respondents. The possible factors for a decrease in testosterone include genetic issues as well as environmental issues and utilization of domestic usage of diet etc.

The researcher also concluded that the exercise intervention of the current study significantly put a positive impact on the muscular hypertrophy of the subjects. Likewise, the current findings reveal a significant impact of an exercise intervention on the anthropometric attributes of the subjects.

REFRENCES

Adaikan, P. G., Gauthaman, K., & Prasad, R. N. V. (2001). History of herbal medicines with an insight on the pharmacological properties of Tribulus terrestris. The aging male, 4(3), 163-169.

T Iqbal & S Altaf. Treatment of Male Infertility Disorders via Tribulus Terrestris and Multivitamins. 2023. 2(5): 12-13.

Hashim, S., Bakht, T., Marwat, K. B., & Jan, A. (2014). Medicinal properties, phytochemistry and pharmacology of Tribulus terrestris L.(Zygophyllaceae). Pakistan Journal of Botany, 46(1), 399-404.

Chhatre, S., Nesari, T., Somani, G., Kanchan, D., & Sathaye, S. (2014). Phytopharmacological overview of Tribulus terrestris. Pharmacognosy reviews, 8(15), 45.

Fernández-Lázaro, D., Fernandez-Lazaro, C. I., Seco-Calvo, J., Garrosa, E., Adams, D. P., & Mielgo-Ayuso, J. (2022). Effects of Tribulus terrestris L. on sport and health biomarkers in physically active adult males: A systematic review. International Journal of Environmental Research and Public Health, 19(15), 9533.

Fernández-Lázaro, D., Mielgo-Ayuso, J., Seco Calvo, J., Córdova Martínez, A., Caballero García, A., & Fernandez-Lazaro, C. I. (2020). Modulation of exercise-induced muscle damage, inflammation, and oxidative markers by curcumin supplementation in a physically active population: a systematic review. Nutrients, 12(2), 501.

Singh, J., Kaur, J., Kaur, M., Rana, A., Rasane, P., & Kaur, S. (2023). Tribulus terrestris: Pharmacological and Nutraceutical Potential. Harvesting Food from Weeds, 79-112.

Chhatre, S., Nesari, T., Somani, G., Kanchan, D., & Sathaye, S. (2014). Phytopharmacological overview of Tribulus terrestris. Pharmacognosy reviews, 8(15), 45.

Sellami, M., Slimeni, O., Pokrywka, A., Kuvačić, G., D Hayes, L., Milic, M., & Padulo, J. (2018). Herbal medicine for sports: a review. Journal of the International Society of Sports Nutrition, 15, 1-14.

Haghmorad, D., Mahmoudi, M. B., Haghighi, P., Alidadiani, P., Shahvazian, E., Tavasolian, P., ... & Mahmoudi, M. (2019). Improvement of fertility parameters with Tribulus Terrestris and Anacyclus Pyrethrum treatment in male rats. International braz j urol, 45(5), 1043-1054.

Warren, A. M., & Grossmann, M. (2022). Haematological actions of androgens. Best Practice & Research Clinical Endocrinology & Metabolism, 36(5), 101653.

Akram, M., Asif, H. M., Akhtar, N., Shah, P. A., Uzair, M. U. H. A. M. M. A. D., Shaheen, G., & Ahmad, K. (2011). Tribulus terrestris Linn.:a review article. J Med Plants Res, 5(16), 3601-3605.

Fernández-Lázaro, D., Fernandez-Lazaro, C. I., Mielgo-Ayuso, J., Navascués, L. J., Córdova Martínez, A., & Seco-Calvo, J. (2020). The role of selenium mineral trace element in exercise: Antioxidant defense system, muscle performance, hormone response, and athletic performance. A systematic review. Nutrients, 12(6), 1790.

Fernández-Lázaro, D., Mielgo-Ayuso, J., Córdova Martínez, A., & Seco-Calvo, J. (2020). Iron and physical activity: Bioavailability enhancers, properties of black pepper (bioperine®) and potential applications. Nutrients, 12(6), 1886.

Fernández-Lázaro, D., Mielgo-Ayuso, J., del Valle Soto, M., Adams, D. P., González-Bernal, J. J., & Seco-Calvo, J. (2021). The effects of 6 weeks of Tribulus terrestris L. supplementation on body composition, hormonal response, perceived exertion, and crossFit® performance: A randomized, single-blind, placebo-controlled study. Nutrients, 13(11), 3969.

Fernández-Lázaro, D., Fernandez-Lazaro, C. I., Seco-Calvo, J., Garrosa, E., Adams, D. P., & Mielgo-Ayuso, J. (2022). Effects of Tribulus terrestris L. on sport and health biomarkers in physically active adult males: A systematic

review. International Journal of Environmental Research and Public Health, 19(15), 9533.
Fernández-Lázaro, D., Fernandez-Lazaro, C. I., Seco-Calvo, J., Garrosa, E., Adams, D. P., & Mielgo-Ayuso, J. (2022). Effects of Tribulus terrestris L. on sport and health biomarkers in physically active adult males: A systematic review. International Journal of Environmental Research and Public Health, 19(15), 9533.
Pokrywka, A., Obmiński, Z., Malczewska-Lenczowska, J., Fijałek, Z., Turek-Lepa, E., & Grucza, R. (2014). Insights into supplements with tribulus terrestris used by athletes. Journal of human kinetics, 41, 99.
Jelagat, P., & Murei, R. INTERNATIONAL JOURNALS OF ACADEMICS &

RESEARCH.
Gray, D. E. (2021). Doing research in the real world.
White, M. G. (2020). Why human subjects research protection is important. Ochsner journal, 20(1), 16-33.
Rao, M., & Mazumdar, V. (2017). Ethical guidelines for biomedical research on human subjects. In The Lineaments of Population Policy in India (pp. 593-661). Routledge India.
Ma, Y., Guo, Z., & Wang, X. (2017). Tribulus terrestris extracts alleviate muscle damage and promote anaerobic performance of trained male boxers and its mechanisms: Roles of androgen, IGF-1, and IGF binding protein-3. Journal of sport and health science, 6(4), 474-481.
Rogerson, S., Riches, C. J., Jennings, C., Weatherby, R. P., Meir, R. A., & Marshall-Gradisnik, S. M. (2007). The effect of five weeks of Tribulus terrestris supplementation on muscle strength and body composition during preseason training in elite rugby league players. The Journal of Strength & Conditioning Research, 21(2), 348-353.
Neychev, V. K., Nikolova, E., Zhelev, N., & Mitev, V. I. (2007). Saponins from Tribulus terrestris L. are less toxic for normal human fibroblasts than for many cancer lines: Influence on apoptosis and proliferation. Experimental Biology and Medicine, 232(1), 126-133.
Roaiah, M. F., Elkhayat, Y. I., GamalEl Din, S. F., & Abd El Salam, M. A. (2017). Prospective analysis on the effect of botanical medicine (Tribulus terrestris) on serum testosterone level and semen parameters in males with unexplained infertility. Journal of dietary supplements, 14(1), 25-31.
Neychev, V. K., & Mitev, V. I. (2005). The aphrodisiac herb Tribulus terrestris does not influence the androgen production in young men. Journal of ethnopharmacology, 101(1-3), 319-323.
Poprzecki, S., Zebrowska, A., Cholewa, J., Zajac, A., & Waskiewicz, Z. (2005). Ergogenic effects of Tribulus terrestris supplementation in men. Journal of Human Kinetics, 13, 41.
Neychev, V. K., & Mitev, V. I. (2005). The aphrodisiac herb Tribulus terrestris does not influence the androgen production in young men. Journal of ethnopharmacology, 101(1-3), 319-323.
Fernández-Lázaro, D., Mielgo-Ayuso, J., del Valle Soto, M., Adams, D. P., González-Bernal, J. J., & Seco-Calvo, J. (2021). The effects of 6 weeks of Tribulus terrestris L. supplementation on body composition, hormonal response, perceived exertion, and crossFit® performance: A randomized, single-blind, placebo-controlled study. Nutrients, 13(11), 3969.

Neychev, V. K., & Mitev, V. I. (2005). The aphrodisiac herb Tribulus terrestris does not influence the androgen production in young men. Journal of ethnopharmacology, 101(1-3), 319-323.

Pokrywka, A., Obmiński, Z., Malczewska-Lenczowska, J., Fijałek, Z., Turek-Lepa, E., & Grucza, R. (2014). Insights into supplements with tribulus terrestris used by athletes. Journal of human kinetics, 41, 99.

Rogerson, S., Riches, C. J., Jennings, C., Weatherby, R. P., Meir, R. A., & Marshall-Gradisnik, S. M. (2007). The effect of five weeks of Tribulus terrestris supplementation on muscle strength and body composition during preseason training in elite rugby league players. The Journal of Strength & Conditioning Research, 21(2), 348-353.

Milasius, K., Dadeliene, R., & Skernevicius, J. (2009). The influence of the Tribulus terrestris extract on the parameters of the functional preparedness and athletes' organism homeostasis. Fiziol Zh, 55(5), 89-96.

Iacono, F., Prezioso, D., Ruffo, A., Illiano, E., Romis, L., Di Lauro, G., ... & Amato, B. (2012). Testosterone deficiency causes penile fibrosis and organic erectile dysfunction in aging men. Evaluating association among Age, TDS and ED. BMC surgery, 12, 1-5.

Wackerhage, H., Schoenfeld, B. J., Hamilton, D. L., Lehti, M., & Hulmi, J. J. (2019). Stimuli and sensors that initiate skeletal muscle hypertrophy following resistance exercise. Journal of applied physiology.

DeFreitas, J. M., Beck, T. W., Stock, M. S., Dillon, M. A., & Kasishke, P. R. (2011).An examination of the time course of training-induced skeletal muscle hypertrophy. European journal of applied physiology, 111, 2785-2790.

Schoenfeld, B. J., Ratamess, N. A., Peterson, M. D., Contreras, B., Sonmez, G. T., & Alvar, B. A. (2014).Effects of different volume-equated resistance training loading strategies on muscular adaptations in well-trained men. The Journal of Strength & Conditioning Research, 28(10), 2909-2918.

Mokaram Bakhtajerdi, J., & Moghadasi, M. (2018). Effects of Heavy Duty versus traditional resistance training on thigh muscle cross-sectional area. Journal of Physical Activity and Hormones, 2(2), 13-28.

Schoenfeld, B. J., Peterson, M. D., Ogborn, D., Contreras, B., & Sonmez, G. T. (2015).Effects of low-vs.high-load resistance training on muscle strength and hypertrophy in well-trained men. The Journal of Strength & Conditioning Research, 29(10), 2954-2963.

Mangine, G. T., Hoffman, J. R., Gonzalez, A. M., Townsend, J. R., Wells, A. J., Jajtner, A. R., ... & Stout, J. R. (2017). Exercise-induced hormone elevations are related to muscle growth. The Journal of Strength & Conditioning Research, 31(1), 45-53.

de Camargo, J. B. B., Barbosa, P. H., Brigatto, F. A., Braz, T. V., & Lopes, C. R. (2023). Muscle Hypertrophy Responses to Changes in Training Volume: A Retrospective Analysis. International Journal of Sports Medicine.

Krzysztofik, M., Wilk, M., Wojdała, G., & Gołaś, A. (2019). Maximizing muscle hypertrophy: a systematic review of advanced resistance training techniques and methods. International journal of environmental research and public health, 16(24), 4897.