Evaluation of the potential of *Tribulus terrestris* to be used by physical activity practitioners

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**ABSTRACT**

*Tribulus terrestris* has been reported to demonstrate certain properties such as increase in testosterone levels, and as such, it is referred to as potential hormone steroid. As a result, the consumption of supplements containing *T. terrestris* has increased among practitioners of physical activity, hence a constant public means of better income. This study was carried out to determine the influence of phytotherapeutic on testosterone concentrations in healthy young practitioners of physical activity. A search was conducted using the term *T. terrestris* in databases: PubMed, EMBASE, Cochrane and BIREME. A total of 374 articles were identified of which 5 were included in the review after the application of the inclusion criteria related to the target audience and randomized clinical trials. Based on the results obtained, *T. terrestris* extracts demonstrated positive effects on hormonal levels in samples of rodents, fish, rabbits, primates and in humans with sexual dysfunction and low levels of the hormone testosterone. For audience that comprised practitioners of physical activity, healthy consumption did not alter the serum concentrations of testosterone. Based on the search conducted, studies on *T. terrestris* are yet to be conducted for the benefit of athletes seek anabolic results, and the greater potential for the realization of physical work is ineffective in increasing testosterone production in healthy individuals for anabolic purposes.

**Key words:** *Tribulus terrestris*, exercise, testosterone, phytotherapeutic, physical activity.

**INTRODUCTION**

Physical activity practitioners are searching ways to increase their hormonal levels of testosterone; however, the administration of the hormone itself, increases the risk of cardiovascular complications and decreases the function of testicles (Rocha et al., 2007; Geraldo et al., 2004). Phytotherapy has been proposed as a method of increasing testosterone and its precursors, and naturally reducing financial costs and risks of the hormonal administration. *Tribulus terrestris*, an angiosperm from the Zygophyllaceae family, due their steroidal saponins that supposable acts as DHEA precursor, increases the serum levels (Adimoelja and Adaikan, 1997). Experimental studies in rats, primates and rabbits have been conducted in this regard (Kumari and Singh, 2015; Gauthaman and Ganesan, 2008). Additionally, one can observed potential sexual reversion in fish (Kavitha et al., 2012; Çek et al., 2007). In humans that presents sexual dysfunction, it showed the potential of increasing testosterone in this individuals (Tahvilzadeh et al., 2016; Kamenov et al., 2017; Roaiah et al., 2015).

The testosterone is an steroidal hormone, that, besides its effects on the libido, increases sports capacities by elevating erythropoiesis, through an anabolic effect on the bone marrow and increasing the renal production of erythropoietin, exerting positive influence on VO2 max and the time of exhaustion, and also elevate protein production.
Figure 1: Principal events related to testosterone and physical activity scheme.

and muscular trophism, as well as basal metabolism (CaetanoJúnior et al., 2014; Aires, 2008).

Physical activity practitioners can benefit from increased VO, lean body mass and basal metabolism by providing a higher effort time until fatigue, increase strength and fat burning. These benefits are related to testosterone levels, exerting influence on bone marrow anabolism and increase the amino acids capitation by muscular tissue (Figure 1).

Also, the plant is rich in nutrients, such as minerals and antioxidants compounds (Duhan et al., 1992), providing additional benefits to the health of those who consume it.

Therefore, the objective of this study was to evaluate the benefits of T. terrestris ingestion in hormonal concentrations of healthy physical activity practitioners.

METHODOLOGY

Was used the PRISMA criteria (Transparent Reporting of Systematic Reviews and Meta-Analysis), to ensure the quality of the studies that were included in the review, through the protocol, with lower bias risk.

To developing the present systematic review, searches were carried out in PubMed, EMBASE, Cochrane and BIREME databases through the MESH terms “Tribulus”, “Tribulus and testosterone”, “Tribulus and exercise”. In total, 374 articles were obtained, of which 114 corresponded to duplicates.

The remaining 260 articles selected were those that included the target public and clinical trials, which corresponded 18 articles; however, of these, only in 5 articles that treatments were made exclusively with T. terrestris in physical activity practitioners and were included in the systematic review (Figure 2). However, the diversity of treatments performed between the studies makes impossible a meta-analysis.

RESULTS AND DISCUSSION

The plant hormonal stimulation capacity is attributed to the presence of steroidal saponins, specially the protodioscin. It was demonstrated in studies with primates, rats and fishes that T. terrestris really elevates testosterone levels and their precursors (Kumari and Singh, 2015; Gauthaman and Ganesan, 2008; Kavitha et al., 2012; Çek et al., 2007). This has attracted the attention of numerous researchers that tend to evaluate if the plant exert effects on humans with
sexual dysfunction (Tahvilzadeh et al., 2016; Kamenov et al., 2017; Kamenov et al., 2017) and thus, the results were favorable to the use of the plant.

Although the benefits were demonstrated previously, when obtaining studies on healthy individuals that practice physical activity, the results do not demonstrated the effects of the plant consume on hormonal levels. A study showed that *T. terrestris* can elevate the testosterone concentrations on the first 10 days of the supplement ingestion, followed by a decrease of the hormone levels on the next 10 days (Roaiah et al., 2015); however, although it was a randomized clinical trial, among all the parameters evaluated, the testosterone concentration was the only one that was not evaluated in the control group.

The other four studies included in the review did not obtain a satisfactory results based on *T. terrestris* consumed by sportsmen with the aim to elevate testosterone levels (Table 1).

In several studies (Milasius et al., 2009; Yiming et al., 2015), the plant consumption improved anaerobic
performance, suggesting a beneficial effect of the consumption of T. terrestris on sports performance, and does not even alter the hormones. However, in a study by Yiming et al. (2015) study, there was a significant decrease of the protein IGFBP-3, that is directly related to GH levels. This suggests that the supplementation with T. terrestris can be harmful to sportsmen that aim muscular trophism; however, this is the only study conducted in this regard.

Physical activity practitioners that aim muscular hypertrophy do not benefit from the phytotherapeutic consumption, as well as individuals with better incomes, through the increase of VO2, also do not enjoy this benefit of consuming Tribulus. In another study, Neychev and Mitev (2005) demonstrated that T. terrestris also do not alter the hormonal concentrations in healthy young people who do not practice physical activity.

Despite these results, the consumption of the studied plant can bring other benefits. The plant T. terrestris bromatological composition indicate that consumption of 100 g contained about 84% of Calcium Al (Adequate Intake), 27% of Zinc RDA (Recommended Dietary Allowances) and more than 4 times for Iron RDA (Gandhi et al., 2013), proving to be an excellent source of minerals.

Furthermore, the consumption of 2.5 g of the plant has enough β-carotene to satisfy the needs of an adult male (Gandhi et al., 2013), an important precursor of antioxidants and Vitamin A. It represents a significant nutritional value that assists in the reduction of oxidative stress that is increased during exercise. It brings benefits to physical activity practitioners even though it does not alter hormonal concentrations. Studies have also demonstrated T. terrestris ability to reduce fasting blood glucose and total cholesterol and LDL cholesterol (Gandhi et al., 2013; Li et al., 2002; Samani et al., 2016; Chu et al., 2003; Tuncer et al., 2009), indicating the benefit of its consumption by diabetic and dyslipidemic individuals (Table 2).

### Table 1: Effects of Tribulusterrestris supplementation in healthy physical activities practitioners

<table>
<thead>
<tr>
<th>Study</th>
<th>Subject, N, age</th>
<th>Dose</th>
<th>Evaluated parameters</th>
<th>Training protocol</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milasius et al., 2009</td>
<td>N=32, being 20 = experimental and 12 = control group; ages 20-22 years old</td>
<td>1 650mg capsule 3 times a day for 20 days</td>
<td>Muscular strength; anaerobic power; blood cells and biochemical indices</td>
<td>30 second workout resistance training</td>
<td>↑ mixed alactic muscle capacity; ↓ lymphocytes; ↑ of the testosterone in the experimental groups in the first 10 days, followed by a fall in the 10 days its subsequent.</td>
</tr>
<tr>
<td>Saudan et al., 2008</td>
<td>Women (n = 2) being 01 with 26 and the other with 40 years old</td>
<td>01 500mg capsule 3 times a day for 02 days</td>
<td>Urinary dehydroepiandrosterone, testosterone / epiandrosterone and urinary LH ratio</td>
<td>Undefined</td>
<td>Didn’t had significant alterations</td>
</tr>
<tr>
<td>Rogersonet al., 2007</td>
<td>Men (n=22) being 11 experimental and 11 control group; with ages in 19.8±2.9 years</td>
<td>01 450mg capsule once a day</td>
<td>Strength, body mass, fat free mass, urinary testosterone / epiandrosterone</td>
<td>Rugby</td>
<td>No alterations</td>
</tr>
<tr>
<td>Antonioet al., 2000</td>
<td>Men (n=15), ages in between 18 and 26 years old</td>
<td>01 3.21 mg/kg capsule once a day</td>
<td>Body composition and performance</td>
<td>Resistance training</td>
<td>Was not significant alterations in none of the analyzed parameters</td>
</tr>
<tr>
<td>Yiminget al., 2015</td>
<td>Men (n=15) being 07 control group and 08 experimental group with ages in between 14 and 18 years old</td>
<td>01 1250mg capsule a day</td>
<td>Muscle mass and fat mass, creatine kinase, blood urinary nitrogen, anaerobic performance, testosterone, dehydroepiandrosterone, IGF-1, IGF-BP3</td>
<td>Boxe</td>
<td>↓ IGFBP-3 in the experimental group; ↓ creatine kinase in the experimental group that performed a high intensity training As for anaerobic performance, there was ↑ mean power (MP) and MP / body weight in the groups that ingested Tribulusterrestris; Body composition, blood levels of testosterone, DHEA and IGF-1 remained unchanged.</td>
</tr>
</tbody>
</table>

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*Academia Journal of Medicinal Plants; Oliveira de Assis and Regis.* 328
Table 2: Principals effects of the *Tribulus terrestris* consume describes in literature.

<table>
<thead>
<tr>
<th>Other effects exercised by Tribulus</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mineral adequacy</td>
<td><em>Tribulus</em> bromatolology shows a significant amount of calcium and zinc, that are related to sexual function (Martínez-Abad et al., 2017; Barbato et al., 2017; Roa et al., 2017; Laurentino et al., 2012; Altoé, 2016). Besides the structural, regulatory and enzymatic functions (Dimenstein et al., 2003).</td>
</tr>
<tr>
<td>Antioxidant effect</td>
<td>Free radicals combat, decreasing the oxidative stress (Novo et al., 2013; Bianchi and Antunes, 1999).</td>
</tr>
<tr>
<td>Vitamin A precursor</td>
<td>It helps in cell differentiation, especially in the immune system, bone tissue and mucosal lined tissues (Dimenstein et al., 2003).</td>
</tr>
<tr>
<td>Diabetes</td>
<td>Reduces the fasting blood glycemia contributing to this pathology control (Li et al., 2002).</td>
</tr>
<tr>
<td>Dyslipidemia</td>
<td>Reduces total and LDL cholesterol, decreasing the risk of cardiovascular diseases (Li et al., 2002; Tuncer et al., 2009).</td>
</tr>
</tbody>
</table>

**DISCUSSION**

The minerals found in the plant extract are necessary for sexual function, since calcium is involved in sperm motility, apoptosis regulation, and acrosomic reaction (Martínez-Abad et al., 2017). While zinc is necessary for spermatid formation and maturation, being important in spermatogenesis, integrating the flagellum of the elongated spermatids remaining in the spermatozoids and reducing the damage in sperm DNA (Barbato et al., 2017; Roa et al., 2017) by acting as an enzymatic cofactor of metalloenzymes involved in DNA transcription. Besides, it acts in steroids receptors expression and protects the spermatozoid by having the antioxidant and antiapoptotic action. As a result, it plays an important role in spermatogenesis and the mineral malnutrition can lead to masculine infertility (Novo et al., 2013; Bianchi and Antunes, 1999).

Besides that, some articles evaluated parameters as the International Index of Erectile Function (IIEF), where a questionnaire is applied, and may be influenced by a placebo effect, on which, participants may believe they are ingesting something that favors the increase of testosterone and for psychological reasons believed to improve libido (Laurentino et al., 2012). Therefore, it can only be said that the *Tribulus* contributed to minerals proper intake and as such, further studies are necessary to prove its real effect on hormonal concentrations.

**Perspective**

The *T. terrestris* extracts brings some benefits to individuals with sexual dysfunction and as a result, physical activities practitioners that aim to increase their testosterone concentrations do not benefit by consuming this plant. However, the plant bromatological composition may reduce oxidative stress and provides better recovery and final performance of the physical activity. Studies were carried out in areas where phytotherapics demonstrated efficacy.

**REFERENCES**


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