

# OPTIGEN INGREDIENTS



## PROTOCIN<sup>®</sup> (PROTODIOSCIN)

### Introduction

Botanical name/species	Tribulus Terrestris
Common name	Burra Gokhru; Gokshura; Puncture Vine; Small Caltrop
Division	Magnoliophyta
Class	Magnoliopsida
Order	Zygophyllales
Family	Zygophyllaceae
Available	India, Eastern Europe & China
Parts used	Leaves, Roots, Fruit, Stem

*Tribulus terrestris* is a weed that grows around the world and is commonly known as “Puncture Vine”. It is a botanical that has been used for hundreds of years in Europe for hormone insufficiency in men and women. It is widely believed that Tribulus is the closest and strongest natural herbal alternative to synthetic hormones.

(Although Tribulus grows in many parts of the world including India, China and Bulgaria, all Tribulus is not created equal. Studies that were conducted at the University of Mississippi for NutraStar, Inc. conclusively proved that Bulgarian Tribulus included significantly more steroidal saponins than plants found in other areas.

The aerial portion of the plant including the fruit contains pharmacologically active metabolites such as phytosteroids, flavonoids, alkaloids and glycosides. However it is the **Protodioscin** as well as other steroidal saponins that are believed to actually elevate the level of several hormones in the human body.

**Protodioscin** which classified as a furostanol saponin, is the active ingredient of the plant extract of *Tribulus terrestris* L.

**Tribulus terrestris** (also known as puncture vine), a member of the Zygophyllaceae family, is an annual herb found in many tropical and moderate areas of the world, including the US and Mexico, the Mediterranean region, and throughout Asia. Its health and medicinal effects to three groups of active Phytochemicals:

**A-** Dioscin, protodioscin, diosgenin and similar. These substances stimulate sexual performance and may be useful for treating a variety of sexual disorders, they help to regulate sexual energy levels and sexual strength by increasing the percentage of free available testosterone levels for men and they even effect pregnenolone, progesterone and estrogen. The hormone balancing abilities of *Tribulus Terrestris* in the bodies of women makes this herb possibly useful for aiding in the treatment of premenstrual syndrome and menopausal syndrome.

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Optigen Ingredients Pty. Ltd. ABN 43 106 107 000.

PO Box 3188, Port Adelaide 5015 Adelaide, South Australia, Australia. 308 St Vincent Street, Port Adelaide 5015, Adelaide, South Australia, Australia  
Phone +61 8 8240 5050 +61 8 8240 5051 Facsimile +61 8 8240 5052 Email info@optigen.com.au Website www.optigen.com.au

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**B-** Sterols such as betasitosterols or stigma. These chemical compounds help to protect the prostate gland from swelling and in combination with the X steroidal saponins, may help to protect the prostate from cancer.

**C-** Proprietary steroidal saponins currently referred by medical researchers and physicians as X steroidal saponins. These X steroidal saponins have the ability to influence the entire immune system of the body. They have been shown to have anti-bacterial and anti-viral effects. Due to the effects of these substances it is now believed that Tribulus Terrestris may be used both internally and externally as a treatment for herpes, and virus infections such as influenza and the common cold.

Most of all, steroidal saponins have been identified as the bioactive constituents responsible for the anabolic and aphrodisiac effects, these saponins (of which protodioscin is the primary) enable the body to produce more testosterone by raising the levels of the Leuteinizing Hormone (LH), which a hormone released normally by the pituitary gland helps to maintain testosterone production. As the LH increases, so testosterone increases.

These effects have been shown in both animal and human clinical trials.

**Protocin®**, delivers the highest levels of Protodioscin per dose of any product on the market. Recent blood tests of people using (Tribistol )for 4 weeks show tremendous increases in all hormone categories including Testosterone, LH and FSH. In addition, individuals reported subjective feedback of increased libido and overall well-being on the product. Further, no adverse effects were reported either through the blood tests or the individuals related to liver functions or any other side effects.

## Macroscopic characteristics:

Fruit pedicellate, globose, possessing five woody wedges shaped cocci, covered with two pairs of short stiff spines, one pair larger than the other. Tips of spines almost meet in pairs together forming pentagonal framework around the fruit. Outer surface of the schizocarp is rough. Odor faintly aromatic and slightly acid in taste.

## Photochemistry:

Studies on the constituents of the Aerial parts of Tribulus terrestris led to the isolation of five new steroidal saponins (terrestrosin A-E), (25R,S)-5 alpha-spirostan-3 beta-ol-3 -O-beta-D-galactopyranosyl (1-2)-beta-D- glucopyranosyl (1-4)-beta-D-galactopyranoside, (25R,S)-5 alpha-spirostan-3 beta-ol-3-O-beta-D-glucopyranosyl (1-4)-[alpha-L-rhamnopyranosyl (1-2)]-beta-D-galactopyranoside, (25R,S)-5 alpha-spirostan-12-on-3 beta-ol-3-O-beta-D-galactopyranosyl (1-2)-beta-D-glucopyranosyl (1-4)-beta-D-galactopyranoside, hecogenin 3-O-beta-D-galactopyranosyl)1-2)-[beta-D-

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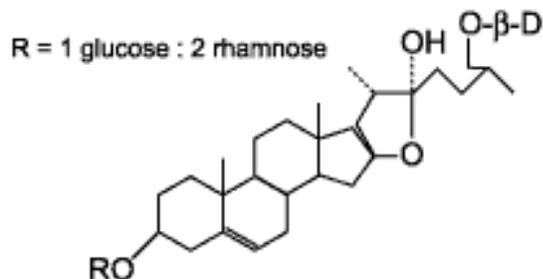
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xylopyranosyl(1-3)]-beta-D-glucopyranosyl(1-4)-beta-D-galactopyranoside and (25R,S)-5 alpha-spirostane-2 alpha, 3 beta-diol-3- O-beta-D-galactopyranosyl(1-2)-beta-D-glucopyranosyl(1-4)-beta-D- galactopyranoside, together with five known steroidal saponins, desgalactotigonin, F-gitonin, desglucolanatigonin, gitonin and tigogenin 3-O-beta-D- xylopyranosyl)1-2)-[beta-D-xylopyranosyl)1-3)]-beta-D-glucopyranosyl)1-4 )-[alpha-L-rhamnopyranosyl(1-2)]-beta-D-galactopyranoside. The structures of the new saponins were elucidated on the basis of spectroscopic analyses, including two-dimensional NMR techniques, and chemical reactions. The alkaloid, Harman, has been reported from the herb, and harmine from the seeds of the plant. The plant contains Saponins, which on hydrolysis, yield steroidal sapogenins diosgenin, gitogenin, chlorogenin(m.p.-275-277<sup>0</sup>), ruscogenin and 25 D-spirosta-3,5-diene. Kaempferol, Kaempferol-3-glucoside, Kaempferol-3-rutinoside, and a new flavanoid tribuloside (C<sub>30</sub>H<sub>26</sub>O<sub>13</sub> ; m.p224-260) have also been isolated from the leaves and fruits.

## Chemical and Physical Characteristics of Protodioscin

Protodioscin is the active ingredient of the plant extract of Tribulus terrestris L., and is produced by Phytotech extracts pvt Ltd. Protodioscin is classified as a furostanol saponin, and is present in the extract at no less than 45% of the total weight. The chemical structure of this compound is shown below in Figure 1.



26-O-β-D-glucopyranosyl-22-hydroxyfurost-5-en-3β,26-diol-3-O-b-diglucorhamnoside

The chemical structure of protodioscin, the active ingredient of Tribulus terrestris L. extract.

Protodioscin is physically characterized as a bitter-tasting amorphous powder, with a yellow-brown color. It is soluble in water, slightly soluble in methanol, but not soluble in chloroform.

## Mechanism of Protodioscin

Protodioscin acts by stimulating the enzyme 5-alpha-reductase, which plays a role in the conversion of testosterone into dihydrotestosterone (Viktorof et al. 1994). In addition, protodioscin also stimulates the hypothalamus secretion of luteinizing hormone (LH), but not of follicle stimulating hormone (FSH). Protodioscin is shown to

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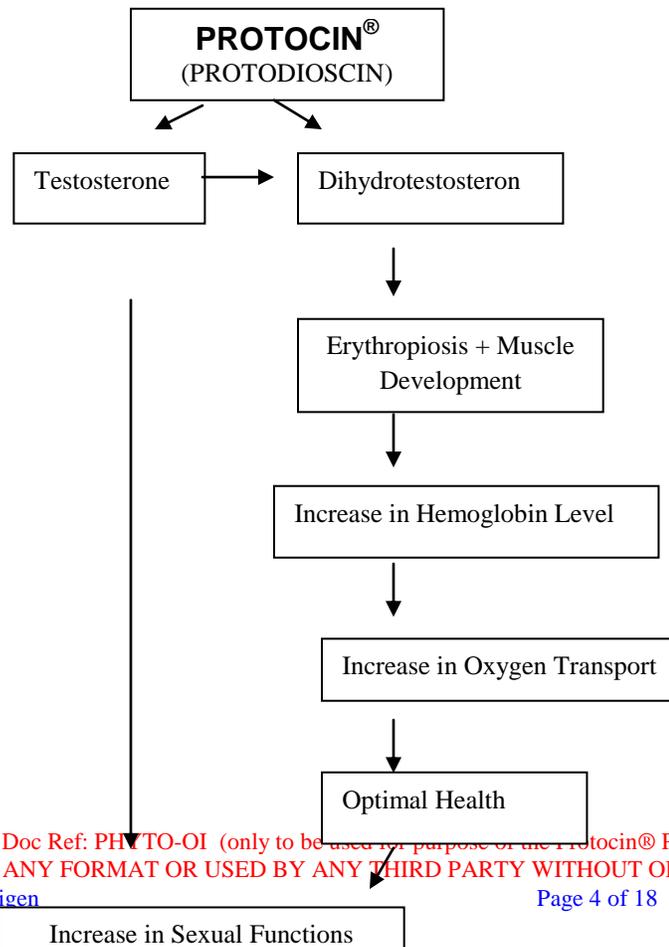
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increase the density of the Leydig, but not that of the Sertoli cells, and to improve the level of spermatogonia and to increase the production of spermatocytes and spermatids without changing the diameter of the seminiferous tubules. Physically, protodioscin treatment results in increased male fertility and sexual functions.

In respect to improving fertility, protodioscin increases the level of spermatogenesis by stimulating the Sertoli and germinal cells, resulting in the increased production of sperms. In this process, protodioscin improves the conversion of testosterone to DHT, which in turn stimulates the production of Androgen Binding Protein (ABP) in the Sertoli cells. Increased ABP production results in increased formation of DHT-ABP complex, which stimulates spermatogenesis in the germinal cells. Another fraction of the DHT-ABP complex is transported to the epididymis, which increases the efficiency of the maturation of spermatozoa into fertile sperms.

In respect to increasing sexual functions, protodioscin works by increasing the conversion of testosterone into the potent DHT (shown in the figure below). In addition to the increase in sexual drive or libido, DHT also stimulates erythropoiesis or production of red blood cells, and muscle developments, thus contributing to the improvement of blood circulation as well as the oxygen transport systems. Importantly, regular use of protodioscin has also been shown to increase the duration of penile erection and improve ejaculation in males.



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The mechanism of protodioscin's action. Protodioscin increases the production of serum testosterone and the conversion of testosterone to dihydrotestosterone. Dihydrotestosterone, in turn enhances erythropoiesis and muscle development. More erythropoiesis or production of red blood cell increases the hemoglobin level, which results in better oxygen transport throughout the body, resulting in a more optimal health. Both increased production of testosterone contribute to the increase in sexual functions, especially the increase in sex drive and better health.

## **PROTOCIN® (Protodioscin 10%) - Total FUROSTANOLIC SAPONIN 80% and 10% PROTODIOSCIN**

### **Physical properties**

Appearance	Greenish brown to brown powder; hygroscopic in nature.
Smell	Characteristic odor
Color	Greenish brown to pale brown powder
Taste	Bitter
Plant part used	Fruit

### **Identification**

Identification	To comply with the standard by Thin Layer Chromatography
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### **Purity**

Loss on Drying	Not more than 10.0%
Solubility -Water solubles	Not less than 85.0%
-Alcohol solubles	Not less than 70.0%
Ash contents	Not more than 20.0%
Arsenic	Not more than 1 ppm
Heavy metals	Not more than 20 ppm
Lead	Not more than 10 ppm

### **Assay**

-Content of Total saponins	Not less than 80.0%
-Content of protodioscin	Not less than 10.0%

### **Microbial count**

Total microbial count	Not more than 1000 cfu/g
Yeast and Molds	Not more than 100 cfu/g
E.coli and Salmonella	Should be absent

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## PROTOCIN<sup>®</sup> (Protodioscin 20%) - Total FUROSTANOLIC SAPONIN 60% and 20% PROTODIOSCIN

### Physical properties

Appearance	Greenish brown to brown powder; hygroscopic in nature.
Smell	Characteristic odor
Color	Greenish brown to pale brown powder
Taste	Bitter
Plant part used	Fruit

### Identification

Identification	To comply with the standard by Thin Layer Chromatography
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### Purity

Loss on Drying	Not more than 10.0%
Solubility -Water solubles	Not less than 85.0%
-Alcohol solubles	Not less than 70.0%
Ash contents	Not more than 20.0%
Arsenic	Not more than 1 ppm
Heavy metals	Not more than 20 ppm
Lead	Not more than 10 ppm

### Assay

-Content of Total saponins	Not less than 60.0%
-Content of protodioscin	Not less than 20.0%

### Microbial count

Total microbial count	Not more than 1000 cfu/g
Yeast and Molds	Not more than 100 cfu/g
E.coli and Salmonella	Should be absent

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## PROTOCIN<sup>®</sup> (Protodioscin 30%) - Total FUROSTANOLIC SAPONIN 50% and 30% PROTODIOSCIN

### Physical properties

Appearance	Greenish brown to brown powder; hygroscopic in nature.
Smell	Characteristic odor
Color	Greenish brown to pale brown powder
Taste	Bitter
Plant part used	Fruit

### Identification

Identification	To comply with the standard by Thin Layer Chromatography
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### Purity

Loss on Drying	Not more than 10.0%
Solubility	Not less than 85.0%
-Water solubles	
-Alcohol solubles	Not less than 70.0%
Ash contents	Not more than 20.0%
Arsenic	Not more than 1 ppm
Heavy metals	Not more than 20 ppm
Lead	Not more than 10 ppm

### Assay

-Content of Total saponins	Not less than 50.0%
-Content of protodioscin	Not less than 30.0%

### Microbial count

Total microbial count	Not more than 1000 cfu/g
Yeast and Molds	Not more than 100 cfu/g
E.coli and Salmonella	Should be absent

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## Method of analysis

Appearance: Greenish brown colored powder, with characteristic odor.

Identification: The Rf value of the spot obtained from sample should be comparable with that of Standard

Loss on drying: **Not more than 10.0 %**  
Determine on IR moisture balance at 105°C

Water solubles: **Not less than 85.0 %**  
Weigh accurately about 1 g of the extract. Add 100 ml of water. Stir for one hour and filter through Whatman filter paper No. 41. Dry the paper at 105°C to a constant weight.

Calculation: 
$$\frac{\text{Wt of the residue} \times 100}{\text{Wt of the sample taken}} \times 100$$

Alcohol solubles: **Not less than 70.0 %**  
Weigh accurately about 1 g of the extract. Add 100 ml of alcohol. Stir for one hour and filter through Whatman filter paper No. 41. Dry the paper at 105°C to a constant weight.

Calculation: 
$$\frac{\text{Wt of the residue} \times 100}{\text{Wt of the sample taken}} \times 100$$

Ash content: **Not less than 20.0 %**  
Weigh accurately about 1 g of the extract in a weighed platinum / silica crucible. Incinerate at 400°C till it is charred. Add 100 ml of water. Stir for one hour and filter through Whatman filter paper No. 41. Dry the paper at 105°C to a constant weight.

Calculation: 
$$\frac{\text{Wt of the residue} \times 100}{\text{Wt of the sample taken}} \times 100$$

Assay: **Not less than 60.0 % Total FUROSTANOLIC SAPONIN and 30% PROTODIOSCIN**

## Content of Steroidal saponins by Gravimetric method:

1. Weigh accurately about 5 gm. sample into a 250 ml glass joint conical flask.
2. Add about 50 ml of the 90% w/v alcohol and reflux for half an hour, cool.
3. Decant the aqu. Alcohol into another 250 ml beaker.
4. Repeat this process 3 times. The final extraction of the alcohol layer should not be colored.
5. Collect the aqu. Alcohol together and evaporate the solvent till the sample volume is about 5 ml.
6. Treat the concentrate with petroleum ether 60-80, 25 ml, by reflux for half an hour. Cool and remove solvent by decantation.
7. Now treat the soft extract as per step 6 with 25 ml of chloroform and followed by 25 ml of Ethyl acetate.
8. Discard the solvents after cooling.
9. Dissolve the soft extract (after three extractions cited above) in 25ml methanol, filter. Concentrate the methanolic extract to 5ml.
10. Add methanolic extract drop by drop with constant stirring to 250ml Acetone to precipitate Glycosides.
11. Filter the precipitate in a pre weighed G4 crucible.
12. Dry the crucible to a constant weight at 105°.
13. From the weight calculate the content of saponins.

## Content of protodioscin by HPLC:

### PHARMACOLOGY:

The active components of the plant *Tribulus terrestris* L. extract are non-steroid saponins of the furostanol type, termed protodioscin. A pronounced stimulating effect on the spermatogenesis is observed after the preparation is administered orally to sexually mature rats.

Increased numbers of spermatogonia, spermatocytes, spermatids and mature spermatozoa in the testes has been observed without widening of the diameter of the seminiferous tubules. In parallel, increased number of Sertoli cells is observed in a volume unit from rat testes. Oral administration stimulates the mitotic activity of spermatogonia in mature rats. Oral administration of the preparation leads to intensification of spermatogenesis and enhancement of the quality of spermatozoa in sexually mature rats. The percentage of motile spermatozoa increases, the characteristics of their motility improve, prolonging the period of their viability at the same time. Given orally to swine, protodioscin stimulates their sexual behavior. The clinical trials of the preparation have also confirmed the experimental data.

Protodioscin, administered to male subjects with disorders in the spermiogram, due to varicocele, increases the volume of ejaculated sperm by 1-2 ml, increases

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spermatozoid concentration by 30 million/ml, increases the percentage of motile spermatozoa by 30%. The preparation has a marked effect on the motility of spermatozoa in case of oligoasthenozoospermia, as revealed by the study of its therapeutic properties in men. The mean number of motile spermatozoa in the group studied was 29% prior to the study, and later it reached up to 36.6%. The motility rate of the spermatozoa prior to the treatment was 1.95 mm/sec and 3.76 mm/sec post treatment.

Of definite interest is the treatment of patients with unilateral and bilateral hypotrophy of the testes, combined with disorders of the spermiogram. The libido was enhanced after a 60-day protodioscin treatment and the characteristics of the spermiogram were improved. Recovery and enhanced libido were observed in patients with primary and secondary hypogonadism after administration, as well as prolonged erection.

Both experimental and clinical studies reveal that protodioscin is not toxic and induces no adverse effects.

Clinical investigations on a total of 212 males with disorders of sexual functions confirmed experimental data pointing at a pronounced stimulating effect on these sexual functions by the new phytochemical preparation of Tribulus terrestris extract. Administered in average daily doses of 1.5 g in the course of 30 to 40 days, it restores and improves libido sexualis in all forms of impotentia coeundi.

Studies on the acute, subchronic and chronic toxicities of protodioscin, the active ingredient of Tribulus terrestris extract, determined that the compound is to be classified as a practically non-toxic substances. The harmlessness of the preparation deserves particular attention. No data about toxic manifestations were established under experimental conditions with acute, subchronic and chronic toxicities (behavioral, hematological, biochemical, functional and morphological studies). No data were established concerning carcinogenic and teratogenic effect.

The combined action of the preparation (stimulation of the sexual behavior and spermatogenesis) and the absence of adverse effects characterize the preparation as an original agent for the treatment of males with disorders in the sexual functions.

## **Clinical application:**

### ***Trials of Tribulus terrestris (protodioscin) on oligo-zoospermia***

N. Moeloek, A. Adimoelja, T. Tanojo, and W. Pangkahila  
Proceedings of the VIth National Congress and IIIrd International Symposium on New Perspectives of Andrology on Human Reproduction  
National Congress of Indonesian Association of Andrologists. Scientific Meeting VI in Manado (1994)

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Tribulus terrestris L. is a natural, non-hormonal herbal preparation. This trial focuses on determining the effect of this preparation on the fertility of men with oligozoospermia.

A three-centered study in Indonesia (the cities of Jakarta, Surabaya, and Denpasar) include 45 subjects. Thirty six of these men compose the experimental group, and are administered Tribulus terrestris L. (Libilov), whereas 9 are given placebo (control group).

The study includes analyses of three phases:

- Before treatment
- During treatment (9 weeks)
- After treatment (3 weeks after treatment)

### ***Effect of protodioscin (Tribulus terrestris) on the well-being and sexual response of men with diabetes mellitus***

K.M. Arsyad

Medical Biology Division of Andrology, University of Sriwijaya, Indonesia (1997)

We conducted this trial to study the effect of Tribulus terrestris (protodioscin) supplement on the sense of well-being and sexual response of men suffering from diabetes mellitus. 30 men between the ages of 40 to 55 years were divided into two 15-men groups. The experimental and control groups were given Tribulus terrestris extract (Libilov tablets, 250mg) and placebo pills 3 times per day for 30 days, respectively. Both groups were not statistically different in age, body weight and fasting sugar levels.

Our results showed that Tribulus supplement is able to improve the sense of well being and sexual response of diabetic subjects. We found improvement in sex drive, erection, ejaculation and orgasm in the treated group and no improvement in these parameters in the control group.

Diabetes mellitus (DM) is a metabolic disease which prevalence tends to increase steadily irrespective of social and economic status (1). Clinical symptoms of DM include symptoms related to the pancreatic compensation stages, including polyphagia, polydipsia, polyuria, and an increase in body weight. If left untreated, these symptoms could lead to nausea and diabetic coma. Other symptoms include that of the pancreatic decompensation stages and other chronic symptoms, such as asthenia, anorexia, hyperesthesia, blurred vision, myalgia, athralgia and a decrease in sexual drive. Diabetes could also be complicated by vasculopathy and neuropathy, or both. Furthermore, sexual dysfunctions in diabetic men are often diagnosed as erectile dysfunction, disorders in ejaculation and decreased libido. These sexual dysfunctions often occur before DM is diagnosed (2).

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Sexual dysfunctions in diabetic men are caused by (3,4,5):

1. Disturbance in hormone productions

Reduction in blood vessels causes the subsequent reduction in blood flow to the testes tissues, leading to degeneration of these tissues and reduction in androgen production. Coupled with decreased hormone production in other glandular tissues, the decrease in total androgen levels is responsible for the decrease in libido.

2. Impaired erection

The destruction of blood vessels increases blood viscosity and abnormally affects the nervous system. This often results in impotence or disturbance in achieving erection.

3. Impaired ejaculation

Impairment in achieving ejaculation is most often caused by the destruction of the nervous system in vesica urinaria.

4. Impaired orgasm

Impairment in achieving orgasm is caused by the failure of fulfilling the appropriate sexual response phase.

The active ingredient in Tribulus terrestris extract, called protodioscin, has been reported to increase the level of dehydroepiandrosterone (DHEA) in the bloodstream. DHEA is a hormone involved in the immune system and has been attributed to be responsible in improving the general sense of well-being. It has been hypothesized that DHEA functions by improving the integrity and functions of cellular membranes, including those of the endothelial cells in the penile corpus cavernosum and other blood vessels (6,7). Treatment with Tribulus terrestris extract (Libilov™) at one tablet three times daily for 10 days has been reported to increase the DHEA level in diabetic and non-diabetic male subjects diagnosed with erectile dysfunction (8). Protodioscin increases the secretion of LH, but not that of FSH. Protodioscin has been shown to increase the density of the Sertoli cells, without changing the density of the Leydig cells; and to increase the number of spermatogonia, spermatocytes and spermatids without affecting the diameter of the seminiferous tubules.

This clinical study was designed to determine the effect of protodioscin on the sense of well-being and the sexual response of men diagnosed with diabetes mellitus.

## ***Aphrodisiac properties of Tribulus terrestris extract (protodioscin) in normal and castrated rats***

A. Gauthaman, P.G. Adaikan, R.N. Prasad

National University of Singapore, National University Hospital, Department of Obstetrics and Gynecology, Singapore

Life Sci 2002 Aug 9; 71(12): 1385-96

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Tribulus terrestris (TT) has long been used in traditional Chinese and Indian systems of medicine for the treatment of various ailments and is popularly claimed to improve sexual functions in man. Sexual behavior and intracavernous pressure (ICP) were studied in both normal and castrated rats to further understand the role of TT containing protodioscin (PTN) as an aphrodisiac. Adult Sprague-Dawley rats were divided into five groups of 8 each that included distilled water treated (normal and castrated), testosterone treated (normal and castrated, 10 mg/kg body weight, subcutaneously, bi-weekly) and TT treated (castrated, 5 mg/kg body weight, orally once daily). Decreases in body weight, prostate weight and ICP were observed among the castrated groups of rats compared to the intact group. There was an overall reduction in the sexual behavior parameters in the castrated groups of rats as reflected by decrease in mount and intromission frequencies (MF and IF) and increase in mount, intromission, ejaculation latencies (ML, IL, EL) as well as post-ejaculatory interval (PEI). Compared to the castrated control, treatment of castrated rats (with either testosterone or TT extract) showed increase in prostate weight and ICP that were statistically significant. There was also a mild to moderate improvement of the sexual behavior parameters as evidenced by increase in MF and IF; decrease in ML, IL and PEI. These results were statistically significant. It is concluded that TT extracts appear to possess aphrodisiac activity probably due to an androgen increasing property of TT (observed in our earlier study on primates).

## ***Tribulus terrestris (protodioscin) increases men's sex drive***

W. Pangkahila

Reproductive Medicine Faculty, University of Denpasar, Indonesia

Proceedings of the Xth National Congress on New Perspectives of Andrology on Human Reproduction

National Congress of Indonesian Association of Andrologists 10th Scientific Meeting in Denpasar(1993)

Male erectile dysfunctions are composed of the dysfunctions of libido, erection, ejaculation and orgasm. One medical approach to solve this problem is the use of natural medicine, i.e. the use of compounds derived from natural sources rather than those of synthetic origins. Here, we conduct a clinical trial to test the efficacy of Libilov's protodioscin, a natural compound derived from the extract of a medicinal plant Tribulus terrestris. In this test, we study the sex drive, erection, ejaculation and orgasm of 53 married men diagnosed with sexual dysfunctions. These men were given Libilov at 3 x 2 tablets per day for 3 months.

We report that statistical analyses suggest significant improvement in sex drive in the majority of our trial constituents, without any evidence of adverse effects.

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## ***Tribulus terrestris (protodioscin) in the treatment of male infertility with idiopathic oligoasthenoterato-zoospermia***

A Adimoelja, L Setiawan, and T Djojotananjo  
Academic Hospital Dr. Soetomo and Airlangga University, Surabaya, Indonesia  
in First International Conference of Medical Plants for Reproductive Medicine in Taipei, Taiwan (1995)

Tribulus terrestris L (TTL) extract is a natural remedy that has been successfully tested clinically for its use in the treatment of idiopathic oligoasthenoteratozoospermia (OTA). Here, we conducted a double blind study of 45 infertile, married men with OTA. 36 men were treated with 500 mg purified TTL (Libilov) 3 times daily for 3 months. Composing the controlled group, 9 men were given placebo (sugar pills) for the same period of time. Spouses of 8 of the men in the treated group successfully achieved pregnancies after treatment of their husbands, whereas no pregnancies occurred in the spouses of the men in the control group. An improvement in the sperm morphology, including that observed under conventional phase contrast microscopy as well as improvements in acrosome morphology and reaction, seemed to account for the increased fertility after treatment. In addition, TTL was also shown to increase the level of dehydroepiandrosterone (DHEA) and might also contributed to the activation of cell membrane receptors and the production of weak androgens. These, in turn, might additionally improve fertility by increasing the level of spermatogenesis.

## ***Effect of protodioscin on the quantity and quality of sperms from males with moderate idiopathic oligozoospermia***

K.M. Arsyad  
Medical Biology Division of Andrology, University of Sriwijaya, Indonesia (1996)  
Medika 22 (8): 614-618 (1996)

This study was conducted to assess the effectiveness of a certain dosage and period of administration of Libilov (protodioscin) on sperm quality and quantity in men with moderate idiopathic oligozoospermia. This study also evaluated protodioscin's effect on libido, erection, ejaculation and orgasm. Lastly, We also determined the length of time that the beneficial effects of the treatment lasted after administration of the preparation was stopped.

Our result showed that oral Libilov treatment with the dose of 3 x 2 tablets per day for 60 days could:

- increase sperm quantity and quality in men diagnosed with moderate idiopathic oligozoospermia
- restore and enhance libido, erection, ejaculation, and orgasm of sexual intercourse, as compared to before the treatment. This result was obtained in more than 80% of the treated patients.

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## ***Protodioscin from herbal plant Tribulus terrestris L improves the male sexual functions, probably via DHEA***

Adimoelja and P. Ganeshan Adaikan  
Airlangga University, Indonesia and National University of Singapore  
in 6th Biennial Asian-Pacific Meeting on Impotence in Kuala Lumpur, Malaysia  
(1997)  
Int. J. Impotence Research v9, supp 1 (1997)

An interesting correlation of dehydroepiandrosterone-sulphate (DHEA-S) level with the incident of low sex drive and higher occurrence of impotence was discovered in studies with patients diagnosed with diabetes mellitus. To test further the relationship between DHEA-S and erectile dysfunction (ED), we conducted a clinical trial of 30 non-diabetic men with ED, 30 non-diabetic men without ED and 15 diabetic men with ED. These men are given extract of Tribulus terrestris (Libilov) at 3 x 250 mg / day for 3 weeks. The DHEA-S levels, as well as other blood and liver parameters were evaluated.

We found a significant increase of DHEA-S levels in diabetic and non-diabetic subjects after treatment, and a significant increase in the frequency of successful intercourse by 60% in both the diabetic and non-diabetic groups with or without ED. Tribulus terrestris L (TTL) is a herbal plant native to Bulgaria and China that has a long history as a powerful aphrodisiac and as a traditional medicine for treating male infertility (1,6). Recently, a chemical compound isolated from TTL called protodioscin (2) has been identified, purified and standardized as a phytochemical agent. In a multi-center, placebo-controlled, randomized, double-blind clinical trial, protodioscin proved to be an effective form of treatment for male infertility (2,6,7).

It is known that sufficient dehydroepiandrosterone (DHEA) in the epididymis is necessary for the maturation process of spermatozoa (5). Furthermore, it has been speculated that in some idiopathic oligoasthenoteratozoospermia, male infertility is due to the low concentration of DHEA in the epididymis. In another clinical trial protodioscin is proved to increase the serum DHEA level of infertile men, without any change in the level of testosterone and other androgens. It is also shown that liver and kidney functions do not change significantly by protodioscin (1,2,6,7). The study concludes that protodioscin in TTL could be the precursor of DHEA in patients with low serum level of this hormone. As TTL has been known for its aphrodisiac quality, speculations have been made that its mechanism of action involves the conversion of protodioscin to DHEA. In turn, DHEA may increase cell membrane integrity and functions (3,4), thereby resulting in better sexual performance and the general feeling of well-being.

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## ***Recommended uses:***

1. Muscle Mass
2. Aphrodisiac
3. Spermatorrhoea
4. Oligospermoea
5. Impotence
6. Diseases of genital complaints
7. Calculus affection
8. Gout
9. Urolithiatic
10. diuretic.

## ***Recommended intake***

A number of clinical trials on human subjects recommend the dosage of Tribulus as below.

**250-500 mg of standardized extract containing 30%, once daily provides remarkable clinical effects.**

No adverse effects to the central nervous or cardiovascular systems were noted in any of the clinical studies: no toxicity and no deviations in blood count occurred. No known negative effects presently found when Tribulus is used as a dietary supplement of the above dosage.

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