

## Evaluation of Oral Administration of Aqueous Leaf Extract of *Momordica charantia* on Fertility Hormones of Adult Male Wistar Rats

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**Abstract:** The aim of this study was to determine the effect of various doses of aqueous leaf extract of *Momordica charantia* on fertility hormones of adult male Wistar rats. Twenty health male albino rats were randomly assigned equally to four groups: low dose (LD), medium dose (MD) and high dose (HD) groups, treated with extracts of *M. charantia* at 12.5g, 25.0g and 50.0g respectively for thirty days. The last group (C) served as control, being given distilled water. The animals were sacrificed after the treatment period. There was statistically significant ( $p<0.05$ ) reduction in plasma FSH and testosterone levels in a dose dependent manner. This study has shown that *M. charantia* suppresses the pituitary-testicular axis, thus careful evaluation of an infertile male should involve a detailed drug history to aid diagnosis and management.

**Key words:** *Momordica charantia* • Testosterone • Follicle Stimulating Hormone • Antifertility

### INTRODUCTION

Plants have been used globally across many cultures as a safe natural source of medicines for treating a variety of medical conditions since time immemorial [1]. *M charantia* (bitter lemon) is a medicinal plant belonging to the Cucurbitaceae family, known widely for its antidiabetic effect [1, 2]. It is cultivated in many damp and wet tropical countries of the world including parts of South America and the Amazon basin, East Africa and Asia where it is used also as food. It's very bitter taste is found in the leaves, the fruits, the stems and other parts of the plant [3].

The male reproductive system consist of the gonads (Testes) containing seminiferous tubules that produce sperms, the conduit for the produced sperms (Including the epididymis and vas deference), accessory glands (prostate and seminal vesicles) and associated hormones. Spermatogenesis and steroidogenesis are two highly organized and intricate functions of the testes tightly regulated by endocrine secretions of the anterior pituitary (Follicle stimulating hormone, FSH and luteinizing hormone, LH) and the testes (Testosterone). These

hormones contribute to male fertility by influencing sperm count, morphology, motility and the maintenance of male sexual characteristic in males among a host of others [1, 4] Male infertility accounts for about 50% infertility worldwide. Most cases of being attributed to abnormal sperm count or low sperm motility [5]. Various studies have demonstrated the effect of herbal extracts on male fertility. Methanol extract of *Sarcostemma acidum* caused a decrease in the number of mature Leydig cells and an increase in the degeneration of Leydig cell population [6]. Ethanolic extracts of the roots of *Martynia annua* to male rats caused Leydig cell atrophy and a significant reduction in the serum concentration of LH and testosterone [7]. Aqueous extract of leaf stem *Leptadenia hastata* Decne reduced the progressive velocity, linearity and sperm motility of male Wistar rats [8] while Leydig cell nuclear area and mature Leydig cell numbers were significantly reduced on oral administration of 70% methanolic extract of *Tinosporacor difolia* stem to male rats in another study [9]. Studies on *M. charantia* have established its effect on both gross and biochemical male reproductive parameters with possible reversibility on attenuating administration [10].

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Most previous workers focused on gross parameters (like testicular histology, sperm count and motility) using the seeds of *M. charantia*. This study intends to add to the body of knowledge by determining the effect of administration of different doses of aqueous leaf extracts of *M. charantia* on serum testosterone and FSH of male mammals using adult male Wistar rats as models.

## MATERIALS AND METHODS

**Sources, Maintenance of Animals:** Twenty adult, healthy, male Wistar rats were used for the study. They were acquired from the Animal house of the department of Physiology, Faculty of Basic Medical Sciences, Olabisi Onabanjo University, Nigeria. The rats were divided randomly into 4 groups: named; Low dose (LD), Medium dose (MD), High dose (HD) and Control (C) groups respectively. All the animals were housed in well ventilated cages made of wood and wire gauze. Wood shavings were used as beddings to keep each compartment dry. Here, normal standard ambient conditions of temperature between 28-31°C, relative humidity between 50-55% and a photoperiodicity of 12h natural light and 12h dark were maintained. The animals were allowed to acclimatize for 2 weeks for proper adaptation to their new environment and were weighed weekly. They had access to pelletized feed purchased from Animal Care Feed Mills in Ogere, Nigeria and water *ad libitum*.

**Weighing of the Rats:** This was done using a beam balance. Their weights ranged between 150g and 200g.

### Identification and Preparation of *Momordica charantia*

**Leaf Extract:** The leaves of *M. charantia* were purchased from the local market in Sagamu Nigeria. It was authenticated by a botanist in the department of Plant sciences, Olabisi Onabanjo University. Samples were air-dried and grounded to powder and weighed. To obtain sample for the LD group, 12.5g of the powdered specimen was boiled in 5000ml of distilled water for some minutes, simmered, cooled and then sieved before administration to the LD group. 25.0g and 50.0g of powdered specimen were used in MD and HD groups respectively.

### Dosage, Route and Duration of Administration of Test

**Solutions:** The volume of aqueous extract of MC was calculated based on the weight of the animals and administered orally via a cannula daily for thirty days. The controls were given distilled water instead of MC.

**Experimental Procedure:** The animals were anesthetized using diethylether, scarified and dissected. A deep incision was made of the ventral surface aiming for the heart in order to collect blood samples. Blood obtained from the animals were put in EDTA bottles to prevent clotting. Samples were centrifuged at 3000r/min for 10minutes to obtain plasma

**Estimation of FSH and Testosterone Levels:** Was done as previously described in one study [11].

**Statistical Analysis:** Results were expressed as mean +standard deviation. Analysis was carried out on SPSS version 16 using analysis of variance (ANOVA). The level of significance was considered at  $p < 0.05$ .

**Ethical Considerations:** All procedures involving animals in this study conformed to the guiding principles for research involving animals as recommended by the Declaration of Helsinki and the Guiding Principles in the Care and Use of Animals (World Medical Association & American Physiological Society, 2002) and were approved by the Departmental Committee on the Use and Care of Animals in conformity with international acceptable standards.

## RESULTS

### Effect of Aqueous Extract of *M. charantia* on Plasma

**FSH Levels:** Oral administration of aqueous extract of *M. charantia* caused significant decrease in FSH in a dose dependent manner in L, M and H groups when compared with controls (Table 1).

### Effect of Aqueous Extract of *M. charantia* on Plasma

**Testosterone Levels:** Oral administration of aqueous extract of *M. charantia* caused significant decrease in testosterone in a dose dependent manner in L, M and H groups when compared with controls (Table 2).

## DISCUSSION

The pituitary-testicular axis is a central regulatory pathway for testicular function and thus male fertility [12].

Most other studies made use of (Single) standard dose [10,12]. However, our results have shown that aqueous extracts of *M. charantia* significantly decreased plasma levels of testosterone and FSH of the male Wistar rats in a dose dependent manner. Administration of *M. charantia* reduced FSH levels by 0.64nmol/l,

Table 1: The effect of administration of aqueous extracts of *M. charantia* on FSH levels adult Wistar rats

Sample group	Dose of MC (grams)	No. of rats	Mean of FSH values (nmol/l) $\pm$ SD
Control (C)	-	5	2.6800 $\pm$ 0.48
Low dose (L)	12.5	5	2.0400 $\pm$ 0.05 *
Medium dose (M)	25.0	5	1.8600 $\pm$ 0.22 *
High dose (H)	50.0	5	1.6600 $\pm$ 0.70 *

\* $p < 0.05$  was statistically significant

Table 2: The effect of administration of aqueous extracts of *M. charantia* on testosterone levels adult wistar rats.

Sample group	Dose of MC (grams)	No. of rats	Mean of testosterone values (nmol/l) $\pm$ SD
Control (C)	-	5	3.3800 $\pm$ 1.61
Low dose (L)	12.5	5	2.7000 $\pm$ 1.39 *
Medium dose (M)	25.0	5	2.4800 $\pm$ 1.04 *
High dose (H)	50.0	5	2.0400 $\pm$ 1.16 *

\* is  $p < 0.05$  was statistically significant

0.82nmol/l and 1.02nmol/l in the LD, MD and HD groups respectively. Previous researches have suggested a direct toxic effect of *M. charantia* leading to destruction of gonadotrophs of the anterior pituitary and inhibin like activity as possible mechanisms for this finding. Yama *et al.* [10] found out that prolactin secretion increased in rats treated with *M. charantia* extracts. Prolactin has been known to interact in a complex manner to inhibit pituitary gonadotropins [4, 12].

Administration of *M. charantia* reduced plasma testosterone of rats in the LD, MD and HD groups by 0.68nmol/l, 0.90nmol/l and 1.34nmol/l respectively. Gonadotropin (FSH and more importantly LH) suppression leading to impaired steroidogenesis (Testosterone synthesis) in the testes of the rats and direct deleterious effect of *M. charantia* on Leydig cells have been implicated [1, 10, 12]. This can translate to morphologic changes in the quality and quantity of the sperms produced and on testicular anatomy as a whole. This has described as subclinical hypogonadotropic hypogonadism [12]. Increased prolactin levels associated with administration of MC also cause increased production of TNF -  $\alpha$  by the testicular macrophages thus decreasing testosterone release by leydig cells [13].

Attenuation of the antifertility effect of *M. charantia* has been observed in other studies by stopping its administration and supplementation with testosterone [10,12] and antioxidants [5]. There was no recovery period in our study.

In conclusion, aqueous leaf extracts of *M. charantia* can cause reduction in fertility hormones in males hence

thorough drug history should be taken by medical personnel evaluating males for infertility so as to make appropriate diagnosis and initiate appropriate treatment.

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