



## Effect of ethanol extract of *Moringa oleifera* seeds on fertility hormone and sperm quality of male Albino Rats

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### Abstract

The aim of the study is to evaluate the effect of the ethanol extract of *Moringa oleifera* seeds on fertility hormone and semen quality of male albino rats. The ethanol extract of *M. oleifera* seed at doses of 100, 200 and 400 mg/kg were administered for 30 days. The effect of the extract on body weight and sexual organs weights (testes and epididymis) were determined. The fertility hormone and semen characteristic was studied. Oral administration of ethanol extract at doses of 100, 200 and 400 mg/kg were significantly increased body weight and sexual organ weight. Also significantly increased serum Testosterone, Follicle-stimulating hormone (FSH) and Luteinizing hormone (LH) compared to the control group, in addition, significantly increased semen characteristic in experimental animals study. The extract was also observed to be devoid of any adverse effects and acute toxicity. The results of the present study demonstrate the effectiveness of *M. oleifera* seeds extract on fertility hormones stimulator and improvement of semen characteristic which justify the traditional use of the plant as aphrodisiac and for management of male certain sexual disorders.

**Keywords:** Albino rats, fertility hormone, *Moringa oleifera*, body weight

### 1. Introduction

A large number of plants have been tested throughout the world for the possible fertility regulatory properties (Bhatia *et al.*, 2010) [6]. Some medicinal plants are extensively used as aphrodisiac to relieve sexual dysfunction, or as fertility enhancing agents. They provide a boost of nutritional value thereby improving sexual performance (Yakubu *et al.*, 2007; Sumalatha *et al.*, 2010) [41, 36]. *M. oleifera* is a medicinally important plant, belonging to family *Moringaceae*. The plant is also well recognized in India, Pakistan, Bangladesh and Afghanistan as a folkloric medicine (Mughal *et al.*, 1999). Different parts of the tree have been used in the traditional system of medicine. In India the *M. oleifera* seeds is being used traditionally as an aphrodisiac (Lalas and Tsaknis, 2002) [18]. The seeds of *M. oleifera* has many different chemical components, including crude fiber, Reducing sugars, resins, alkaloids, flavnoids, organic acids, sterols, Tannins, Saponins, and proteins. Moringa has been found to be a good source of polyphenols and antioxidants (Mishra *et al.*, 2011) [22]. Phytochemicals such as vanillin, carotenoids, ascorbates, tocopherols, beta-sitosterol, moringine, kaempferol, and quercetin have been reported in its leaves, roots, flowers, fruits and seeds. In addition, it has content of unsaturated fatty acids, especially linoleic, oleic and palmitic acids. *M. oleifera* is rich in amino acids, vitamins and minerals particularly iron (Subadra *et al.*, 1997; Faye, *et al.*, 2011) [35, 13]. The seeds have been used in indigenous medicine for over many decades as traditional medicine. Moreover, *M. oleifera* was found to be of a nutritional value as it contains a number of important vitamins, including: vitamins A, B complex (B1, B3, B6 and B7), C, D, E and

K (Dorga and Tandon, 1975; Booth and Wickens, 1988) [9, 7]. The *M. oleifera* are used to exert its protective effect by decreasing liver lipid peroxides, as an antimicrobial agent (Faizi *et al.*, 1998) [12]. Moringa tree has become an outstanding indigenous source of highly digestible protein, calcium (Ca), iron (Fe) and antioxidants, these nutritional characteristics of the plant may be, potentially beneficial to the developing regions of the world where undernourishment is a major concern showed by Mori *et al.* (2009) [24]; Ashfaq *et al.* (2011) [4] and Tesfay *et al.* (2011) [37]. Therefore, the present work was undertaken to effect of ethanol extract of *M. oleifera* seeds on fertility hormone and semen quality of male albino Rats.

### 2. Materials and Methods

#### Plant materials and extraction procedure

The seeds of *M. oleifera* were purchased from frame of Moringa analysis and development group of Khartoum North, Sudan and the taxonomical identification of the seeds was confirmed by a senior plant taxonomist. Seeds of *M. oleifera* were first dried in the shade, left in ethanol (85%) for more than two days in Soxhlet apparatus. Then the 85% ethanol extract was dried in Rotary Evaporator apparatus, weighed and dissolved in distilled water to give the final concentration of 100 mg extract/kg, 200 mg extract /kg and 400 mg extract /kg and were administered orally by Gavage for the three groups of rats; A, B, and C, for 30 days.

#### Experimental Design

##### Extract administration

Twenty-four male Wistar rats weighing between (160-200 g) for all experimental, will be maintained under

standard environment conditions and fed with standard pellet diet and water *ad libitum*, will be used for the present study. After a week of adaptation, the rats will be randomly divided into four groups A, B, C and D (n=6) for seeds ethanol extract treated with different doses (100, 200 and 400 mg/kg for extract of *M. oleifera*) by orally for 30 days, group (D) as control group (Sabu, and Subburajub, 2002) [31].

**Body weight determination**

Body weights of experimental animals before and after experiments were measured using small balance (0-5 kg capacity), following an overnight fasting. The body weights were used to calculate the daily weight gain.

**Sexual organs weights determination**

All the control (standard) and experimental groups of male rats were evaluated for their body weight. The animals were completely anaesthetized with anesthetic ether (Narsons Pharma), sacrificed by cervical decapitation and then testis and epididymis were carefully removed through alowerd abdominal incision and testes were then separated from the epididymis. and weighed using digital electronic balance. The organs weight of each sexual organs were determined (Thakur and Dixit, 2006; 2007; Amini and Kamkar, 2005) [38, 39, 2].

**Semen collection**

The testicles were then removed through alowerd abdominal incision and testes were then separated from the epididymis. The right and left epididymis were trimmed off the body of the testes and semen sample were collected from the tail of the epididymis through an incision made with ascalpel blade. Sperm cells were sucked into apasteur pipette from the caudal epididymis. The incisions were also flushed with 2-3 drops of 2.9% buffered sodium citrate kept at body temperature.

**Sperm analyses**

**Sperm motility and count**

This experiment was conducted following the method adopted by (Prasad *et al.*, 1972) [28]. 100 mg of caudal epididymis was minced in 5 ml of physiological saline. One drop of an evenly mixed sample was applied to a Neubauer’s counting chamber under a cover slip. Quantitative motility expressed as a index was determined by counting both motile and immotile

spermatozoa per unit area. Epididymal counts was made by routine procedure and expressed as million/ml of suspension.

**Percentage of abnormal spermatozoa**

The smears were prepared by placing a drop from semen sample and one or two drops of previously warmed (37°C) eosin -nigrosin stain at one of clean slide and another side (spreader) was brought towards the mixture until it touched it. The smears were allowed to dry in the air and then examined using high power (100X) microscope oil immersion objective. 200 sperm cells from different fields were examined and the number of abnormal ones was calculated as percentage.

**Sperm viability**

To determine sperm vitality, 40 µl of freshly liquefied semen was thoroughly mixed with 10 µl of eosin-nigrosin (Merck, Germany), and 1 drop of this mixture was transferred to a clean slide. At least 200 sperms were counted at a magnification of ×100 (Olympus Japan) under oil immersion. Sperms that were stained pink or red were considered dead, and those unstained were considered viable (Raji *et al.*, 2003; Kisa *et al.*, 2004) [29, 16].

**Hormone assay**

At the end of experiments, blood was collected by cardiac puncture. Serum was separated by centrifugation at 3000 rpm for 15 min and stored frozen at -20°C until use. Plasma testosterone, follicle-stimulating hormone (FSH) and luteinizing hormone (LH) and were measured by radioimmunoassay (RIA) using special kits (Radim, Italy) as described in the instructions provided with the kits.

**Statistical analysis**

Data were analyzed by Statistical Analysis System (SAS). One-way Randomized Complete Design (RCD) was assessed and then Duncan’s Multiple Range Test (DMRT) was used for mean separation.

**3. Results**

**Body and sexual organs weights**

Rats treated with ether *M. oleifera* seeds showed significant (P≤0.01) dose dependant increase in body weight and sexual organs (testes and epididymis) (Table 1).

**Table 1:** Changes in body and sexual organs weights (gm) of experimental rats fed different dose of Moringa (*Moringa oleifera*) seeds extract

Parameters	Control	Treatments (mg/kg body wt.)			P-value
		100	200	400	
Initial body weight	181.50 <sup>d</sup> ±0.31	182.50 <sup>a</sup> ±0.33	189.67 <sup>b</sup> ±0.35	197.17 <sup>a</sup> ±0.59	0.004**
Final body weight	185.68 <sup>d</sup> ±0.37	197.00 <sup>c</sup> ±0.54	211.66 <sup>b</sup> ±0.64	223.27 <sup>a</sup> ±0.71	0.002**
Testes weight	2.13 <sup>d</sup> ±0.11	2.43 <sup>c</sup> ±0.12	3.27 <sup>b</sup> ±0.16	3.80 <sup>a</sup> ±0.17	0.049*
Epididymes weight	0.80 <sup>d</sup> ±0.04	0.87 <sup>c</sup> ±0.06	0.92 <sup>b</sup> ±0.08	0.94 <sup>a</sup> ±0.09	0.047*

Key: Values are mean ± SD. Means bearing different superscript letters in a row are significantly different (P≤0.05) according to DMRT. P ≤ 0.02-0.05 \* significant; P ≤ 0.01\*\* highly significant.

**Sperms analysis**

Mean values of rats treated with *M. oleifera* seeds showed significant (P ≤0.05) improvement in semen

characteristics [motility (%), sperm count (million/ml), normal morphology (%), viability (%)] [Table 2].

**Table 2:** Semen characteristics of experimental rats fed different dose of Moringa (*Moringa oleifera*) seeds extract

Parameters	Control	Treatments (mg/kg body wt.)			P-value
		100	200	400	
Motility (%)	70.89 <sup>d</sup> ±0.18	79.60 <sup>c</sup> ±0.23	81.44 <sup>b</sup> ±0.25	84.52 <sup>a</sup> ±0.26	0.002**
Sperm count (million/ml)	50.72 <sup>d</sup> ±0.10	53.32 <sup>c</sup> ±0.12	58.87 <sup>b</sup> ±0.15	69.97 <sup>a</sup> ±0.17	0.041*
Normal morphology (%)	89.40 <sup>d</sup> ±0.29	91.20 <sup>c</sup> ±0.32	97.00 <sup>b</sup> ±0.36	98.40 <sup>a</sup> ±0.37	0.005**
Abnormal morphology (%)	10.20 <sup>a</sup> ±0.09	7.60 <sup>b</sup> ±0.07	4.40 <sup>c</sup> ±0.06	2.50 <sup>d</sup> ±0.02	0.034*
Viability (%)	87.20 <sup>d</sup> ±0.27	89.40 <sup>c</sup> ±0.29	92.00 <sup>b</sup> ±0.31	95.00 <sup>a</sup> ±0.36	0.026*

Key: Values are mean ± SD. Means bearing different superscript letters in a row are significantly different ( $P \leq 0.05$ ) according to DMRT.  $P \leq 0.02-0.05$  \* significant;  $P \leq 0.01$ \*\* highly significant.

#### Fertility hormone

Mean values of rats treated with *M. oleifera* seeds

showed significant ( $P \leq 0.01$ ) increased in fertility hormone (testosterone, FSH and LH), (Table 3).

**Table 3:** Hormone fertility of experimental rats fed different dose of Moringa (*Moringa oleifera*) seeds extract

Parameters	Control	Treatments (mg/kg body wt.)			P-value
		100	200	400	
Testosterone (ng/mL)	1.90 <sup>d</sup> ±0.17	2.52 <sup>c</sup> ±0.17	6.32 <sup>b</sup> ±1.83	7.10 <sup>a</sup> ±2.32	0.002**
FSH (mIU/ml)	9.87 <sup>d</sup> ±0.07	12.40 <sup>c</sup> ±0.24	14.70 <sup>b</sup> ±0.55	16.05 <sup>a</sup> ±0.98	0.001**
LH (mIU/ml)	11.44 <sup>c</sup> ±0.08	11.50 <sup>c</sup> ±0.21	13.34 <sup>b</sup> ±0.32	14.67 <sup>a</sup> ±0.45	0.023*

Key: Values are mean ± SD. Means bearing different superscript letters in a row are significantly different ( $P \leq 0.05$ ) according to DMRT.  $P \leq 0.02-0.05$  \* significant;  $P \leq 0.01$ \*\* highly significant.

#### 4. Discussion

This research demonstrates that oral administration of alcoholic extract of *M. oleifera* doses 100, 200 and 400 mg/kg body weight in male rats for 30 days caused a significant increase in fertility parameters especially in higher dose. The model employed in this work has been used previously by several investigators to assess the effects of different compounds on fertility and reproduction in laboratory animals (Lilibeth and Glorina, 2010) [19].

Administration of ethanol seeds extract of *M. oleifera* at the dose of 100, 200 and 400 mg/kg, significantly ( $P < 0.01$ ) caused an increase in body weight, when difference between initial weight and final body weight were compared (Table 1), support earlier reports that *M. oleifera* is of a high nutritional value (Ram, 1994; Makkar and Becker, 1996; Anwar *et al.*, 2007) [30, 21, 3]. The weight of the reproductive organs like testes and epididymis, increased significantly ( $P < 0.05$ ) when compared with that of control animal group (Table 1). Steroids are one of the causes of increased body and sexual organ weight and an increase in these parameters could be regarded as a biological indicator for effectiveness of the plant extract in improving the genesis of steroidal hormones (Thakur and Dixit, 2007) [38, 39]. Since androgenic effect is attributable to testosterone levels in blood (Amini and Kamkar, 2005) [2], it is likely that the plant extracts have a role in testosterone secretion allowing better availability of hormone to gonads. The testes, epididymis and other reproductive organs are structurally and physiologically dependent upon the testosterone and other androgens. Testosterone stimulates growth and secretory activity of the reproductive organs (Singh *et al.*, 1995; O' Donnel *et al.*, 1994) [33, 27] so, a significant increase of these hormones in our study could increase the number and function of somatic and germinal cells of testis and in results increase the testis and epididymis weight.

Administration of ethanol seeds extract of *M. oleifera* at the dose of 100, 200 and 400 mg/kg, significantly ( $P < 0.001$ ) increased the sperm (motility, sperm count, normal morphology, viability) in epididymis as compared to control group (Table 2). *M. oleifera* (50 mg/kg/orally for 100 days) an improved sperm concentration and motility, these were also evident in previously reported work (Akunna *et al.*, 2012) [1]. It has been observed that rats treated for 8 weeks with ascorbic acid, a potent antioxidant, showed a significantly increased epididymal sperm concentration (Sonmez *et al.*, 2005) [34]. Treatment with isoflavones resulted in an increase in sperm count and antioxidant activity in male rabbit (Yousef *et al.*, 2004) [42]. These results may be due to presence of flavonoids. Flavonoids are well known antioxidants that can ameliorate oxidative stress-related testicular impairments in animal tissues (El-Missiry, 1999; Ghosh *et al.*, 2002; Kujo, 2004) [10, 15, 17]. It also stimulates testicular androgenesis and is essential for testicular differentiation, integrity, and steroidogenic functions (Dawson *et al.*, 1990; Luck *et al.*, 1995; Salem *et al.*, 2001) [8, 20, 32]. Our finding was also corroborates with the finding of Mukhallad *et al.*, (2009) [26], who studied the effect of *Nigella sativa* on spermatogenesis and fertility of male albino rats. Testosterone supplementation has previously been shown to improve sexual function and semen quality (Aversa and Fabbri, 2001) [5], in addition to the intensity of ejaculations which might also be expected to improve (Morels, 1996) [23]. Similar conclusion was recorded by Watcho *et al.*, (2005) [40], while working on hexane extract of *Mondia whitei* on the reproductive organ of male rats. In previous study, sperm count, motility and viability had a significant increase (El-Tahomi *et al.*, 2010) [11]. It is a well confirmed that, these parameters in mammals are regulated by the two Gonadotropins, LH and FSH. FSH binds with receptors in the sertoli cells and directly stimulates spermatogenesis.

The plant extracts also significantly increased male fertility hormone particularly testosterone, follicle-stimulating hormone (FSH) and luteinizing hormone (LH), *Moringa oleifera* (50 mg/kg/orally for 100 days) an improved plasma testosterone these were also evident in previously reported work (Akunna *et al.*, 2012) [11]. The saponins may boost the level of testosterone in the body (Gauthaman and Adaikan, 2008) [14]. LH stimulates the production of testosterone in Leydig cells, which in turn may act on the Sertoli and peritubular cells of the seminiferous tubules and indirectly stimulates spermatogenesis via testosterone (Singh *et al.*, 1995; O'Donnel *et al.*, 1994) [27]. Therefore, a significant increase in LH hormone concentration in our study treated rats could lead to increased testosterone secretion from leydig cells (O'Donnel *et al.*, 1994) [27].

## 5. Conclusion

The present results confirm that the seeds *M. oleifera* ingestion produce increased effects on male fertility hormone and sperm analyses in adult male rat. It also lends support to the claims for traditional usage of *M. oleifera* as a sexual function enhancing medicine. Work is in progress on the isolation and character-ization of the spermatogenic principle in the plant extract.

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