

## Survey on the effect of plant extract on reproductive parameters of mammals: A review

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### ABSTRACT

*Reproductive parameters of male and female are found to be altered by many plant extracts. Evaluation of such herbs has been in progress worldwide for several decades to identify effective and safe substances for regulation fertility. This approach proved to be a good alternative to synthetic drugs as the chemicals of plant origin have limited side effects. Various medicinal plants extracts were investigated for their antifertility and fertility activity both in male and female animal models. This review presents update information gathered on scientifically screened medicinal plants used for enhancing fertility as well as anti-fertility activity. This review provides the information on botanical name along with their common name, ethnic use, parts used, and their importance in regulating reproductive activity on target organ like testis, ovary, uterus and on pregnancy.*

**Key words:** Plant extract, mammals, reproduction, fertility, anti-fertility.

### INTRODUCTION

Infertility is one of the major reproductive health issues; which is mainly due to male factors<sup>1</sup> which interfere with the process of spermatogenesis and reduce sperm quality and quantity. Environmental pollutants and some diseases such as coronary heart diseases, diabetes mellitus, chronic liver diseases, chronic smoking, and insufficient vitamins intake have been reported to cause deleterious effects on spermatogenesis<sup>2</sup>.

Considering the sensitivity of reproduction system, it is being easily affected by mentioned factors. In world about 15% of couples are affected by infertility among these 40 to 50% are because of male factors<sup>3</sup>. Existence of natural and sufficient spermatozooids in sperm is necessary for fertility, inability to produce sperm and ejaculation, premature ejaculation causes infertility<sup>4</sup>.

On the other hand fertility control is again another issue of global and national public health concern. Current methods of contraception result in failure with an unacceptable rate of unintended pregnancies having many side effects<sup>5,6,7</sup>. Besides these chemicals use of anti-fertility agent is one of the methods in controlling human population<sup>8</sup>.

India has vast resources of natural products people have been using many of the medicinal plants for inducing abortion and permanent sterility<sup>9</sup>. A large number of herbal drugs are used to control fertilization with considerable success<sup>8</sup>, numerous plants have been reportedly used historically by women to aid child delivery, stimulate menstrual flow or reduce fertility<sup>10,11</sup>. Modern scientific studies in experimental animals have confirmed the effect of some of these herbs on the reproductive system without producing apparent toxic effects<sup>12,13</sup>.

### MATERIAL AND METHODS

A brief survey has been done to gather information of plants related to reproductive health issues. Plants extracts which are found to effect reproductive system of mammalian models in various experiments are taken into account.

In this review the effect of plant extracts on the reproductive parameters such as spermatogenesis, activity of germinal and leydig cells, sperm motility, sperm concentration, survivability, weight of sex organs and accessory organs in male whereas in female weight of ovaries, serum level of FSH, LH, estrous cycle, ovulation have been compiled together. Based on the positive and negative effect the extract posses on the parameters, plants are grouped under two broad sections: (I) Plant extracts inducing fertility and (II) Plants having antifertility effects.

## RESULTS AND DISCUSSION

### (I) Plant extracts inducing fertility

#### 1. *Aloe vera*:

*Aloe* is a cactus-like perennial herbaceous plant of *Asphodeloideae* family which grows easily in arid warm regions of Africa, North America, Europe, and Asia and generally can be sown as pot plant in houses. This plant contains many vitamins including antioxidant vitamins like A and C, vitamins of B group like thiamin, niacin, B2 (Riboflavin), B12, and folic acid and elements like Sodium, potassium, calcium, magnesium, manganese, copper, chrome, and iron are also present. In an experiment, a mature male mouse was treated with 0.5cc of extract with 50, 100, and 200 mg/kg doses every other day for twenty days. It seems that compounds in *Aloe vera* extract doesn't affect Pituitary-hypothalamus-testis axis and affects spermatogenesis in mice directly via stimulating activity of germinal cells and also indirectly via stimulating leydig cells and increasing testosterone hormone<sup>14</sup>.

#### 2. *Zingiber officinale*:

The active ingredients of ginger (*Zingiber officinale* L., Family *Zingiberaceae*) roots and leaves such as zingerone, gingerdiol, zingibrene, gingerols and shogaols produced antioxidant activity<sup>15</sup>. The natural antioxidants can protect DNA and other molecules from cell damage induced by oxidation and can improve sperm quality and increase reproductive efficiency of men<sup>16</sup>. Oral administration of ginger extract at 250 and 500 mg/kg for 65 days to male diabetic rats caused increases in the weight of testes and seminal vesicle, a decrease in blood glucose associated with increases in serum insulin. As a result an improvement of sperm motility and quantity as well as alleviation in testicular degenerative changes was seen in the testis of diabetic rats<sup>17</sup>.

#### 3. *Cynoglossum zeylanicum*:

*Cynoglossum zeylanicum* of family *Lauraceae* is commonly known as cinnamon. Bark of cinnamon is used in Arabian countries as a spice for most foods. In Eastern and Western folk medicine, it used for treating abdominal and chest pains, chronic diarrhea, hypertension, kidney disorders and rheumatism. Cinnamon extracts have also demonstrated hepatoprotective and antioxidant effects in CCL4 (Carbon tetrachloride) - intoxicated rats. With regard to cinnamon extract, data revealed that its oral administration at the large dose, 500 mg/kg body weight decreased blood glucose level associated with increases in serum insulin and testosterone levels and an improvement of sperm motility and quantity as well as alleviation of testicular degenerative changes were observed in the testis of diabetic rats<sup>8,17</sup>.

#### 4. *Tribulus terrestris*:

The plant *Tribulus terrestris* of family *Zygophyllaceae*, has been long time known in native medicine of eastern countries and Bulgaria. It has been used in the treatment of sexual deficiencies. This plant contains biologically rich compounds as steroids, saponins, flavonoids, alkaloids and unsaturated acids, which are involved in promoting numerous physiological responses<sup>18,19</sup>. The most considerable effect of *Tribulus terrestris* extract is observed on sperm concentration and survivability of rams when administrated with 1,5g daily for 40 days. Survivability of sperms at 37°C in treated rams is significantly higher than in control group by 73 % and the viability of spermatozoids in experimental rams was very long, more than 24 hours. Count of spermatozoids was found to be enhanced by 31%<sup>20</sup>.

#### 5. *Xylopiya aethiopica*:

*Xylopiya aethiopica*, an angiosperm of the *Annonaceae* family is a tropical evergreen tree growing up to 20 metres bearing aromatic seeds. Fruit decoction of *X. aethiopica* is used to treat bronchitis, asthma, infertility, arthritis and rheumatism and as postpartum tonic<sup>21</sup>. The finding indicates that ethanolic extract of *X. aethiopica* causes increase in animal body weight as well as weights of sexual organs such as testis

and epididymis dose-dependently. Ethanolic fruits extract of *X. aethiopica* was administered orally to groups of male Sprague Dawley rats at the doses of 30, 100 and 300 mg/kg for 60 days. The number of sperms in epididymis was also markedly increased. The increased sperm counts as well as increased weight of sexual organs are indicative of improved fertility because of extract treatment. In conclusion, ethanolic extract of *X. aethiopica* increased steroid hormones as well as sperm count, the mechanism of which appears to be through stimulation of gonadotropin probably by hypothalamus activation<sup>22</sup>.

#### **6. *Moringa oleifera* Seed:**

*Moringa oleifera* (Linn) 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<sup>23</sup>. The aqueous extract of *M. oleifera* seed at doses of 100, 200 and 500 mg/kg were administered for 21 days. The effect of the extract on body weight, reproductive and vital organ weight were determined. Oral administration of aqueous extract at doses of 100, 200 and 500 mg/kg significantly increased the libido and sperm count in experimental animal. The extract was also observed to be devoid of any adverse effects and acute toxicity. Thus, aqueous extract of *M. oleifera* seed was found to enhance sexual behaviour in male rats<sup>24</sup>.

#### **(II) Plant extracts having antifertility effects:**

##### **1. *Achillea millefolium*:**

*Achillea millefolium* is a plant known as Yarrow, belonging to the *Asteraceae* family, native to Europe, North America, Southern Australia and Asia<sup>25,26</sup>. *Achillea millefolium* flowers in particular with high dose, cause a significant decrease in fertility parameters in male rats. Oral administration of alcoholic extract of *Achillea millefolium* 200 and 400 mg/kg, for 55 days, in male rats, was found to reduce the hormone level of testosterone. The extract was also found to alter androgen hormones synthesis of Leydig cells<sup>27</sup>.

##### **2. *Cynodon dactylon* Pers:**

*Cynodon dactylon* Pers (Family: *Graminae*) is a creeping grass found in warm climates all over the world between 450 south and north altitude. The *Cynodon dactylon* is available throughout the year, and used by the domestic animals as food and for pooja in all parts of India. The juice of this plant is astringent and is applied externally to fresh cuts and wounds. It is also useful in treatment of catarrhal ophthalmia, dropsy, hysteria, epilepsy, insanity, chronic diarrhea and dysentery<sup>28</sup>. Effect of aqueous extract of entire plant of *Cynodon dactylon* extract on reproductive organ weight and estrous cycle in female rats was evaluated. A extract of *Cynodon dactylon* 400 mg/kg body weight /day, was orally administered for 30 days. A significant increase ( $P < 0.001$ ) in the weight of the uterus and a significant decrease ( $P < 0.001$ ) in the weight of the ovaries was observed in the treated group. Further, the estrous cycle was found to be irregular and disturbed. Findings revealed that the aqueous extract of entire plant of *Cynodon dactylon* possess antifertility activity<sup>29</sup>.

##### **3. *Polygala rosmarinifolia*:**

*Polygala rosmarinifolia* of family *Polygalaceae*, was traditionally used by Americans to treat snake bites<sup>30</sup> and as an expectorant to treat cough and bronchitis. Anti-fertility effect of ethanol extract of whole plant extract of *Polygala rosmarinifolia* was observed in male albino rats. The relative weight of the testes and epididymis were decreased. The epididymal sperm count, motility and sperm abnormality were reduced significantly in treated rats. The results of fertility test indicated that the treated adult male rats reduced the number of female's impregnation on administration of 100 and 200 mg/kg body weight. In addition, the number of implantations and the number of viable fetuses were also decreased<sup>31</sup>.

##### **4. *Curcuma comosa*:**

Estrogens have been reported to occur naturally in a number of plants and can depress fertility in animals on ingestion<sup>32,33,34</sup>. In Thailand, *Curcuma comosa* Roxb of family *Zingiberaceae*, which is widely used for relief of lower abdominal pain in males contains estrogen like activity<sup>35,36</sup>. Intragastric administration of the *C. comosa* extract at a dose of 500 mg/kg body weight for 7 consecutive days in mature male Wistar rats, significantly decreased weights of testes, ventral prostate and seminal vesicles. The decreased testicular weight corresponded with a marked regression of spermatogonia and spermatids in the seminiferous tubules. Biochemical analysis revealed significantly decreased activity of acid phosphatase

in the ventral prostate. The activity of  $\alpha$ -glucosidase in the cauda epididymides, and the fructose content in coagulating glands, were not significantly affected. Sperm concentration and motility in the cauda epididymides were also significantly suppressed<sup>37</sup>.

##### 5. *Artemisia lanata*:

*Artemisia lanata*, aromatic shrubs belonging to the *Asteraceae* family, is traditionally used worldwide for its anti-inflammatory, antimicrobial, antifungal, and sedative activities<sup>38,39</sup>. The pregnant rats were treated with vehicle or 200 and 400mg/kg of *A. lanata* hydroalcoholic extract from 2-8 day of pregnancy. Then, number and weight of neonates, duration of pregnancy, and percent of dead fetuses were determined. *A. lanata* had no significant effect on duration of pregnancy, average number of neonates, and weight of neonates. However, administration of 200 and 400 mg/kg of the extract led to 30% and 44% abortion in animals, respectively<sup>40</sup>.

##### 6. *Momordica charantia*:

Methanolic extract of *Momordica charantia* seeds of family *Cucurbitaceae*, was administrated orally at dose level of 25 mg/100 g body weight showed irregular pattern of estrous cyclicity and significantly increased in length of the estrous cycle in rats in a reversible manner<sup>41</sup>. Phytochemical analysis of the extract showed the presence of steroids, triterpenoids, reducing sugars, sugars, alkaloids, phenolic compounds, flavonoids and tannins<sup>42</sup>. The disruption of the estrous cycle was possibly because of these phytochemicals on the ovary which controls ovarian functions and estrous cyclicity through interplay of ovarian and extra ovarian hormones<sup>41</sup>.

**Table 1. Dose dependent effect of plant extracts in enhancing the fertility of mammals**

Species	Doses (mg/kg)	Effect	Reference
<i>Aloe vera</i>	0.5 cc of extract with 50, 100, and 200 mg/kg doses every other day for twenty days in mature male mice.	Stimulates activity of germinal cells and leydig cells and increasing testosterone hormone.	[14]
<i>Zingiber officinale</i>	Oral administration of ginger extract at 250 and 500 mg/kg for 65 days to male diabetic rats.	Increases in the weight of testes and seminal vesicle, a decrease in blood glucose associated with increases in serum insulin and testosterone levels and an improvement of sperm motility	[17]
<i>C. zeylanicum</i>	Oral administration at the large dose, 500 mg/kg body weight to male diabetic rats.	Decreases blood glucose level associated with increases in serum insulin and testosterone levels and an improvement of sperm motility.	[8,17]
<i>Tribulus terrestris</i>	Rams, administered with 1,5g daily for 40 days.	Sperm concentration and survivability increased.	[20]
<i>Xylopi aethiopica</i>	<i>X. aethiopica</i> was administered orally to groups of male Sprague Dawley rats at the doses of 30, 100 and 300 mg/kg for 60 days.	The increased sperm counts as well as increased weight of sexual organs.	[22]
<i>Moringa oleifera</i>	The aqueous extract of <i>M. oleifera</i> seed at doses of 100, 200 and 500 mg/kg were administrated for 21 days in male albino rats.	Enhanced sexual behavior.	[24]

Table 2. Dose dependent effect of plant extracts in reducing fertility of mammals

Species	Doses mg/ml	Effects	References
<i>Achillea millefolium</i>	Oral administration of alcoholic extract of <i>Achillea millefolium</i> (200 and 400 mg/kg), for 55 days, in male rats.	Reduction in the hormone level of testosterone.	[27]
<i>Cynoglossum zeylanicum</i>	Ethanol extract of whole plant of <i>C. zeylanicum</i> (50, 100 and 150 mg/Kg body weight) repeated treatment for 14 days in male rats.	A significant decrease in serum level of testosterone.	[8]
<i>Cynodon dactylon</i>	400 mg/kg body weight /day, for 30 days in Wistar female rats.	Decrease in weight of ovaries, and the estrous cycle was found to be irregular and disturbed.	[29]
<i>Polygala rosmarinifolia</i>	100 and 200 mg/kg body weight.	The treated adult male rats reduced the number of female's impregnation	[31]
<i>Curcuma comosa</i>	500 mg/kg body weight for 7 consecutive days in mature male Wistar rats.	Intragastric administration of the <i>C. comosa</i> extract, significantly decreased weights of testes, ventral prostate and seminal vesicles.	[8]
<i>Artemisia lanata</i>	200 and 400 mg/kg of the extract from the 2-8 day of pregnancy.	30 and 44% abortion in animals, respectively.	[11]
<i>Momordica charantia</i>	<i>Momordica charantia</i> seeds were administrated orally at dose level of 25 mg/100 g body weight.	Irregular pattern of estrous cyclicity and significantly increased in length of the estrous cycle in rats in a reversible manner.	[41]

### CONCLUSION

Plants have been a source of medicine in the past centuries and today scientists and the general public recognize their value as a source of new or complimentary medicinal products. Recently, wide array of research investigations highlight the potential health beneficial principles from phytal sources. Medicinal plants constitute one of the main sources of new pharmaceuticals and health care products. There has been an increase in demand for the phytopharmaceuticals all over the world because of the fact that the

allopathic drugs have more side effects. This review makes an attempt to compile some of the plants whose extract have been used to enhance fertility and antifertility in mammals. Various phytoconstituents like alkaloids, flavonoids, tannins, xanthenes, triterpenes, quinones etc. were involved in regulation of reproductive activity.

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#### REFERENCES

1. Isidori, A.M. Pozza, C. Gianfrilli, D. and Isidori, A. Medical treatment to improve sperm quality. *J. Reproduc. Biomed.* **12**: 704 -714 (2006)
2. Mosher, W. D. and Pratt, W.F. Fecundity and infertility in the United States: incidence and trends. *J. Fertil. Steril.* **56**: 192-193 (1991)
3. Singh, R. Barden, A. Mori, T. and Beilin, L. Advanced glycation end-products: a review, *Diabetologia.* **44**: 129-146 (2001)
4. Hamman, J.H. Composition and Application of *Aleo vera* Leaf Gel. *Molecules.* ISSN 1420-3049. DOL: 10.3390 (2008)
5. Singh, A. and Singh, S.K. Evaluation of antifertility potential of Brahmi in male mouse. *Contraception.* 71-79 (2009)
6. Vasudeva, N. and Sharma, S.K. Post –Coital antifertility activity of *Hibiscus rosasinensis* Linn roots. *Oxford Journals.* **5(1)**:91-94 (2007)
7. Malihezaman, M. and Pahlavan, S. Effect of aqueous extract of *Anethum graveolens* on male reproductive system of rats. *Journal of Biological Sciences.* **7(5)**:815-818 (2007)
8. Anitha, M. Sakthidevi, G. Muthukumarasamy, S. and Mohan, V.R. Evaluation of anti-fertility activity of ethanol extract of *Cynoglossum zeylanicum* (Vahl. Ex. Hornem) Thumb.ex Lehn (Boraginaceae) whole plant on male albino rats. *Journal of current chemical and Pharmaceutical Sciences.* **3(2)**:135-145 (2013)
9. Dixit, V.P. Rodents in Indian Agriculture, *Scientific Publisher, Jodhpur.* **1**:595-604 (1992)
10. Bodhankar, S.L. Garg, S.K. and Mathur, V.S. Antifertility screening of plants, Part IX; Effect of five indigenous plants on early pregnancy in albino rats. *Indian J Med Res.* **62 (6)**: 831 – 837 (1974)
11. Farnsworth, N.R. Bingel, A.S. Cordell, G.A. Crane, F.A. and Fong, H.H. Potential value of plants as source of new antifertility agent. *Indian J Pharm sci.* **64(4)**: 535 – 598 (1974)
12. Prakash, A.O. Saxena, V. Shukla, S. Tewari, R.K. Mathur, S. Gupta, A. et al. Anti-implantation activity of some indigenous plants in rats. *ActoEurFertil.* **16(6)**:441-448. (1974)
13. Desta, B. Ethiopian traditional herb drugs part III, Antifertility activity of 70 medicinal plants. *J Ethnopharmacol,* **44(3)**:199-209 (1974)
14. Mehrdad, M. and Alireza, K. The Effects of *Aloe vera* Extract on Reproductive Parameters in Mice. *International Conference on Biological, Environment and Food Engineering (BEFE-2014)* August 4-5, 2014 Bali (Indonesia)
15. Zancan, K.C. Marques, M.O. Petenate, A.J. and Meireles, M.A. Extraction of ginger (*Zingiber officinale Roscoe*) oleoresin with CO<sub>2</sub> and co-solvents: A study of the antioxidant action of the extracts. *J. Supercr. Fluids.* **24(1)**: 57-67 (2002)
16. Yang, H.S. Han, D.K. Kim, J.R. and Sim, J.C. Effect of alpha- tocopherol on cadmium induced - toxicity in rat testis and carcinogenesis. *Korean Med. J.* **21**: 445-451 (2006)
17. Dalia, A. Hafez. Effect of Extracts of Ginger Goots and Cinnamon Bark on Fertility of Male Diabetic Rats. *Journal of American Science.* **6(10)** (2010)
18. Xu, Y.X. Chen, H.S. Liang, H.Q. Gu, Z.B. Liu, W.Y. Leung, W.N. and Li, T.J. Three new saponins from *Tribulus terrestris*. *Planta Med.* **66(6)**: 545-50 (2000)

19. Yan, W. Ohtani, K. Kasai, R. and Yamasaki, K. Steroidal saponins from fruits of *Tribulus terrestris*. *Phytochemistry*. **42(5)**: 1417-22 (1996)
20. Kistanova, E. Zlater, H. Karcheva, V. and Kolev, A. Effect of plant *Tribulus terrestris* extract on reproductive performances of Rams. *Biotechnology in Animal Husbandry*. **21(1-2)**: 55-63, (2005)
21. Burkill, H.M., The Useful Plants of West Tropical Africa, Families A-D, Vol.1. Kew, *Royal Botanic Gardens*, (1985)
22. Woode1, E. Alhassan, A. Chrissie, S. Abaidoo. Effect of ethanolic fruit extract of *Xylopia aethiopica* on reproductive function of male rats. *Int J Pharm Biomed Res*. **2(3)**:161-165 (2011)
23. Mughal, M.H. Ali, G. Srivastava, P.S. and Iqbal, M. Improvement of drumstick (*Moringa pterygosperma* Gaertn) – a unique source of food and medicine through tissue culture. *Hamdard Med*. **42**: 37–42. (1999)
24. Varsha, S. Z. Dinesh, K. Dabhadkar, and Vaibhao, G. Thakare and Shital R. Pare Effect of Aqueous Extract of *Moringa oleifera* Seed on Sexual Activity of Male Albino Rats Biological Forum – An International Journal. **5(1)**: 129-140 (2013)
25. Lorenzi, H. and Matos, F.J.A. Medicinal plants in Brazil: native and exotic. Nova Odessa. *Plantarum* p. 512 (2002)
26. Balbach, A. As plantas curam, Vida Plena, Itaquaquecetuba, p.218. (1995)
27. Parandin, R. and Ghorbani, R. Effects of alcoholic extract of *Achilea millefolium* flowers on fertility parameters of male rats. *International Journal of PharmTech Research*. **2(4)**:2492-2496 (2010)
28. Pal, D. Evaluation of CNS activities of aerial parts of *Cynodon -dactylon pers* in mice. *Acta Polo Pharm*. **65(1)**:37-43 (2008)
29. Nayanatara, A.K. Akshatha, A. Kottari, S. Soofi, A.A. Rejeesh, E.P. Bhagyalakshmi, K. Shetty, S.B. Kini, R.D. and Pai1. S.R. Effect of *Cynodon dactylon* extract on estrous cycle and reproductive organs in female wistar rats. *International Journal of Analytical, pharmaceutical and biomedical sciences*. **1(3)**:10-15 (2012)
30. Mc. Guffin, M. Hobbs, C. and Upton, R. (eds). American Herbal Products Associaton *Botanical Safety Handbook*. Boca Raton. FL: CRC Press, 89, (1997).
31. Alagammal, M. Sakthidevi, G. and Mohan, V.R. Anti-fertility activity of whole plant extracts of *Polygala rosmarinifolia* Wight & Arn against male albino rats. *Journal of Advanced Pharmaceutical Sciences*. **3(1)**:385-93 (2013)
32. Braden, A.W.H. Hart, N.K. and Lamberton, J.A. The estrogenicactivity and metabolism of certain isoflavones in sheep. *Aust J Agric Res*. **18**: 335–348 (1967)
33. Pelissero, C. Bennetan, B. Babin, P. Le Menn, F. and Dunognes, J. The estrogenic activity of certain phytoestrogen in the Siberian sturgeon *Acipenser baeri*. *J Steroid Biochem Molec Biol*. **38**: 293–299 (1991)
34. Wong, E. and Flux, D.S. Oestrogenic activity of red clover iso-flavones and some of their degradation products. *J Endocrinol*. **24**: 341–348 (1962)
35. Piyachaturawat, P. Ercharuporn, S. and Suksamrarn, A. Uterotrophic effect of *Curcuma comosa* in rats. *Int J Pharmacog*. **33**: 334–338 (1995a)
36. Piyachaturawat, P. Ercharuporn, S. and Suksamrarn, A. Estrogenic activity of *Curcuma comosa* extract in rats. *Asia Pac J Pharmacol*. **10**: 121–126 (1995b)
37. Piyachaturawat, P. Timinkul, A. Chuncharunee, A. and Suksamrarn, A. Effect of *Curcuma comosa* extract on male fertility in rats. *Pharmaceutical Biology*. **37(1)**: 22–27 (1999)
38. Ramezani, M. Behravan, J. and Yazdinezhad, A. Composition and antimicrobial activity of the volatile oil of *Artemisia kopetdaghensis* Krasch., M.Pop. & Linecz ex Poljak from Iran. *Flavour and Fragrance Journal*. **21**: 869-71 (2006)
39. Mirdeilami, S.Z. Barani, H. Mazandarani, M. and Heshmati, A. Ethnopharmacological survey of medicinal plants in Maraveh Tappeh region, north of Iran. *Iranian Journal of Plant Physiology*. **2**: 325-36 (2011)
40. Ainehchi1, N. and Zahedi, A. Effects of *Artemisia lanata* Extract on Reproductive Parameters of Female Rats. *Crescent Journal of Medical and Biological Sciences*. **1(2)**: 49-53 (2014)

41. Ifeanyi, A.C. Eboetse, Y.O. Ikechukwu, D.F. Adewale, O.A. Carmel, N.C. and Olugbenga, O.A. Effect of *Momordica charantia* on estrous cycle of sprague-dawley rats. *Pacific Journal of Medical Sciences.* **8(1):** (2011)
42. Britto, A.J. and Gracelin, H.S. Phytochemical analysis and antibacterial activity of *Momordica charantiadescourt*, a known medicinal plant. *Journal of Basic and Applied Biology.* **5(1&2):** 307-311 (2011)