

The effects of Aloe Vera sap on progesterone, estrogen and gonadotropin in female rats

Poorfarid M^{*1}, Karimi Jashni H², Houshmand F³

Received: 02/18/2012

Revised: 07/23/2012

Accepted: 11/12/2012

1. Dept. of Evolutionary Biology, Islamic Azad University, Fars Sciences and Research Branch, Shiraz, Iran
2. Dept. of Anatomy, School of Medicine, Jahrom University of Medical Sciences, Jahrom, Iran
3. Dept. of Pathology, School of Medicine, Jahrom University of Medical Sciences, Jahrom, Iran

Journal of Jahrom University of Medical Sciences, Vol. 10, No. 4, Winter 2013

J Jahrom Univ Med Sci 2013; 10(4):6-10

Abstract

Introduction:

Aloe Vera or yellow Sabr is a durable plant belonging to Sousesian family. This plant has a strange potential to treat scars and burns. Aloe Vera leaf has antimicrobial and anticancer attributes. This study is designed to assess the probable effects of Aloe Vera sap on progesterone, estrogen and gonadotropin in female rats.

Materials and Methods:

In this experimental study, 40 female rats with the mean weight of 180 ± 20 gr were divided into five groups of control, sham, and intervention groups 1, 2, and 3. The control group did not receive any drug. The sham group only received 2 ml distilled water. Intervention groups received 50, 100 and 200 mg/ kg hidroalcoholic extract of Aloe Vera during 10 days orally (equal to 2 sexual cycles). Finally, the rats were anesthetized using ether and blood samples were taken through their ventricles. Blood serum was extracted and the serum concentration of estrogen, progesterone, luteinizing hormone (LH) and follicle-stimulating hormone (FSH) was measured using immunoassay. Data were analyzed using one-way ANOVA.

Results:

The mean serum level of estrogen was significantly higher in intervention groups 2 (100 mg) and 3 (200 mg) compared to the control group ($P < 0.05$). No significant difference was found between the intervention groups and control group for serum level of progesterone, LH and FSH.

Conclusion:

Given these findings, the Aloe Vera sap may have favorable effects on estrogen synthesis due to its phytoestrogen components such as beta sitosterol, and can increase the estrogen level.

Keywords: Aloe vera, Estrogen, Progesterone, Gonadotropins, Rat

Introduction

The active ingredients present in plants, accompanied by other substances are in biological equilibrium. These substances do not accumulate in the body and have no side-effects, which is a great advantage over chemical drugs. The only exceptions

are poisonous plants that should not be administered without accurate prescription of a doctor (1). Aloe Vera is a plant from liliopsida class, liliales order, and liliaceae genus, with over 250 species worldwide (2). In botanical terms, Aloe Vera is a perennial plant with lance-shaped, sharp

pointed, and jagged and edged leaves. Aloe Vera grows in autumn, with yellow flowers and short woody stem, to which leaves are directly attached. The leaves have a convex outer surface and a concave inner surface, and the flower is arranged in a dense cluster (3). Historically, the traditional medicinal use of this plant for skin problems and other disorders dates back thousands of years ago. The main chemical constituents of the Aloe Vera plant are Anthraquinones (Aloein, Aloe Amodine, and Coumaric Acid), polysaccharides, glycoproteins, prostaglandins, phytoestrogens such as beta-cytosterol, cholesterol, and fatty acids like camosterol (2, 4, and 6). There are various reports on the uses of this plant for treatment of arthritis, gout, rheumatism, acne, burns, pain and gastrointestinal tract ulcers (7, 8). Aloe Vera gel causes healing of wounds and burns, lesions due to exposure to UV rays are also improved by this gel (9-11). Anti-cancer, anti-bacterial, and anti-inflammatory activities have also been observed in Aloe Vera plant, which are attributed to glycoprotein and polysaccharides (12-14). Studies also reveal use of aqueous Aloe Vera extract by women of western regions of Cameroon to treat infertility (15).

A study on the effect of Aloe Vera extract on the pregnant rats' placenta showed that use of different doses of this extract cause metabolic changes in the placenta structure, impairment and reduction in placenta function, and the reproductive system. However, it has no effect on the growth, mortality, disability, or abortion (16). In a study aiming to examine the effect of Aloe Vera on pregnant rats' ovaries, it was found that this plant causes minimal weight gain in rats and increased vasculo-genesis around the secondary follicles. Results also showed that Aloe Vera has similar effect to estrogen and follicle-stimulating hormone (17).

A recent study on the effect of this plant on testosterone and gonadotropin hormones in adult male rats also showed

that hydro-alcoholic extract of this plant has an anti-androgenic property that can reduce androgen-dependent parameters including secretion of gonadotropins and probably cause oligospermia (18).

Given the limited information available on the effect of this plant on the reproductive system, and also considering different compositions of Aloe Vera plant including Aloe Amodin, and Phytoestrogens such as Beta-cytosterol, it is possible that these compounds could affect sex hormones. Thus, the present study was conducted with the aim to examine the effect of hydro-alcoholic Aloe Vera leaf extract on estrogen, prostrogen, and gonadotropins hormones in female rats.

Materials and Methods

In this experimental study, 40 adult female Wistar rats were used. On the first day of the study, rats were aged 2-3 months and weighed 180 ± 20 grams. They were kept in 12 hour light/dark cycle. The temperature was 23 ± 3 °C round the clock, and compressed food and water were available ad lib. The rats were divided into 5 groups of 8 as follows:

Control group: The rats in this group were given food and water ad lib for the duration of the experiment.

Case group: The rats in this group received food and water ad lib. Additionally, the same as the experimental groups and concurrently, they orally received 2 ml of distilled water.

Experiment groups: The experiment groups 1, 2, and 3 received 50, 100, 200 mg/kg weight hydro-alcohol Aloe Vera extract, respectively for 10 days (equivalent to two sex cycles). The extract was administered to the rats in the estrous cycle. When this period had elapsed, with performing vaginal smear test, those rats that had reached the stage of sexual estrous cycle were selected, weighed, and anesthetized with ether. Then, blood samples were taken from the heart ventricle. Blood samples were centrifuged at 3000 rpm for 10 minutes to separate the

blood serum. Hormone measurement was performed according to the usual laboratory methods (RIA) with a Gamma counter.

Preparation of Aloe Vera extract

The extract was prepared with the standard method of soaking and percolation. To do this, 200 grams of chopped fresh plant leaves in 1000 ml of 50% ethanol were percolated for 72 hours. Then, using a rotary device, the excess solvent was separated from the extract. The resulting powder from desiccation process was dissolved in distilled water at 50, 100, and 200 mg doses. Equal volume of distilled water (2 ml) was used for all doses.

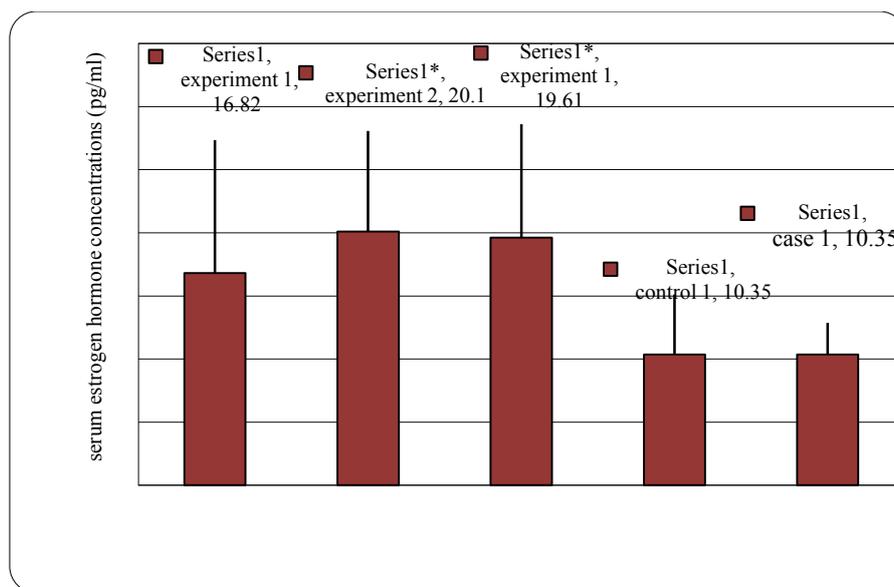
Analysis of data

All groups' data were coded in prepared tables and input in SPSS software. For analysis of data, one-way ANOVA and post hoc tests were used. Significant level was considered at $P=0.05$

Results

Statistical analyses were performed and mean estrogen, progesterone, luteinizing, and follicle-stimulating hormones in control, case, and experiment groups were compared.

Analysis of the effect of different amounts of Aloe Vera hydro-alcohol extract on the serum estrogen hormone concentration showed a significant difference between experiment groups, control and case groups ($P=0.02$). Using post hoc LSD test, a difference in mean values between experiment group 2 (20.1 ± 7.97) and control group (10.35 ± 4.77), the experiment group 2 (20.1 ± 7.97) and case group (10.35 ± 2.5), experiment group 3 (19.61 ± 8.99) and control group (10.35 ± 4.77), experiment group 3 (19.61 ± 8.99) and case group (10.35 ± 2.5) was observed. ($P=0.018$, $P=0.013$, and $P=0.013$) (Chart 1)



* means $P<0.05$

Chart 1: Comparison between mean serum estrogen hormone concentrations in different groups

Analysis showed that the amounts of 50 and 100 mg/kg weight of Aloe Vera hydro-alcohol extract reduced serum progesterone hormone concentrations in experiment groups. But, this reduction

between experiment groups, control and case was statistically insignificant.

Analysis showed that the amounts of 50 and 100 mg/kg weight of Aloe Vera hydro-alcohol extract reduced serum

luteinizing hormone concentrations in experiment groups. But, this reduction between experiment groups, control and case was statistically insignificant. Also, in the experiment group 3 with a dose of 200 mg/kg weight, serum concentration of this hormone increased, but compared to the control group, this increase was insignificant.

The analysis of the effect of different amounts of Aloe Vera extract on serum follicle-stimulating hormone showed that concentration of these hormones in 50, 100, 200 mg/kg weight doses in the experiment groups reduced. But, this reduction between experiment groups, control and case was statistically insignificant.

Discussion

The results did not show any significant difference in gonadotropins and progesterone in experiment groups receiving 50, 100, and 200 mg/kg weight Aloe Vera extract compared to the control group. But, estrogen concentrations significantly increased in experiment groups receiving 100 and 200 mg/kg weight.

Tilifo et al. in 2004 showed that Aloe Vera plant extract contains compound that increase ovarian steroidogenesis and serum estrogen concentration (19), which is in agreement with the findings of the present study. Also, since Aloe Vera plant extract has similar effects to follicle-stimulating hormones effects on the ovaries (16), hence, it functions in a similar manner, and causes an increase in growth and development of follicles and consequently, an increase in estrogen secretion from follicular cells.

Administration of Aloe Vera extract caused a reduction in serum luteinizing hormone concentration, but insignificantly. The reduction in concentration of this hormone could be explained by phytoestrogen influence on hypothalamus and inhibition of activity of cells that produce gonadotropin-releasing hormones,

causing cessation of hypothalamus, hypothalamus, and gonad axis (20).

In a study on Aloe Vera extract effect on male rats' sex hormones, no significant change was observed in the level of luteinizing hormone (18), which was in agreement with results of this study.

Roberts et al. in 2000 showed that luteinizing hormone levels in rats exposed to genistein (a type of phytoestrogen) were reduced (21). Studies by Mc Gravy et al. on a phytoestrogen rich diet in humans and animals showed that compsterol inhibited secretion of luteinizing hormone (20). Since secretion of progesterone is dependent on luteinizing hormone, then with reduced luteinizing hormone, progesterone is also reduced, but not significantly.

According to the studies on the effect of Aloe Vera extract on pregnant rats' ovaries, it was observed that this plant causes increased number of secondary follicles, reduction in dimensions of secondary follicles, and increased vascular filling state. Development of secondary follicle totally depends on secretion of follicle-stimulating hormone, and Aloe Vera has a similar effect to follicle-stimulating hormone in female rats. All these effects are similar to estrogen effects on the reproductive system (17).

Mutual reaction with steroid ligand causes the onset of genetic duplication of specific estrogen receptor and this leads to advancement of specific messenger RNAs production. There are estrogen and progesterone receptors among many proteins that are produced in most estrogen responsive cells, and it has been found that beta-cytosterol compound present in Aloe Vera has biological activity of estrogenesis (23). It seems that, with its biological activities, this compound has an important role in increasing estrogen.

Conclusion

According to the results obtained in this study, different amounts of Aloe Vera hydro-alcohol extract cause an increase in

estrogen hormone in female rats. It appears that use of this plant could have positive effects on the process of fertility.

The present article is part of the thesis submitted for the Master's Degree by the first author, which was financed by Jahrom University of Medical Sciences.

References:

1. Adlercreutz H, Mazur W. Phytoestrogens and western diseases. *Ann Med* 1997; 29(2): 95-120.
2. Botes L, van der Westhuizen FH, Loots du T. Phytochemical contents and antioxidant capacities of two Aloe greatheadii var. davyana extracts. *Molecules* 2008; 13(9): 2169-80.
3. Andrew CH. The encyclopedia of medicinal plants: a practical reference guide to more than 550 herbs, oils, and medicinal plants. London: Dorling Kindersley Publ, Inc; 1996: 57.
4. Baby J, Raj SJ. Pharmacognostic and phytochemical properties of Ficus carica Linn – an overview. *Int J Pharm Tech Res* 2010; 3(1): 8-12.
5. Surjushe A, Vasani R, Saple DG. Aloe vera: a short review. *Indian J Dermatol* 2008; 53(4): 163-6.
6. Braun L. Aloe vera: Aloe barbadensis. *J Complement Med* 2005; 4(1): 64-7.
7. Mirheidar H. Herbal education. Tehran: Islam Cult Publ Office; 2003: 96-107. (Persian)
8. Feily A, Namazi MR. Aloe Vera in dermatology: a brief review. *G Ital Dermatol Venereol* 2009; 144(1): 85-91.
9. Maenthaisong R, Chaiyakunapruk N, Niruntraporn S, et al. The efficacy of aloe Vera used for burn wound healing: a systematic review. *Burns* 2007; 33(6): 713-8.
10. Moghbel A, Ghalambor A, Allipannah Sh. Wound healing and Toxicity Evaluation of aloe vera cream on outpatients with second Degree Burns. *Pharm Sci* 2007; 3(3): 157-160.
11. Puvabanditsin P, Vongtongsri R. Efficacy of aloe vera cream in prevention and treatment of sunburn and suntan. *J Med Assoc Thai* 2005; 88(4): 173-6.
12. Hu Y, Xu J, Hu Q. Evaluation of antioxidant potential of aloe vera (Aloe barbadensis Miller) extracts. *J Agric Food Chem* 2003; 51(26): 7788-91.
13. Agarryo O, Olaleye MT, Bello ML. Comparative antimicrobial activities of aloe vera gel and leaf. *Afr J Biotech* 2005; 4(12): 1413-4.
14. Langmead L, Makins RJ, Rampton DS. Anti-inflammatory effects of aloe vera gel in human colorectal mucosa in vitro. *Aliment Pharmacol Ther* 2004; 1(5): 521-7.
15. Telefo PB, Moundipa PF, Tchouanguep FM. Oestrogenicity and effect on hepatic metabolism of the aqueous extract of the leaf mixture of Aloe buettneri, Dicliptera verticillata, Hibiscus macranthus and Justicia insularis. *Fitoterapia* 2002; 73(6): 472-8.
16. Kosif R, Akat G, Oztekin A. Microscopic examination of placenta of rats prenatally exposed to Aloe barbadensis: a preliminary study. *Int J Morphol* 2008; 26(2): 275-81.
17. Rengin K, Gullan A. Investigation of the effects of Aloe barbadensis on rat ovaries. *J of Med Food* 2009; 2(6): 1393-7.
18. Shariati M, Mokhtari M, Rastegar S. Effect of Aloe extract on testosterone and gonadotropin hormone on rat. *J Sabzevar Univ Med Sci* 2009; 1(16): 12-17. (Persian)
19. Telefo PB, Moundipa PF, Tchouanguep FM. Inductive effect of the leaf mixture extract of Aloe buettneri, Justicia insularis, Dicliptera verticillata and Hibiscus macranthus on in vitro production of estradiol. *J Ethno Pharmacol* 2004; 91(2-3): 225-30.
20. McGarvey C, Cates PA, Brooks A, et al. Phytoestrogens and gonadotropin-releasing hormone pulse generator activity and pituitary Luteinizing hormone (LH) release in the rat. *Endocrinol* 2001; 142(3): 1202-8.
21. Roberts D, Veera Machaneni DN, Schlaff WD, et al. Effects of chronic dietary exposure to genistein, a phytoestrogen, during various stages of development on reproductive hormones and spermatogenesis in rats. *Endocrinol* 2000; 13(3): 281-6.
22. Moshtaghi A, Johari H, Shariati M, et al. The effect of palm pollen on estrogen, progesterone and gonadotropin in rats. *J Rafsanjan Univ Med Sci* 2010; 9(2): 117-24. (Persian)