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Full Length Research Paper

Gonadosomatic index of female Wister rats treated with graded concentration of *Aloe Vera* gel

Ajala Oluwasola Oluwatoyin, Oyeyemi Matthew Olugbenga, Fayomi Adetunji Peter* and Olaniyan David

Department of Veterinary Surgery and Reproduction, Faculty of Veterinary Medicine, University of Ibadan, Oyo state, Nigeria.

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***Aloe Vera* (Av) gel with its multiple beneficial effects has also been associated with some side effects. The gonadosomatic index of female Wistar rats treated with graded concentration of Av gel was investigated. Seventy two sexually mature female Wistar rats weighing 140 to 255 g and 16 to 20 weeks of age were randomly grouped into four. The group A (control) rats were given distilled water while the treatment groups B, C and D were given 200, 300 and 400 mg/kg of the gel, respectively. Ovaries were collected from six rats randomly picked from each group after one, two and three weeks of gel administration. These were weighed and the gonadosomatic index was calculated. A concentration-dependent decrease ($P < 0.05$) in the gonadosomatic index of the treated groups which was also significantly different ($P < 0.05$) from one treatment group to the other as the concentration of gel administration increases were observed after each week of gel administration. It was concluded that the intake of Av gel up to 200 mg/kg for a period up to seven consecutive days causes a decrease in the ovarian mass characterized in the rat, and this may have consequences on the fecundity and fertility rate.**

Key words: *Aloe Vera* gel, gonadosomatic index, graded concentration, female Wistar rat.

INTRODUCTION

Several plants have become popular in our contemporary world because of the increased interest of people in herbal medicine (Holanda et al., 2009). One of such popular plants is *Aloe vera* (Rajasekaran et al., 2005).

A. vera (Av) gel has about 75 active constituents which are largely classified into alkaloids, glycoproteins, resins, enzymes, vitamins, amino acids, minerals, salicylic acids, sterols, genolins, saponis, lignin and polysaccharides (Atherton, 1998; Holanda et al., 2009; Ni et al., 2004). As a result of its potential potency, Av gel was reported to be effective in the treatment of burns and other wounds (Pugh et al., 2001; Joshi, 1998); dermatitis, cutaneous leishmaniasis (Holanda et al., 2009; Capasso et al., 1998); arthritis, acne, gout (Chithra et al., 1998); asthma, candida, chronic fatigue syndrome, eczema, cold sores, ulcers, digestive and bowel disorders (Newall et al., 1996; Holanda et al., 2009; Vogler and Ernst, 1999).

*Corresponding author. E-mail: fayomiadetunji@yahoo.com.

Pharmacologically, Av gel has anti-microbial, anti-viral, anti-inflammatory, anti-fungal, anti-diabetic, anti-cancer and immunomodulatory activities (Vogler and Ernst, 1999; Holanda et al., 2009; Capasso et al., 1998; Reynolds and Dweck, 1999), with documented hypolipidemic, hypoglycemic and immunostimulatory activities (Holanda et al., 2009; Patel and Mengi, 2008; Pugh et al., 2001).

The authors have reported some side effects which are associated with the use of Av gel, which include contact dermatitis, mild hitching and burning after topical usage (Syed et al., 1996; Williams et al., 1996; Fulton, 1990); hepatotoxicity in rat and man (Rabe et al., 2005; Holanda et al., 2009) with sperm damage in the mice (Shah et al., 1989). Oyeyemi and Fayomi (2011) have observed higher gonadosomatic index in the testicular weight with significant sperm abnormalities in the semen of rats treated with Av gel for seven consecutive days, but there is paucity of information on the influence of Av gel on the reproductive potential of the female Wistar rats. Therefore, this study was designed to investigate the

gonadosomatic index of the female Wistar rats treated with graded concentration of *A. vera* gel.

MATERIALS AND METHODS

Experimental animal

72 sexually mature female Wistar rats were used for this study. Each weighed between 140 to 255 g and aged 16 to 20 weeks.

Experimental animal management

These rats were housed in the Experimental Animal Unit of the Faculty of Veterinary Medicine, University of Ibadan, Oyo State, Nigeria. University of Ibadan is about 6 km to the North of Ibadan city at latitude 3°54′ E and latitude7°26′ N at mean altitude of 277 m above sea level (Oyeyemi and Fayomi, 2011). The annual rainfall is about 1200 mm most of which fall between April and October, and a dry season from November to March (Oyeyemi and Fayomi, 2011) during which this work was done. The rats were kept in circular plastic cages of about 60 cm in circumference with depth of about 20 cm and these were covered with wooden and wire meshes top. Bedding was provided with wood shaven and this was replaced every week. They were fed *ad libitum* with a purchased rat feed, a ration containing 21% crude protein, 3.5% fat, 6% crude fibre, and 0.8% phosphorus, from Ladokun Feeds Limited, Ibadan. Water was supplied *ad libitum*. The feed and water were given using earthen troughs.

Gel preparation

Av stems were collected and identified at the herbarium unit of the Botany Department, University of Ibadan. These were thoroughly washed followed by rinsing under flowing tap water. This was followed by final rinsing with distilled water. The fleshy mass of the *A. vera* stem was carefully opened by cutting the sharp edges. The flowing gel was funnelled into a sterile beaker. Two, 3.0 and 4.0 g of *A. vera* gel were weighed using a digital microsensitive weighing scale. Each of these was then diluted with100 ml of distilled water (measured by the measuring cylinder) to constitute 200, 300 and 400 mg/kg concentrations, respectively. These were gently stirred with spatula.

Administration of gel

The rats were randomly grouped into 4 groups (A to D) of 18 rats each. The group A was used as control and these were given normal saline while the treatment Groups B, C and D were administered with 200, 300 and 400 mg/kg of the gel, respectively. These dosing were done orally and in the morning (07:00 to 09:00 h) using oral cannula and tuberculin syringe.

Sample collection

Six rats from each group were randomly selected, weighed and euthanized by decapitation. This collection procedure was done after one week, two weeks and three weeks of gel administration. A mid-caudoventral abdominal incision with a sterile scalpel blade was used to immediately exteriorize the genital tracts. The ovaries were immediately severed and weighed using a sensitive electronic weighing machine.

Data analysis

The mean percentages and standard error of means were calculated for the gonadosomatic index (calculated as [gonad weight/body weight] × 100%). One way ANOVA (analysis of variance) and Duncan[a] multiple comparison test of the Statistical Package for Social Sciences (SPSS 17.0) were used to establish any significant difference at 95% confidence interval. P-values less than 0.05 were considered significant.

RESULTS

The results are presented as mean ± standard error of mean as shown in Table 1. After one week of gel administration, there was a concentration-dependent decrease ($P < 0.05$) in the gonadosomatic index of the treated groups when compared with the control (group A). The difference between the group B and groups C and D was also significant ($P < 0.05$), but there was no significant difference ($P > 0.05$) between the decrease in group D when compared with that of group C. This observation was the same for the right ovaries, left ovaries and for the two ovaries combined.

A concentration-dependent decrease ($P < 0.05$) in the gonadosomatic index of the treated groups which was also significantly different ($P < 0.05$) from one treatment group to the other as the concentration of gel administration increases, were observed after two and three weeks of gel administration. These observations were also similar for the right ovaries, left ovaries and for the two ovaries combined.

DISCUSSION

The observed concentration-dependent decreased gonadosomatic index in rats treated with graded concentration of Av gel suggests a reduction in the rate of folliculogenesis or an increased rate of follicular atresia.

Reduction in folliculogenesis rate may be an indirect ‘side effect’ through the hypothalamus with a consequential excessive gonadotropin-releasing hormone (GnRH) release resulting from continuous physiologic hypolipidemic and hypoglycemic influence of the Av gel (Holanda et al., 2009; Patel and Mengi, 2008). Generally, sexual maturation and reproductive functions in mammals are mainly regulated by the GnRH which is released from the hypothalamus in a pulsatile way and this triggers the production and release of gonadotropins, follicle stimulating hormone (FSH) and luteinizing hormone (LH) (Singh and Krishna, 2010). The action of GnRH on the ovary varies and the developmental stage of the follicles determines the nature of this effect (Singh and Krishna, 2010). These include the induction of oocyte maturation in pre-ovulatory follicles and rupture of the follicles (Hillensjo and LeMaire, 1980; Ekholm et al., 1981) which result in quicker regression of the graffian follicle, thereby contributing to the reduction of the

Table 1. Gonadosomatic index of female Wistar rats treated with graded concentration of aloe vera gel.

	Groups (%)	After one week	After two weeks	After three weeks
Right	A (× 10^{-3})	3.25 ± 0.014^{a}	3.35 ± 0.021^{a}	3.31 ± 0.034^{a}
	B (× 10^{-3})	3.08 ± 0.017^{b}	2.81 ± 0.016^{b}	2.43 ± 0.033^{b}
	C (× 10^{-3})	2.92 ± 0.022^{c}	2.35 ± 0.025^{c}	2.20 ± 0.012^{c}
	D (× 10^{-3})	2.90 ± 0.019^{c}	1.55 ± 0.013^{d}	1.32 ± 0.013^{d}
Left	A (× 10^{-3})	3.22 ± 0.089^{a}	3.28 ± 0.024^{a}	3.26 ± 0.020^{a}
	B (× 10^{-3})	3.02 ± 0.016^{b}	2.79 ± 0.024^{b}	2.35 ± 0.030^{b}
	C (× 10^{-3})	2.90 ± 0.014^{c}	2.31 ± 0.023^{c}	2.16 ± 0.015^{c}
	D (× 10^{-3})	2.88 ± 0.057^{c}	1.28 ± 0.018^{d}	1.30 ± 0.013^{d}
Both	A (× 10^{-3})	3.24 ± 0.019^{a}	3.32 ± 0.018^{a}	3.29 ± 0.020^{a}
	B (× 10^{-3})	3.05 ± 0.013^{b}	2.80 ± 0.014^{b}	2.39 ± 0.024^{b}
	C (× 10^{-3})	2.91 ± 0.013^{c}	2.33 ± 0.018^{c}	2.18 ± 0.011^{c}
	D (× 10^{-3})	2.89 ± 0.015^{c}	1.41 ± 0.043^{d}	1.31 ± 0.009^{d}

Means with different superscripts within the column are significantly different ($P < 0.05$).

ovarian mass presented as decreased gonadosomatic index in this study. GnRH also has inhibitory effects on smaller follicles (Hsueh and Jones, 1981) and a sustained release of it would directly decrease folliculogenesis, also causing a reduction in the ovarian mass and the gonadosomatic index.

The decreased gonadosomatic index of the ovaries observed in this study may also be due to the initiation of follicular atresia in the rat ovaries by GnRH (Parborell et al., 2005), as well as the suppression of cell division through the anticancer activities of the Av gel (Reynolds and Dweck, 1999).

Further studies directed toward monitoring the GnRH profile and other accompanying hormonal influences in female Wistar rats treated with Av gel would help to expound the observations made in this study.

It can be concluded that the intake of Av gel up to 200 mg/kg for a period up to seven consecutive days causes a decrease in the ovarian mass characterized by decreased gonadosomatic index in the rat and this would have consequences on the fecundity and fertility rate.

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