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BIOLOGICAL RESPONSE OF MALE RATS TO AQUEOUS EXTRACT OF GINGER (*ZINGIBER OFFICINALE* ROSCOE)

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ABSTRACT

Purpose: To investigate the biological response of male rats to treatment with aqueous extract of ginger.
Methods: Eighteen healthy and sexually mature male albino rats of 12 weeks old were used as the mammalian model for this study. They were assigned to three groups of six rats each and treated with aqueous extract of ginger at 0, 100 and 200 mg/Kg BW/day respectively for 7 days intraperitoneally. Blood was collected by cardiac puncture for hormonal assay. Cauda epididymes were dissected out, weighed and processed for epididymal sperm count.
Results: Aqueous extract of ginger increased significantly ($P<0.05$) the weight of epididymes and epididymal sperm count. It also increased the serum levels of testosterone and follicle stimulating hormone (FSH), while it decreased the serum levels of estradiol, prolactin and luteinizing hormone/interstitial cell stimulating hormone (LH/ICSH).
Conclusions: The androgenic and pro-fertility effect of the aqueous extract of ginger in the mammalian model makes it a possible fertility booster.

INTRODUCTION

Ginger (*Zingiber officinale* Roscoe) an aromatic herb that belongs to the family Zingiberacea. Ginger is valued over the world as a culinary herb, condiment, spices, home remedy and herbal medicinal agent. The important active components of the ginger rhizome are thought to be volatile oils and pungent phenol compounds such as gingerols, shogaols, zingerone and gingerols (Morakinyo *et al*., 2008). Ginger is also available in extracts, tinctures, capsules and oils. It is used for treating various diseases such as abdominal bloating, constipation, gastrointestinal distresses, morning sickness in pregnant women, asthma, eye diseases, cough, rheumatoid arthritis, postoperative nausea, indigestion, heart palpitation and heart diseases, laryngitis, belching, arteriosclerosis, motion sickness and many other sicknesses (Mowrey and Clayson, 1982; Ernst and Pittler, 2000).

Ginger is also said to have aphrodisiac properties and it is known to widen blood vessels in the region of small pelvis (Pamplona-Roger, 1999). Myers *et al.* (1995) suggested that, ginger could increase the contents in the epididymes and vas deferens without producing any spermatotoxic effects. Morakinyo *et al*. (2008), reported dose dependent increases in the weight of testes and epididymes, sperm count and serum testosterone level.

Due to insufficient information on the effect of ginger on the hormonal milieu of male rats. This work was carried out to further explore the effect of aqueous extract of ginger (*Zingiber officinale*) on the weight of epididymes, epididymal sperm count and some sex hormones such as testosterone, FSH, LH/ICSH, estradiol and prolactin in male rats.

MATERIALS AND METHODS

Animals

Eighteen healthy and sexually mature male albino rats of 12 weeks old were used in this study. The rats were obtained from the Experimental Animal Unit of Zoology and Environmental Biology Department, University of Calabar, Calabar. The rats were housed in conventional wire mesh cages under standard laboratory conditions (temperature 25-30^{0}C, 12 hours light and 12 hours darkness cycle). They were allowed free access to water and pellet feed throughout the period of the experiment. Generally, the study was conducted in accordance with the recommendation from the declarations of Helsinki on guiding principles in care and use of animals.

Plant material

The rhizomes of ginger were procured from Watt Market in Calabar, Nigeria. They were authenticated in the Herbarium, Department of Botany, University of Calabar, Calabar where voucher specimens were deposited. The rhizomes of ginger were shade-dried and pulverized with an electric grinder. The aqueous extracts were then obtained by maceration method with physiological saline for 6 hours to obtain a final stock concentration of 1 g/ml (Morakinyo *et al*., 2008).

Experimental design and procedure

Eighteen mature male rats were randomly divided into three groups of six rats each. The male rats in group 1 served as control and were administered with 1ml of physiological

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saline intraperitoneally. The rats in groups 2 and 3 were administered with 100 and 200 mg/Kg BW/day respectively for 7 days; obtained by diluting the stock solution accordingly. The rats were sacrificed under chloroform anaesthesia 24 hours after the last treatment. Blood was collected by cardiac puncture for hormonal assay. The epididymes and testes were dissected out and weighed using Scout Pro SPU 601 electronic weighing balance. The epididymes were processed for epididymal sperm count and sperm head abnormality test.

Epididymal sperm count

The epididymal sperm count was obtained by macerating known weight of cauda epididymes in physiological saline in the ratio of 1:10 weight by volume. After vigorous pipetting to release the sperm cells; the suspension was filtered using an 80µm stainless mesh. The sperm count was obtained by cytometry using the improved Neubauer cytometer according to Ekaluo *et al*. (2008).

Hormonal Assay

The blood samples were spun at 2500 rpm for 10min using Wisperfuge model 1384 centrifuge (Tamson, Holland) at 10-25˚C. Serum samples were assayed for levels of testosterone, follicle stimulating hormone (FSH), luteinizing hormone/interstitial cell stimulating hormone (LH/ICSH), estrogen (estradiol) and prolactin using the Microwell (solid phase) enzyme linked immunoassay (ELISA) technique utilizing the competitive binding principle; with analytical grade reagents (Syntron Bioresearch Inc., USA) according to Ekaluo *et al*. (2010).

Statistical Analysis

Data from the weight of testes and epididymes, epididymal sperm count and sperm head abnormality and levels of sex hormones in the serum were subjected to the analyses of variance (ANOVA) while differences in means were separated using least significant difference (LSD) according to Obi (2002).

RESULTS

General observations showed that all the rats in the study looked healthy and there was a general increase in body weights of all rats in both treatment and control groups during the treatment period. The increases in body weights of the rats indicated that aqueous extract of ginger (*Zingiber officinale*) had no adverse effect on growth and body weight of the rats. However it had a significant ($P<0.05$) and dose-dependent effect on weight of epididymes. It also increased the epididymal sperm count as shown in Table 1. The aqueous extract of ginger had significant ($P<0.05$) and dose-dependent effect on hormonal profile of male rats. It increased the serum levels of testosterone and FSH, while it decreased the serum levels of estradiol, prolactin and LH/ICSH as shown in Table

Table 1 Effect of aqueous extract of ginger on weight of epididymes, epididymal sperm count and serum level of sex hormones in male rats

Parameter	Dosage of ginger (mg/kg BW)		
	Control (0)	100	200
Epididymes (g)	$0.30^{a} \pm 0.06$	$0.40^{b} \pm 0.13$	$0.80^{c} \pm 0.13$
Epididymal sperm count ($x10^6$/ml)	$15.00^{a} \pm 0.13$	$18.50^{b} \pm 0.32$	$27.70^{c} \pm 0.22$
Testosterone (ng/ml)	$4.35^{a} \pm 0.18$	$12.10^{b} \pm 0.13$	$17.80^{c} \pm 0.14$
Estradiol (pg/ml)	$0.89^{c} \pm 0.06$	$0.51^{b} \pm 0.13$	$0.37^{a} \pm 0.13$
Prolactin (ng/ml)	$15.00^{c} \pm 0.13$	$11.75^{b} \pm 0.32$	$10.20^{a} \pm 0.22$
FSH (mIU/ml)	$0.80^{a} \pm 0.14$	$1.63^{b} \pm 0.13$	$1.67^{b} \pm 0.06$
LH/ICSH (mIU/ml)	$10.80^{c} \pm 1.82$	$9.45^{b} \pm 1.75$	$8.10^{a} \pm 3.25$

^{abc} [Values across the table with dissimilar superscript are significantly different at 0.5% based on ANOVA]

DISCUSSION

The significant increase in the weight of the epididymes could be due to increased androgen biosynthesis as evidenced by a significant increase in serum testosterone levels in experimental rats (Morakinyo *et al*., 2008), and the increase in the weight of the epididymes could also be explained by the increase in the levels of testosterone and FSH which results in a synergic stimulation of the spermatogenic cells to undergo successful spermatogenesis, sperm maturation in the epididymes and the secretory activity of the accessory sex glands (Greenspan and Stawler, 1997; Gelain *et al*., 2005). This also accounts for the observed increase in sperm count of rats administered with aqueous extract of ginger (*Zingiber officinale*).

The increase in serum testosterone level agrees with the reports of Kamtchouing *et al*. (2002) and Morakinyo *et al*. (2008), which suggests a possible androgenic property of ginger. The increase in the level of FSH and reduction in the levels of estradiol and prolactin probably enhanced the androgenic activities of ginger (Kamtchouing *et al*., 2002)..

In conclusion, this study shows that aqueous extract of ginger (*Zingiber officinale*) has androgenic properties with the capability of increasing the weight of the epididymes and sperm count. Hence it could be use as a possible fertility booster.

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