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Full Length Research Article **Effects of** Zingiber Officinale on **Reproductive Functions in the Male Rat**

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ABSTRACT

To investigate the effects of *Zingiber Officinale* on male reproductive functions and study the mechanisms underlying these effects, aqueous extract of *Zingiber Officinale* were administered orally to two groups of male rats at 500mg/kg b.w. and 1000mg/kg b.w. A third group served as control and received the treatment vehicle, distilled water. Treatment lasted for 14 and 28 days before sacrifice. Organ weight, epididymal sperm counts, motility, viability and morphology, seminal fructose, testicular malonhydialdehyde, and serum testosterone were determined. The treatment caused a significant increase (P<0.05) in the weight of the testis and epididymis. There were dose and duration dependent increase in sperm count and motility (P<0.05). There was also a significant increase (P<0.05) in serum testosterone level. Malonhydialdehyde levels were significantly reduced (P<0.05). Our results indicated that extract of *Zingiber Officinale* possesses pro-fertility properties in male rats which might be a product of both its potent antioxidant properties and androgenic activities.

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Key Words: Zingiber Officinale, testosterone, androgenic, malonhydialdehyde and sperm.

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INTRODUCTION

Zingiber Officinale commonly called ginger belongs to the family Zingiberaceae. The plant is a knotted, thick, beige underground stem (rhizome) that has been used in traditional medicine to aid digestion and treat stomach upset, diarrhea, nausea, and arthritis for centuries. In addition to these medicinal uses, ginger continues to be valued around the world as an important cooking spice and is believed to help the common cold, flulike symptoms, headaches, and even painful menstrual periods. Today, ginger root is widely used as a digestive aid for mild stomach upset and is commonly recommended by health care professionals to help prevent or treat nausea and vomiting associated with motion sickness, pregnancy, and cancer chemotherapy (Bone et al, 1990; Grontved et al, 1988; Sripramote et al, 2003). Ginger is used as support in inflammatory conditions such as arthritis (Altman et al, 2001), and may even be used in heart disease (Bhandari et al, 1998) or cancer (Katiyar et al, 1996). The important active components of the ginger root are thought to be volatile oils and pungent phenol compounds such as gingerols, shogaols, zingerone, and gingerols (Sekiwa et al, 2000; Zancar et al, 2002). Although the beneficial effect of ginger has been exploited, little research has been conducted on its activity on male reproductive functions except a study that reported that Z. Officinale possess androgenic property (Kamtchouing et al, 2002). This work was therefore carried out in view of the paucity of literature on the action of Z. Officinale extract on reproductive functions and antioxidant activities in male rats.

MATERIALS AND METHODS

Animals

Adults male rats weighing between 140-160g were maintained in a well ventilated animal house under standard condition of humidity, temperature and a constant 12 hour light:12 hour dark lighting schedule. The animals were housed in clear polypropylene cages lined with wood chip beddings. They were fed with standard pellet diet (Livestock Feeds, Ikeja, Lagos) and water was made available at all times. The health and reproductive status of the animals were assessed and only healthy animals were selected for the experiment.

Extraction of plant material

The Z. Officinale rhizome was purchased from local commercial sources and shade dried at room temperature before being pulverized with an electric grinder. The extracts were then obtained by maceration method with distilled water for 48hours to obtain a final aqueous concentration of 1g/ml.

Experimental Design

Thirty six adult male rats were randomly divided into 3 groups of 12 animals each. Group 1 (control group) was administered with the vehicle (distilled water) while groups 2 and 3 were given an aqueous suspension of *Z. Officinale* at 500mg/kg and 1000mg/kg. Six rats from each experimental group were randomly sacrificed after 14 days of extract administration while the remaining rats were allowed up to 28 days before sacrifice. Treatment was done daily using oral dosing needle and twenty four hours after the last dose, blood was collected and the animals were sacrificed.

Sperm Function Analysis

The rats were sacrificed after the last day of administration and weighed for the essential reproductive organs, such as testis, caudal epididymis, seminal vesicle and prostate glands. The spermatozoa were obtained by making a small incision (1ml) in the caudal epididymis and evaluated for sperm count, motility, viability and morphology. The sperm count was determined with an improved Neubauer haemocytometer and viability was assessed by eosin-nigrosin dye exclusion test. Epididymal sperm motility was assessed by calculating motile spermatozoa per unit area and was expressed as percent motility. Sperm morphology was done using the Wall and Ewas stain and examined under the microscope as described earlier in literatures.

Malonhydialdehyde Estimation

This was measured as an indicator of lipid peroxidation and by extension reactive oxygen species. Testes homogenate prepared was placed in micro-centrifuge tube and incubated with thiobarbituric acid (TBA). Following the incubation, samples were centrifuged (2 000 rpm, 10 min) and the absorbance of the pink clear supernatant was measured at λ = 532 nm in duplicate samples. Malonhydialdehyde bis (dimethyl acetal) was used as the external standard.

Fructose Measurement

Seminal fructose was determined according to according to a WHO manual protocol. Briefly, seminal plasma is deproteinized with zinc sulfate and barium hydroxide. The deproteinized seminal plasma is then reacted with acidic resorcinol to form a colored product. The absorbance is read at 410nm.

Testosterone Assay

Blood samples were spun at 2500rpm for 10 minutes in a table top centrifuge. The serum samples obtained were analyzed to determine the concentration of testosterone. The analysis was carried via the tube-based enzyme immunoassay (EIA) method. The protocol used for the hormone was according to the method described for the kit (Immunometrics Limited UK) and meet the WHO standards in research programme for human reproduction.

Statistical Analysis

Data are expressed as mean \pm SEM and analysed using the Student's *t*-test and ANOVA where necessary. P < 0.05 was accepted as significant. **RESULTS** Effects of Z. Officinale on body and organ weight – Administration of Z. Officinale caused no changes in the weight of the seminal vesicle and prostate gland. However, testicular weight was increased significantly (P<0.05) after 14 and 28 days treatment in a dose and duration dependent manner when compared with the controls. In exception to the epididymal weights of other groups, the 1000mg/kg group of the 28 days treatment showed a significant weight increase (P<0.05) compared with the control (Table 1).

Effects of Z. Officinale on sperm function – Caudal epididymal sperm count and motility were significantly increased (P<0.05) after 14 and 28 days treatment in a dose and duration dependent manner compared with the controls. There were no differences in other sperm parameters of viability and morphology compared with controls (Table 2).

Effects of Z. Officinale on malonhydialdehyde estimation – Treatment with Z. Officinale significantly decreases (P < 0.05) the levels of malonhydialdehyde in the experimental rats in a dose and duration dependent manner as compared with the control. This reduction was highest for the group 3 (1000mg/kg) in the 28 days and lowest for the group 2 (500mg/kg) 14 days treatment regimen (Fig. 1).

Effects of Z. Officinale on fructose levels – Z. Officinale caused no significant changes in the fructose level in the experimental rats after 14 days and 28 days administration (Table 3).

Effects of *Z. Officinale* on serum testosterone levels – There were dose and duration dependent increases in the serum testosterone levels in the *Z. Officinale* administered rats compared with the controls (Fig. 2).

DISCUSSION

The results of the present study suggested that *Zingiber Officinale* have a beneficial effect on male reproductive functions in rats. These data are confirmed by our observation on the increased

sperm counts, motility, testosterone, and decrease malonhvdialdehvde levels. The significant increase in the absolute weight of the testis and epididymis could therefore be due to increased androgen biosynthesis as evidenced by a significant increase in serum testosterone levels in the experimental rats. Androgens have been shown to be necessary for the development, growth and normal functioning of the testes and male accessory reproductive glands and studies have shown that the level is positively correlated with the weight of testis, epididymis, seminal vesicle and prostate glands (Setty et al, 1997; Prins et al, 1991). This increased reproductive organ weight is equally consistent with the report of Kamtchouing et al who observed an increase in the testicular weight of rats treated with Z. Officinale for 8 days with a concomitant increase in testosterone level. Moreover, an effect due to testosterone changes alone should have led to an increase in the weight of all accessory organs; it is therefore plausible that the increased weight of the testis and epididymis reflects a dual effect of increased testosterone levels and sperm contained in these organs.

The observed increase in the sperm functions in the Z. Officinale administered rat could be attributed to favourable and increased spermatogenic activities as results of high testosterone levels. Testosterone is known to be critically involved in the development of sperm cells and derangement results widely in leydig cell dysfunction and testicular steroidogenic disorder (Zhang et al, 2001). It is known that a major function of the epididymis is sperm maturation which leads to the acquisition of fertilizing ability and viability of spermatozoa. Therefore, improvement in the activities of the epididymis could have led to an increase in progressive motility of sperm in the experimental rats. The increased sperm count and motility thereby shows that treatment with Z. Officinale improves and enhances the fertilizing capacity of the Semen. These qualities were often used as a measure of sperm production, testicular function and/ or male fertility. Low sperm count and motility and high percentage abnormal spermatozoa level each have been associated with reduced fertility (Raji et al 2003, Adeeko and Dada 1998).

Another explanation for these improved testicular/sperm function in this study is the reduced level of malondialdehyde, the most abundant individual aldehyde resulting from lipid peroxidation breakdown in biological systems. Malondialdehyde is an indirect indicator of reactive oxygen species, ROS, which has potential toxic effects on sperm quality and function (Sharma and Agarwal, 1996; Sikka et al, 1995). For instance, Agarwal and co-workers (1994) reported that increased formation of ROS is correlated with the reduction of sperm motility. In the light of the above, Z. Officinale seems to confer a protective antioxidant defence capacity on the treated rats as evidenced by a significant reduction in the level of malondialdehyde.

In conclusion, the extract of *Zingiber Officinale* might be said to have pro-fertility properties in male rats which might be a consequence of both its potent antioxidant properties and androgenic activities.

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