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Research Paper

Potential of castor seed (*Ricinus communis*) powder-formulated feed in the fertility control of wild-caught female African Giant Rats (*Cricetomys gambianus*)

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Abstract

The objective of this study was to evaluate the potential of Castor seed powder-formulated feed in the fertility control of wildly caught female African giant rats (AGR). The study was conducted at Central Animal House of University of Ibadan, Nigeria between February and April, 2022. Four different concentrations of experimental feeds were formulated by mixing castor seed powder with commercial rat feed in the ratio 1:12, 1:6, 1:1, 0:1 (control). Twenty wildly caught female AGR were randomly allocated into four groups (with 5 rats/group), acclimatized for 4 weeks and fed with appropriate experimental feed for 60 days with water provided as necessary. Blood samples were collected at 20 days intervals and analyzed for reproductive hormones (Follicle Stimulating Hormone (FSH), Luteinising Hormone, Progesterone, and Estrogen) and cellular enzymes using standard methods. The collected data were analysed using descriptive statistics and ANOVA while means were separated using Tukey's test. No significant difference was recorded in the mean feed intake (%) (1:1: 94.81 ± 0.77, control: 96.48 ± 0.43) and body weight (g) (1:1: 868.20 ± 75.12, control: 872.80 ± 48.09) among the groups. There was significantly reduced FSH (IU/L) (7.8 ± 0.7) compared to control (15.2 ± 1.0). Progesterone and estrogen (IU/L) were significantly lower (1.2 ± 0.2; 18.8 ± 1.9) than the control (4.1 ± 0.1; 33.8 ± 1.4). The Castor seed powder has the potential of reducing the reproductive ability of the female African giant rats and therefore can be recommended to the farmers for use.

1. Introduction

Rodent species that are the group of small mammals are categorized based on their differences in the skull characteristics as myomorphs and sciuromorphs (Happold, 2013). Myomorphs include rats and mice, while sciuromorphs are squirrels. Myomorphs are highly adapted to various lifestyles, which include terrestrial, aquatic, arboreal, and fossorial (Witmer, 2007). Rodent species play the ecological roles of aiding soil mixing and aeration, serving as prey-base for predatory species, enhancing organic matter composition, serving as pollinating and dispersal agents, and as environmental engineer by serving as indicators of environmental health (Aplin et al., 2003; Buckle and Smith, 2015). Meanwhile, some of them have been implicated as the noxious pest species, causing economic damage to agricultural crops in the field and store, while some others have been identified as carriers of zoonotic diseases (Buckle and Smith, 2015). A lot of attempts have been made towards ensuring mitigation of the damage by the latter rodent pest species. However, virtually all the rodent control efforts are aimed at achieving lethality by poisoning, trapping, and hunting,

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with most of the approaches being the use of chemical poison (Tran and Hinds, 2012).

While it is important to reduce the rodent damage, the use of chemical poison has been considered to be an inappropriate management strategy due to its associated shortcomings which include the problem of bait shyness, secondary poisoning, and non-target effects. An aspect of Ecologically Based Rodent Management (EBRM) involves reducing the fertility of the rodent pest species, thereby reducing the number of young produced and recruited into population (Chamber et al., 1999). This is owing to the fact that rodent species are greatly favoured with high reproductive potential (Aplin et al., 2003). Therefore, rather than reducing their population through lethal means, agents such as plant constituents that could reduce their reproductive ability are adopted (Tran and Hinds, 2012; Bhakta et al., 2019). Fertility control has been considered as a caring and effective rodent management strategy which is primarily aimed at reducing the number of young produced and recruited into the population which in turn leads to the decrease in the damage inflicted on agricultural crops (Singleton et al., 2021).

Zoonotic diseases transmission can also be reduced by reducing the population of the species causing the transmission (Meerburg et al., 2009). About 5-10% of annual crop damage is caused by rodent pests in developing countries (Singleton et al., 2021). An aspect of fertility control is immunological mechanism of rodent population control, which could be achieved by immune-contraception in females and immune-castration in males. Another aspect is the use of chemicals, such as 4-vinylcyclohexene diepoxide (Siers et al., 2020) and Triptolide and a combination of two synthetic hormones, levonorgestrel and quinestrol (Shi et al., 2020), that have the potential of causing sterility in animals. Many approaches have been reported to suppress reproduction using natural plant extracts. The plant extracts may exert their inhibitory effects directly on a specific process within the reproductive target (such as development of oocytes and ovarian follicles, implantation) or may indirectly affect a number of sites (like oviduct, uterus, vagina) within the reproductive tract of animals owing to changes in hormone synthesis and release by the hypothalamic–pituitary–gonadal (HPG) axis (Tran and Hinds, 2012).

In female mammals, oestrous cycle is regulated by various reproductive hormones, which include gonadotrophin releasing hormone (GnRH), luteinising hormone (LH), follicle stimulating hormone (FSH), oestrogen, progesterone and prostaglandin F2α (PGF2α) (Tran and Hinds, 2012). These reproductive hormones can be inhibited or disrupted by the natural plant extracts that have abortifacient or contraceptive potentials. Some of the plant-based products also have potential of preventing implantation (Kumar et al., 2012).

Some botanical products have been screened for their potential of causing infertility or contraception in animals (Tran and Hinds, 2012). For example, extracts of various parts (leaves, bark, seeds) of the Neem tree (*Azardirachta indica*) have long been associated with effects on fertility, particularly in Indian culture. Various forms of Neem have effects in both sexes – disrupting spermatogenesis, preventing implantation, inducing abortion and preventing follicle development (Gbotolorun et al., 2008; Morovati et al., 2008). Extracts of seeds of pawpaw adversely affect the reproduction of female rodents by increasing follicular atresia, disrupting ovulation, inducing irregular oestrous cycles, inhibiting implantation and reducing litter sizes (Dosumu *et al*., 2008). *Quassia amara* is also a shrub that has been reported to have contraceptive potential in female albino rats (Raji *et al*., 2010). Castor bean (*Ricinus communis*) has also been reported to have potential of reducing the reproductive ability in laboratory rodents (Raji *et al*., 2006). In the present study, the efficacy of castor bean seed powder was investigated in wildly caught female African giant rats to know its potential in reducing the fertility of the species.

2. Materials and Methods

2.1 Castor oil seed collection, identification, and pod removal

Castor oil seeds were plucked from the Castor plant at Mosoke Area in Nigeria, along Ajibode-Apete Road. The castor oil seed was identified and voucher number (UIH-23150) allocated at the herbarium of the department of botany, University of Ibadan, Nigeria. The coat and the pod of the castor oil seeds were removed by hand pressing. The seeds were air dried for 10 days under an open shade and pulverized with the help of a mortar and pestle to fine powder (Bhakta et al., 2019).

2.2 Formulation and pelletizing of the rodent experimental feed

The experimental feeds were formulated into three different concentrations as described by Olayioye *et al.* (2014) by mixing the castor seed powder with commercial rats feed thoroughly in the ratio of 1:1, 1:6, and 1:12, while commercial rats feed only, served as control. Thus, the treatment feeds were prepared from each 1 kg of castor seed powder and 1, 6 and 2 kg of commercial feed to make the 1:1, 1:6 and 1:12 ratio. Each of the formulated feeds was then turned into pellet. Each animal was then fed with 30 g per day with water supplied *ad libitum*.

2.3 Experimental design

2.3.1 Experimental animals

Twenty (20) sexually mature female African Giant rats (AGRs) were wildly caught from the University of Ibadan and its environs using live traps. Ethical approval was secured with the assigned number: UI-ACUREC/19/0136 from the Animal Care and Use Research Ethics Committee (ACUREC) of Faculty of Veterinary Medicines, University of Ibadan. The determination of sexual maturity (immature/mature) and that of the development stage (juvenile/sub-adult/adult) help to correctly identify an animal to the species level. In some case, juveniles could be misidentified with adults from another species. Decision tree was used to determine the developmental stage, by considering the third molar growth (fully grown in adults, partly grown in sub-adults, and absent in juveniles) and sexual organs externally (fully opened in adults, partially opened in sub-adults and closed/undeveloped in juveniles) (Jean-Chritophe et al., 2011).

The weights of AGRs that were used for this research were between 630 and 1136 g, which fall within the actual weight range of any sexually mature AGRs (Kingdon et al., 2013). The twenty female AGRs were then randomly allocated into four experimental groups (Group 1, 2, 3, and 4) with five animals per group. All the AGRs were then treated prophylactically for cestodiasis by the veterinary expert at the start of acclimatization and then two weeks after.

2.3.2 Acclimatization of the rats

The wildly caught AGRs were acclimatized by rearing in a netted cage (each animal was housed individually) for 30 days in Central Animal House, College of Medicine, University of Ibadan, so as to get them rehabilitated to enhance good health and accustomed to the environment in captivity (Olayioye et al., 2014). During the period of acclimatization, the animals were fed for 10 days with the food they were used to in the wild which includes palm nut and kernel, maize grain, cassava, yam, banana and pawpaw. This was withdrawn gradually until they got used to the standard normal rat feeds (containing crude protein - 13%, fat - 8%, crude fibre - 15%, calcium - 0.9%, available phosphorus - 0.35%, metabolizable energy - 2600 kcal/kg) and water was provided as necessary.

2.3.3 Collection of blood samples prior to administering the experimental feeds for hormone analysis

After acclimatization, blood samples were collected, in the morning between 8 and 9 am by ocular puncture, from the captive AGRs, before the administration of the experimental feeds commenced to ascertain the level of reproductive hormones. They were first anaesthetized for a minute using chloroform in an enclosed plastic. Thereafter, they were brought out for blood sample collection. 3 ml of blood was collected in plain bottles for enzymes and reproductive hormone analyses. The level of enzymes, which includes aspartate transaminase (AST), alanine transaminase (ALT), alkaline phosphatase (ALP), were analyzed to test for the effect of the experimental feed on the liver enzymes as a liver function test to evaluate the humanness of the treatment on the experimental animals, while the level of reproductive hormones, which includes luteinising hormone (LH), follicle stimulating hormone (FSH), progesterone (PRG), and estrogen (ESTR) were checked to assess the effect of the feed on the hormones as to whether it has contraceptive or fertility-dwindling potential in the animals. The data collected prior to administration of experimental feeds formed the baseline data in this study.

2.3.4 Administration of experimental feeds and collection of blood samples

Each of the three treatment groups of five animals was fed with appropriate experimental feed (30 grams of feed per animal) daily and water was provided *ad libitum* for 60 days (Raji et al., 2010). The test animals in the control group were also fed with commercial rat feed without the castor seed powder. At interval of 20 days, blood samples were collected for hormone and enzyme analysis. In essence, samples were collected three times excluding baseline. These included blood samples collection after first 20 days, second 20 days, and third 20 days of administration.

2.4 Data Analysis Methods

Descriptive statistics in SPSS was computed for each of the parameters – feed intake, body weight, hormone, and enzymes - among the four groups of AGRs. Analysis of Variance (ANOVA) was carried out to test for significant difference among the means of the data that were collected while means were separated where there were significant difference using Tukey's test.

3. Results and Discussion

3.1 Effect of the experimental feeds on feed intake and body weight of female African giant rats

3.1.1 Effect of the feeds on intake

The results of the present study showed that the feed intake recorded in all the groups of female AGRs were generally high. However, there was no significant difference in the feed intake between the experimental groups fed with 1:6 and 1:1 feed concentration and their control (Table 1). The feed intake recorded in the group fed with the lowest feed concentration was significantly lower than its control group. The overall difference in the feed intake among the female AGRs was statistically significant ($F = 3.791$, $df = 19$, $p < 0.05$).

Table 1: Percentage mean feed intake of the female African giant rat during the experiment

Treatment groups	Percentage Feed Intake (Mean ± SEM)
1:12	90.53 ± 2.48 a
1:6	95.63 ± 0.66 b
1:1	94.81 ± 0.77 b
Control	96.48 ± 0.43 b

Means having the same alphabets/letters are not significantly different from each other ($p > 0.05$)

The result showed that *R. communis* seed powder inclusion in the diet did not affect the palatability and intake of the feed by AGRs. Contrarily, Fayinminnu *et al.* (2022) reported lowest feed intake in the Wistar rats that received the experimental feeds having highest percentage of *Thevetia neriifolia*. The high feed intake recorded in the present study among the treatment groups could be attributed to the palatability and hence acceptance of the experimental feed.

3.1.2 Effect of the experimental feeds on body weight

The body weight (g) of the female AGRs used was between 630 and 1136. There were observed differences among the mean body weights both within and across the treatment groups (Figure 1). There was increase in the mean body weight from baseline (body weight taken before the start of experimental feed) to the third experimental feed, in which the rats received 1:12 feed concentration, and second (with 1:6 experimental feed concentration) treatment groups while in the third (with 1:1 experimental feed concentration) treatment group, the mean body weight reduced from baseline value in the first 20 days of experimental feed administration after which it increased in the second and third 20 days of administration. Across the treatment groups, reduced mean body weight (g) was recorded in the treatment group that received highest concentration of the feed compared with the control at each interval of administration.

There was no statistically significant difference among the mean body weights within and across the treatment groups ($F = 0.145$, $df = 79$, $p>0.05$). Thus, the formulated diets did not have effect on the body weight of the AGRs used in this study. This disagrees with report by Olayioye et al. (2014) who stated that there was decrease in the body weight with increase in concentration of the experimental feed. However, Raji et al. (2010) gave similar report to the findings of the present study. However, they also further reported that the weight gain was significantly different. This means that the *R. communis* seed powder used as inclusion in the commercial feed to formulate the diets used in this study did not affect the body weight increase in the groups of AGRs.

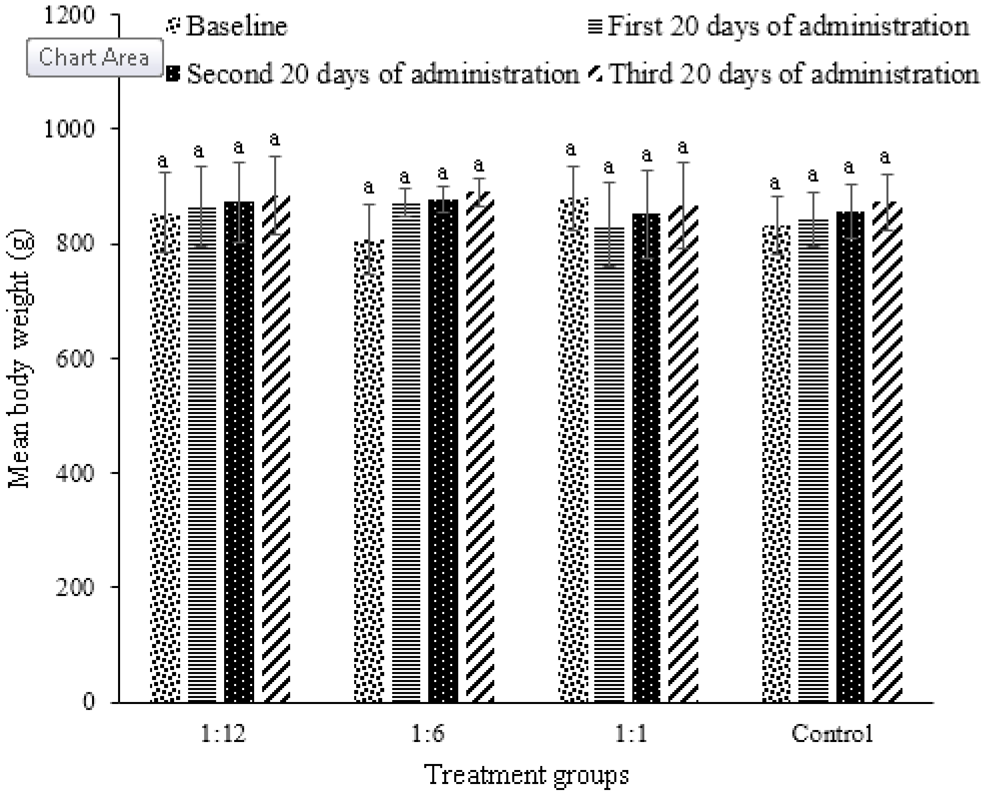

Figure 1: Body weight of female African giant rats (Mean ± SEM); Bars having the same letters are not significantly different from each other (p > 0.05)

Contrary to the report of this study, Fayinminnu et al. (2022), who conducted assessment of *Thevetia neriifolia* toxicity as a rodenticide in Wistar rats where it was reported that there was significant weight loss among the groups that received highest percentage of the test sample which was attributed to the low feed intake due to non-palatability of the *Thevetia neriifolia* based diets. There has also been earlier report by Taiwo and Igbeneghu (2014) that *Thevetia neriifolia* has poisonous cardiac glycoside that could make the diets non-edible thereby resulting in low feed consumption and eventual loss in weight (Fayinminnu *et al.*, 2022).

3.2 The treatment effect on reproductive hormone in the female African giant rats

The mean serum concentrations of LH, FSH, progesterone, and oestrogen were recorded for female AGRs in each of the three treatment groups at baseline (before the start of experimental feed administration) and immediately after the first, second, and third 20 days of the feeds administration.

3.2.1 Luteinising hormone

There was overall decrease in the mean serum concentration of LH in female AGRs in each of the treatment groups with time (Figure 2). In contrast, progressive increase in the mean serum concentration of LH was recorded in the control group. In addition, there was significant reduction in the mean serum concentration of LH in the group that received highest concentration of experimental feed from 16.40 ± 1.36 IU/L at second 20 days of administration to 9.20 ± 1.32 IU/L at third 20 days of administration. Statistically, there was significant difference among the mean serum concentrations of LH in female AGRs in the treatment groups ($F = 4.312$, $df = 79$, $p<0.05$).

The results revealed that serum LH level was affected by the *R. communis* formulated diet because it lowered the LH level in blood. The decline in the level of LH was most significant in female treated groups that received highest concentration of the diet. Luteinising hormone functions in the stimulation of ovulation and formation of corpus luteum in female.

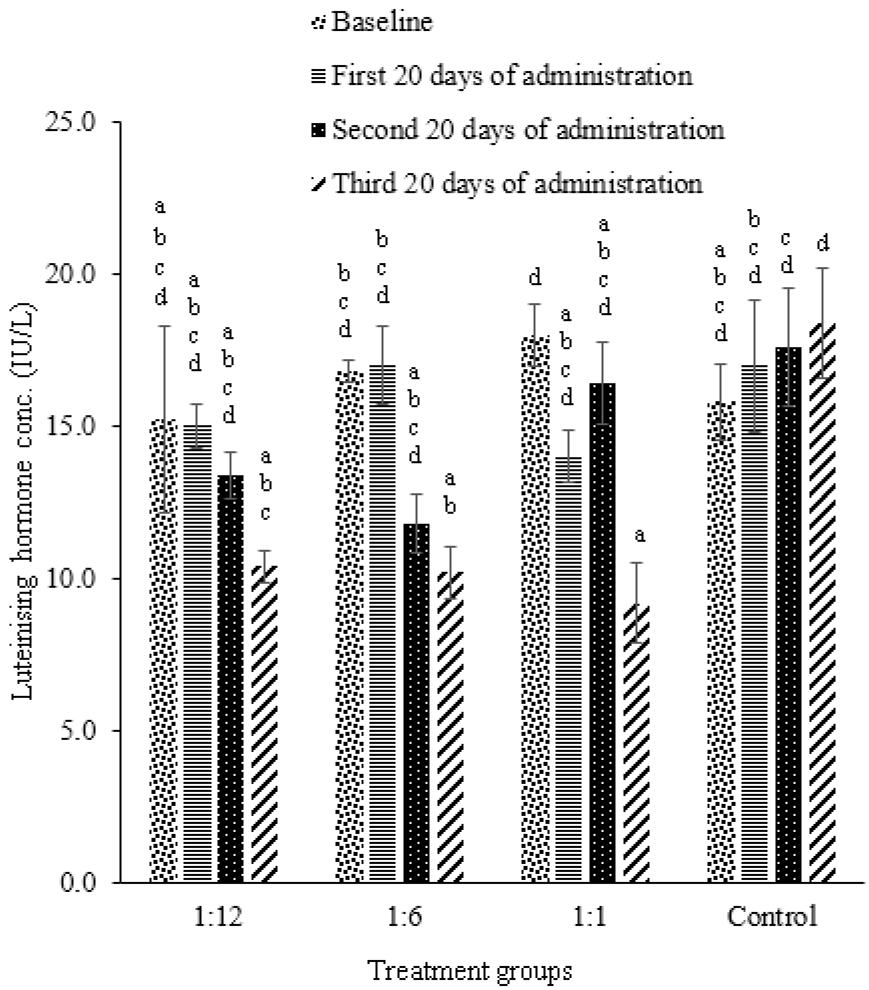

Figure 2: Levels of Luteinising hormone in female African giant rats (Mean ± SEM); Bars having the same letters are not significantly different from each other ($p > 0.05$)

In other words, it could have been that *R. communis* seed powder in the diets inhibits ovulation and corpus luteum formation. Tran and Hinds (2012) also reported that the extract of Soapnut plant (*Sapindus trifoliatus*) caused significant reduction in the level of LH and other reproductive hormones thereby causing disruption of the oestrus cycle and follicular development. Similarly, the extract of the whole plant of snake gourd (*Trichosanthes cucumerinas*) was reported by Arawwawala *et al.* (2010) to significantly reduce serum LH in treated groups of female rats.

3.2.2 Follicle stimulating hormone

The mean serum concentration of FSH in each of the treatment groups in the female AGRs decreased overall with time except in all the experimental groups (Figure 3). There was, however, consistent increase in the mean serum concentration of FSH in the control group. There was statistically significant difference among the mean serum concentration of FSH across the treatment groups ($F = 4.752$, $df = 79$, $p < 0.05$).

The *R. communis* seed adversely affected the serum FSH level in the female treated groups of AGRs as there was significant decline in its level. This could probably be that *R. communis* has contraceptive effect in the female. FSH is a hormone that stimulates the growth of ovarian follicles in the ovary before ovulation. It also stimulates estrogen secretion. In other words, the *R. communis* seed powder used in formulating the diets could have caused significant decline in the FSH production thereby inhibiting estrogen formation. Thus, the seed powder of *R. communis* has anti-fertility/contraceptive potential to female AGRs. Olawuwo *et al*. (2020) reported significant reduction in the FSH in the dry season compared to that in the wet season.

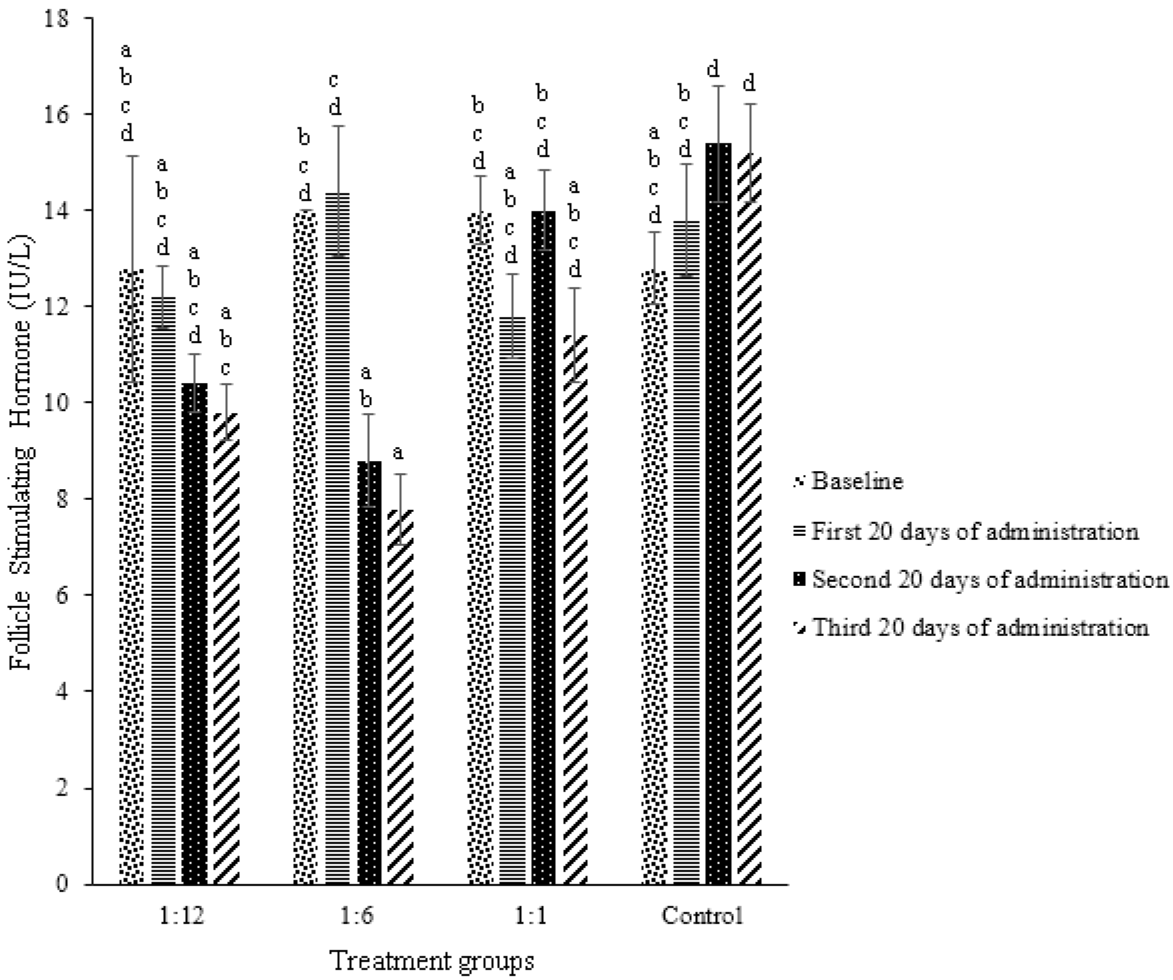

Figure 3: Levels of Follicle Stimulating hormone in female African giant rats (Mean ± SEM); Bars having the same letters are not significantly different from each other ($p > 0.05$)

Meanwhile, the FSH was reportedly reduced in the wet season, which matches the experimental season of the present study. In other words, the significant decline in FSH reported in the present study could be attributed to contraceptive potential of *R. communis* seed powder by inhibiting the anterior pituitary to secrete FSH. Arawwawala *et al.* (2010) and Kage *et al.* (2009) reported that the whole plant extract of *Trichosanthes cucumerina* (a tropical vine) caused significant reduction in the serum FSH in treated groups of female rats.

3.2.3 Progesterone hormone

In the female AGRs, there was fluctuation in the mean serum concentration of progesterone in both the group that received 1:6 and 1:1 feed concentrations (Figure 4). But there was progressive increase in the mean serum concentration in the group that received lowest concentration at baseline to the second 20 days of administration; however, there was a slight decrease at third level. On the contrary, for the control, the mean serum concentration of progesterone continuously increased with time of experimental feed administration. The difference among the mean serum concentration of progesterone in the treatment groups in the female African giant was statistically significant ($F = 8.133$, $df = 79$, $p < 0.05$).

Based on the results, *R. communis* in the diet at higher concentration did not have effect on the serum progesterone level in females. However, the effect of the lowest concentration of *R. communis* in the diet of this study could probably be that the non-pregnant female AGRs required small to moderate amount of *R. communis* seed powder to ensure progesterone level increase when there is no conception.

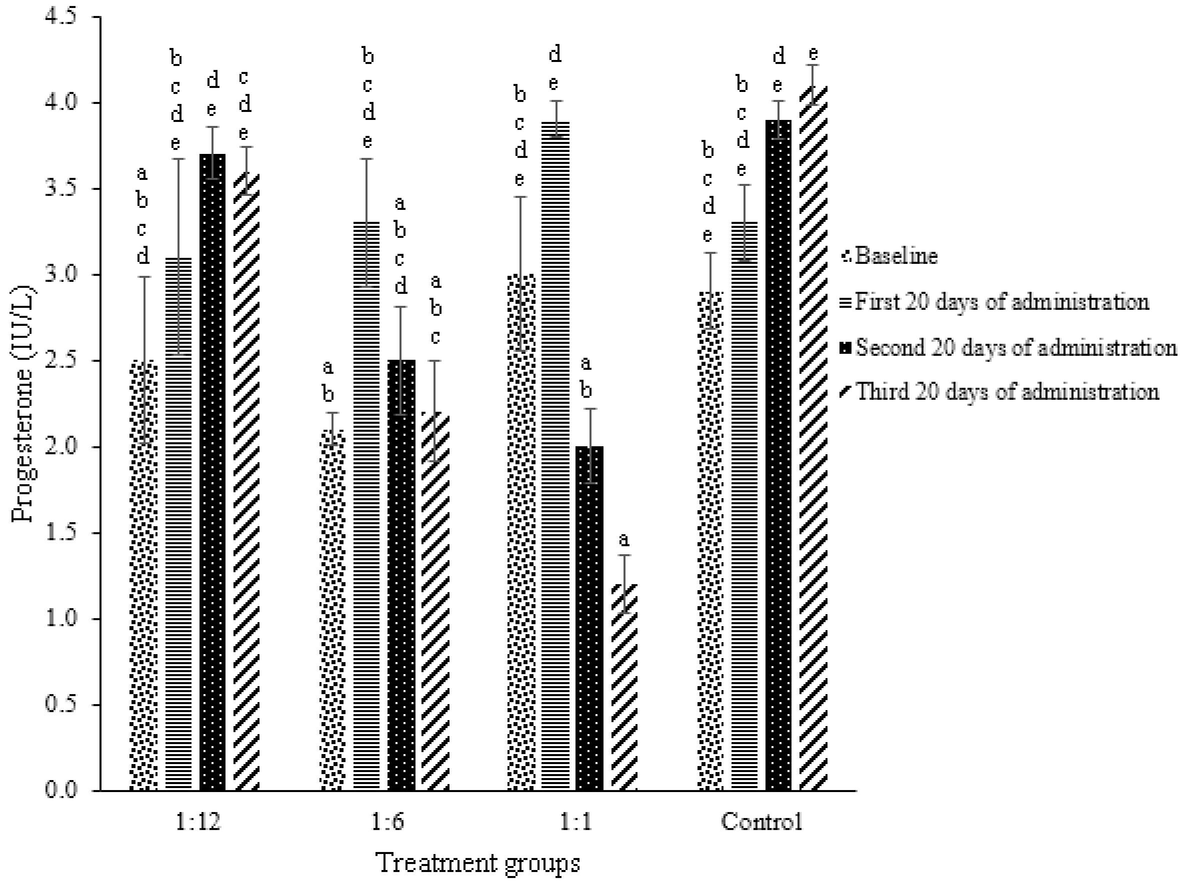

Figure 4: Levels of Progesterone hormone in female African giant rats (Mean ± SEM); Bars having the same letters are not significantly different from each other (p > 0.05)

The function of progesterone which is produced in the ovaries is to sustain pregnancy by maintaining the thickened uterus lining in order to prevent abortion. Its presence also inhibits secretion of FSH and LH. Extract of *Sapindus trifoliatus* administered orally (Tran and Hinds, 2012)caused induced degeneration of developing follicles, and there was reduction in the rates of implantation and pregnancy due to significantly reduced progesterone which functions in the maintenance of thickening of uterus lining.

3.2.4 Estrogen hormone

There was initial increase in the mean serum concentration of estrogen in the female AGRs in the treatment groups that received the lowest and highest concentrations of experimental feed (Figure 5). Meanwhile, there was fluctuation in the mean serum concentration of estrogen in the group fed with 1:6 concentration. However, there was progressive increase in the mean serum concentration of estrogen in the control group. There was statistically significant difference among the mean serum concentration of estrogen in the treatment groups (F = 5.002, df = 79, p < 0.05).

The site of estrogen production in the female is ovary. It is however produced in sizable quantities in the testis, as well as the brain. Its functions include promotion of thickening of uterine lining, inhibition of FSH secretion, stimulation of pituitary to secrete LH. In the female AGRs, the overall serum estrogen level decreased in the three treatment groups, the decrease was significant for the 1:1 ratio feed concentration. However, the hormone increased continuously with time in the control group. This is not in agreement with the report of the previous finding by Raji *et al.* (2010) where it was reported that the agent – quassin-significantly reduced the serum estrogen secretion. The significant increase in the serum estrogen reported in the present study could be that the *R. communis* seed powder has the tendency of facilitating the secretion of estrogen by the ovary in the female African giant rats.

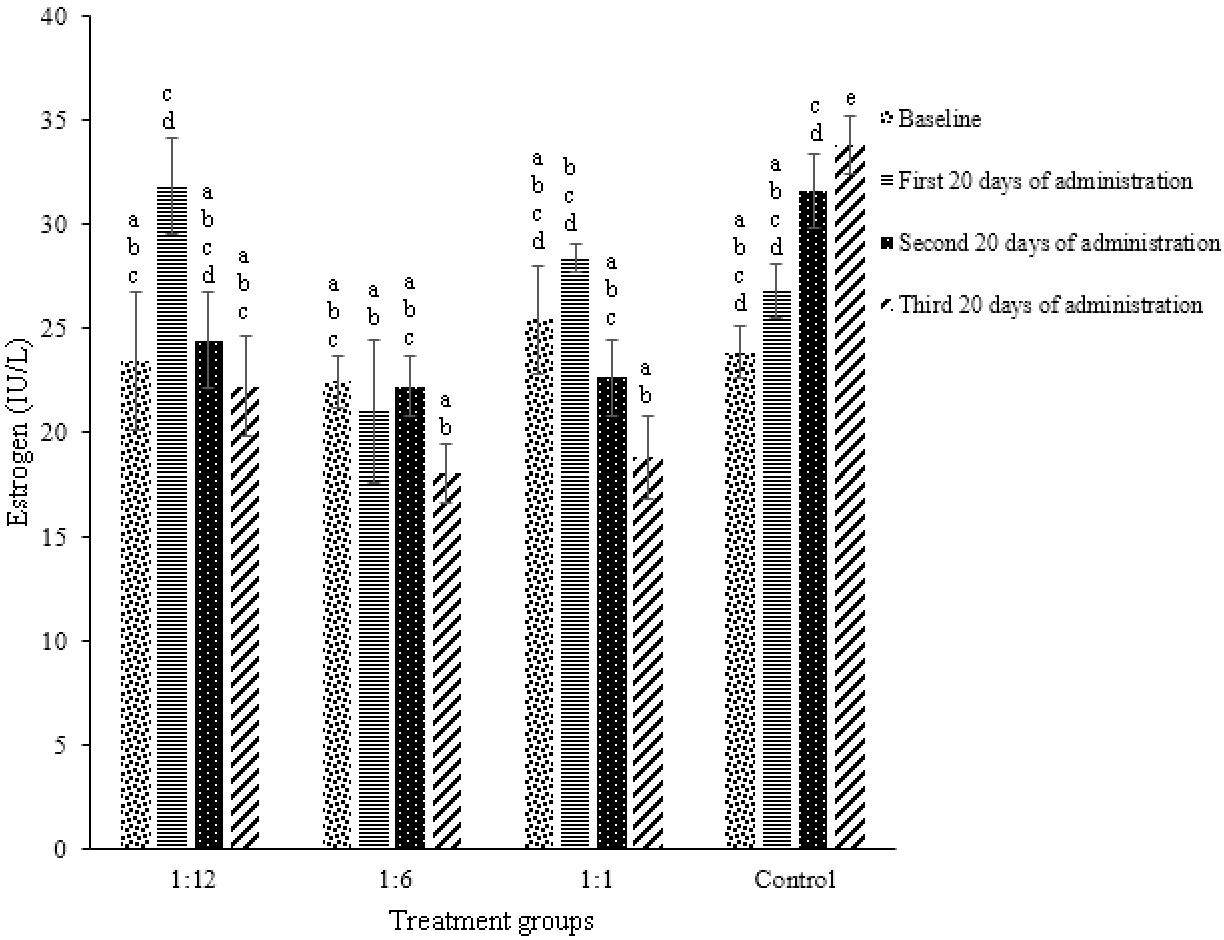

Figure 5: Levels of Estrogen hormone in female African giant rats (Mean ± SEM); Bars having the same letters are not significantly different from each other ($p > 0.05$)

A significant reduction of estrogen and other reproductive hormones was reported by Tran and Hinds (2012) in the rats treated with the extract of soapnut plant (*Sapindus trifoliatus*) which resulted in the disruption of oestrus cycle and follicular development.

3.3 Effect of the formulated diet on the enzymes in the female African giant rats

3.3.1 Aspartate aminotransferase (AST)

The results showed that the mean serum AST concentration in female AGRs in the group fed with the lowest and highest concentrations of the feeds at third 20 days of administration were significantly higher than their corresponding baseline (Figure 6). The mean serum AST recorded in the group fed with 1:6 concentration of feed at second 20 days of administration was significantly lower than its corresponding baseline and control. In addition, there was no significant difference between the mean serum AST recorded at first and second 20 days of administration and even in comparison with its corresponding baseline in the group that received the highest concentration of feed. There was statistical significance in the overall mean AST level among the groups ($F = 7.215$, $df = 79$, $p < 0.05$).

Thus, at both lowest and highest concentrations, there was significant effect of *R. communis* seed powder on the serum AST level in the female AGRs. Regardless of the concentration of *R. communis* seed powder used in the present study, it caused significant increase in the serum AST level produced by the liver with time. This could be indicative of liver damage or inhibition of liver functions in the female AGRs used in the present study. AST has been reported to be one but not only the liver marker enzyme to evaluate liver malfunction (Imafidon and Okunrobo, 2012).

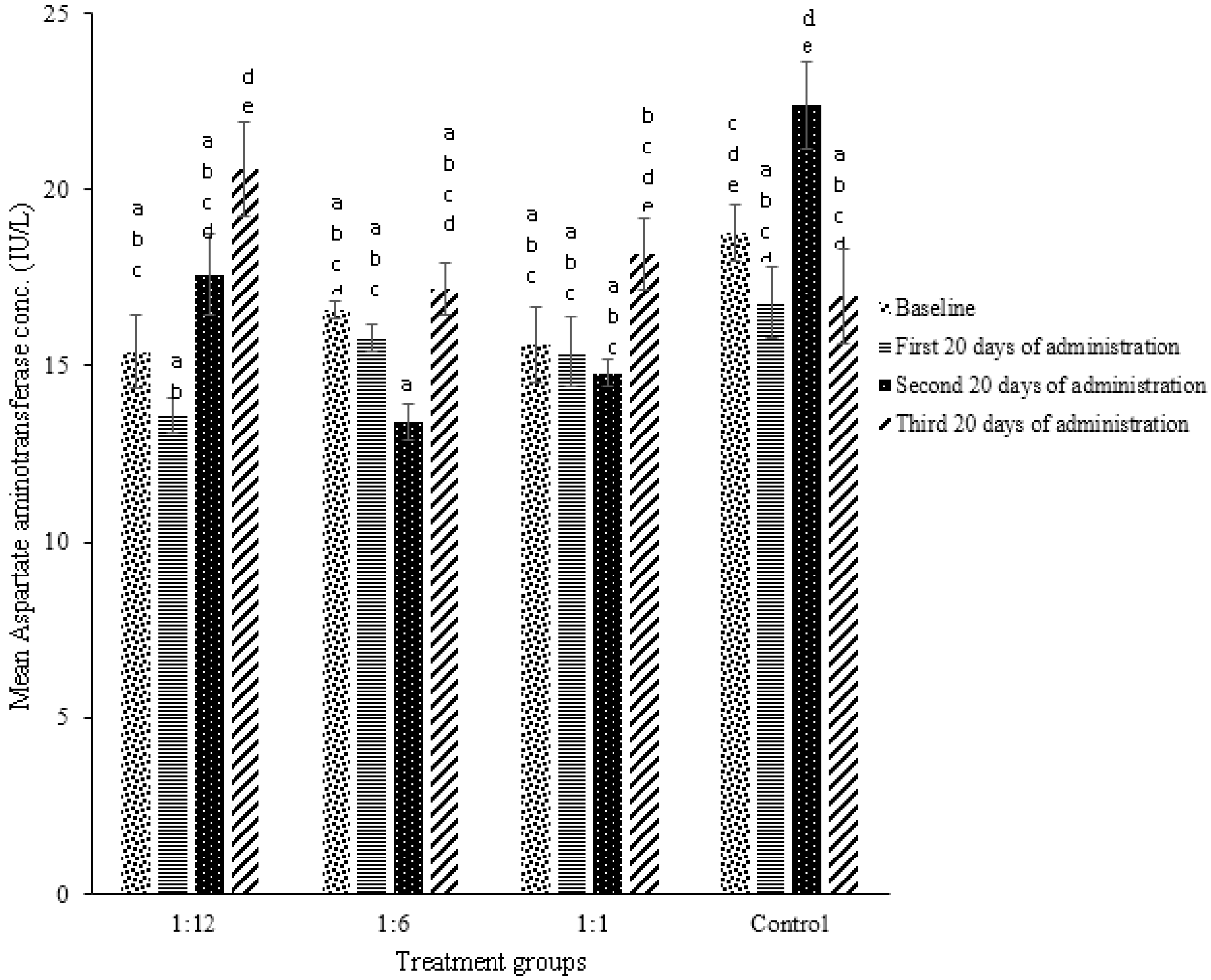

Figure 6: Concentration of Aspartate aminotransferase (AST) enzyme in female African giant rats (Mean ± SEM); Bars having the same letters are not significantly different from each other (p > 0.05)

It could also be indicative of the damage other than liver because AST is also produced by the muscle cells. Findings by Ityavyar *et al*. (2020) showed significantly high levels of AST in the female and male rats which supports results of the present study.

3.3.2 Alanine aminotransferase (ALT)

There were fluctuations in the means of ALT in each of the treatment groups. There was no significant difference in the mean ALT recorded at third 20 days of administration between the group fed with the lowest and highest concentration of feeds but each was significantly higher than its corresponding baseline values and their control (Figure 7). The mean serum ALT recorded in the group fed with 1:6 concentration of feed at second 20 days of administration was significantly lower than its corresponding baseline and control. There was statistical significance in the overall mean ALT level among the groups (F = 10.079, df = 79, $p < 0.05$).

The highest and lowest concentrations of *R. communis* seed powder used in the present study had no significant effect on the serum ALT level in female AGRs as the length of time of administration increased. However, median concentration of *R. communis* seed powder significantly lowered the ALT level in female. This could mean that *R. communis* seed powder did not cause adverse effect to the liver functions in the female. Serum ALT was reported to be the major liver enzyme used to evaluate liver malfunction (Imafidon and Okunrobo, 2012).

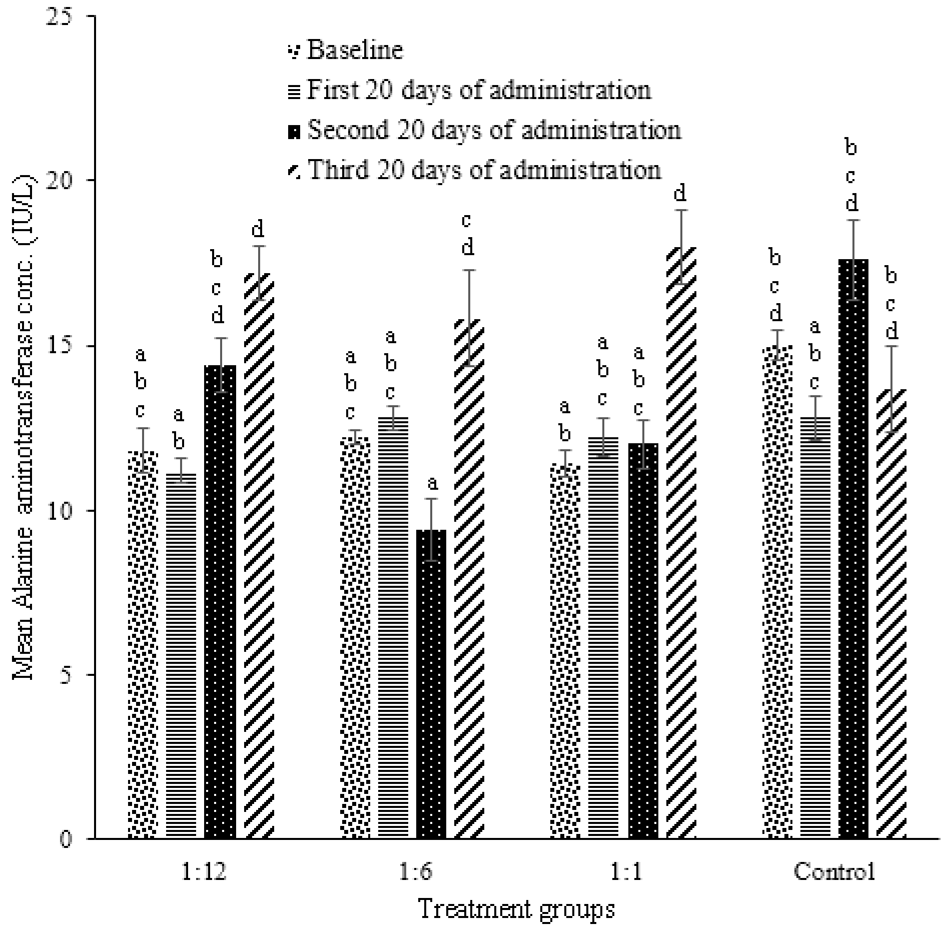

Figure 7: Concentration of Alanine aminotransferase (ALT) enzyme in female African giant rats (Mean ± SEM); Bars having the same letters are not significantly different from each other (p > 0.05)

3.3.3 Alkaline phosphatase (ALP)

There was no significant difference between the mean serum ALP recorded in the group that received highest concentration of feed at third 20 days of administration and its corresponding baseline value and even its control (Figure 8). However, there was significant increase in the mean ALP recorded in the groups fed with 1:12 and 1:6 concentration of feed at third 20 days of administration compared with their corresponding baseline values. There was statistical significance in the overall mean ALP level among the groups ($F = 4.116$, $df = 79$, $p < 0.05$).

ALP is the serum enzyme produced in the biliary system of the liver. Its release in large amount to the blood stream is indicative of the damage to bile duct. The results of the present study revealed that highest concentration of the *R. communis* seed powder incorporated in the diet did not have significant effect on the serum ALP level in the female AGRs used in this study. But lower concentration showed significant increase in the serum ALP level. Thus, low concentration of *R. communis* seed powder has potential of stimulating the biliary system to produce large amount of serum ALP and this could have adverse effect by inhibiting the function of the bile duct. This is similar to the report of Elagib *et al.* (2012) that serum ALP was higher in the rats in the treated groups.

3.4 Effect of *Ricinus communis*-formulated diet on the ovarian histology of the African giant rats

The results obtained from the histopathology of the ovary of AGRs are shown in Figure 9. All the treatment groups show the follicles of the ovaries at different stages of development. Some follicles have vacuolar cells at the membrane of the lumen with a deeply eosinophilic material pushing the oocytes to one side of the lumen. However, no visible lesion was observed in the ovaries of the African giant rats in all the treatment groups.

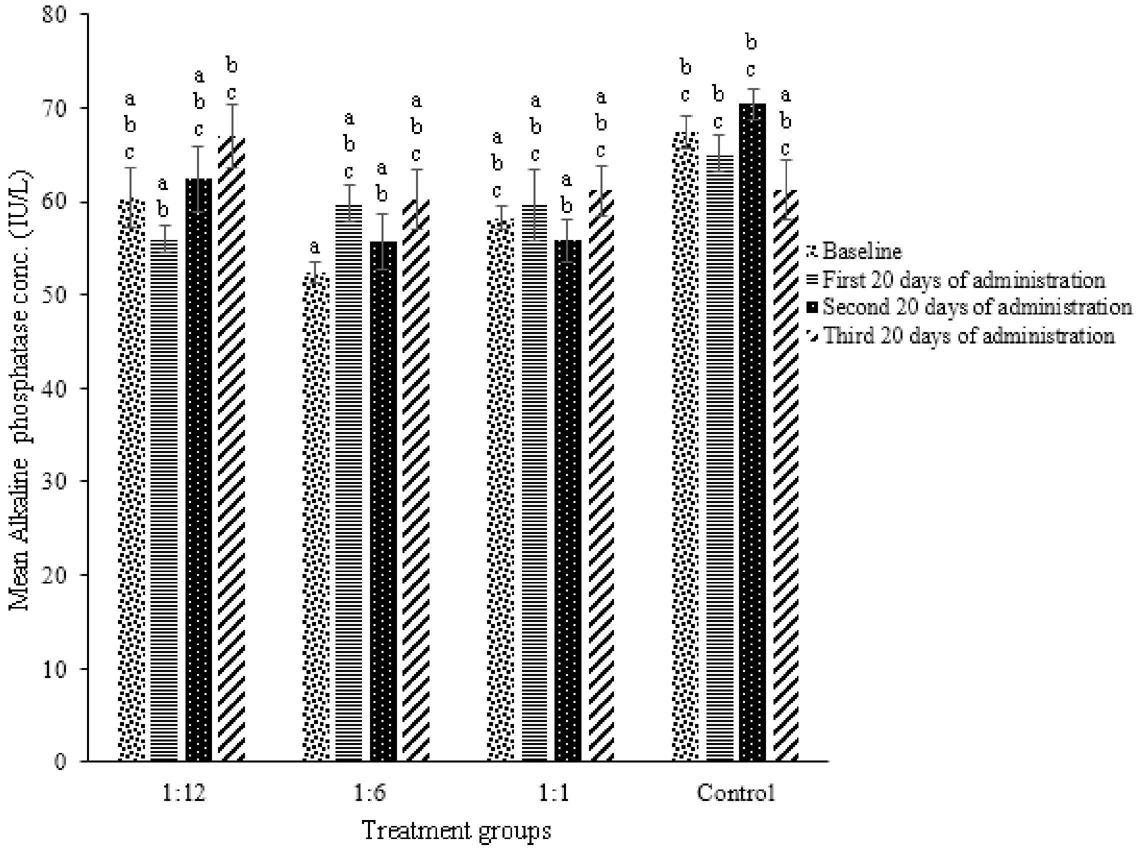

Figure 8: Concentration of Alkaline phosphatase (ALP) enzyme in female African giant rats (Mean ± SEM

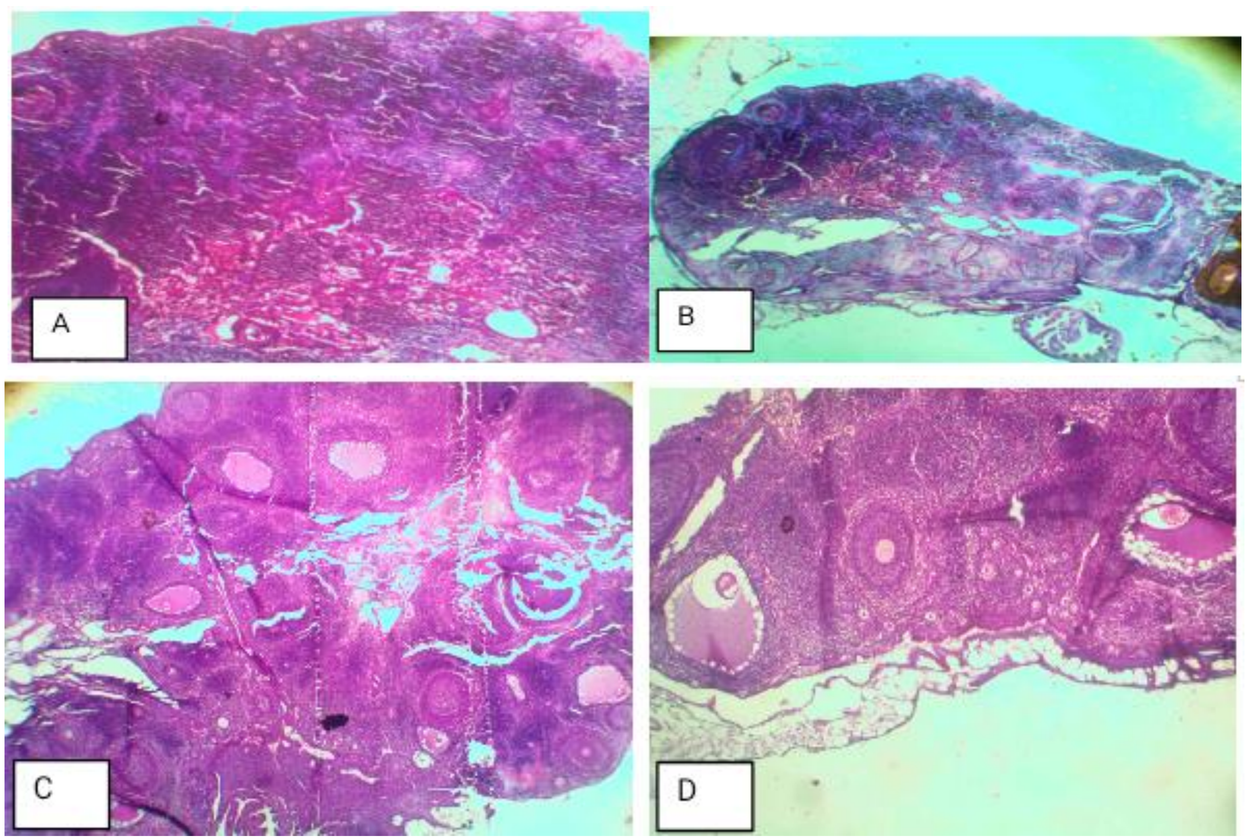

Figure 9: 100x H&E cortex and medulla and follicles at different stages of development in the female African Giant Rat (a) fed with 1:12 experimental feed (b) 1:6 experimental feed (c) 1:1 experimental feed (d) in the control group

4. Conclusion

Castor seed powder has the contraceptive potential in the wildly caught female African giant rats. The rate of consumption of the feeds formulated with the castor seed powder depicts its acceptance and palatability as a bait by the African giant rats. It could therefore be recommended for use by the farmers in combination with other rodent population management methods in order to have more ecofriendly, humane and effective management of rodent pests.

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