Effect of Aqueous Root Extract of *Senna siamea* Lam Reproductive Parameters of Male Wistar Rat (*Rattus norvegicus*)

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ABSTRACT

Stress on animal considerably affects the relative efficiency by which body processes occur. The aim of this work is to study effects of aqueous root extract of Senna siamea on morphormetrics and some reproductive parameters using male wistar rats. Twenty weaned male wistar rats with average weight 86-97g were used for the study. The rats were randomly allotted based on their initial body weights (BW) into five (5) treatments (control; 0.25; 0.50; 0.75 and 1.00 ml/ kgBW) comprising six (6) rats. Feed and fresh water were given ad libitum. The aqueous extract was administered via oral route in the morning for ten (10) days consecutively. The results reveal that animals in the treated groups had better bodyweight and intestines than the control. The *effect on sperm characteristics produced significant effect on mass motility, sperm concentration and abnormalities and insignificant effect on colour and mass activity in the treated rats compared to control. It is concluded that the extract is safe and beneficial if taken in safety dose. The results of this study justify the use of this plant as traditional medicine.*

Keywords: *morphometric, reproductive, root, Senna siamea, traditional medicine*

INTRODUCTION

The science of phytotherapy (treatment by the use of plants or herbs) has increased tremendously. It has developed over the centuries into a recognized form of therapy to the extent that many conventional physicians are turning from the ordinary form of treatment used by doctors, depending much on drugs and surgery to the use of natural methods (Fatehi, Rashidabady and Fatehi-Hassanabad, 2003). They have succeeded using the plants and herbs because of the disappointing results of the much vaunted wonder drugs with short time only to be succeeded by new ones. A major factor limiting the wider food usage of many tropical plants is the ubiquitous occurrence in them of a diverse range of natural compounds capable of precipitating deleterious effects in man and animals. Manifestations of profound neurological effect and even death. Compounds, which act to reduce food intake or nutrient utilization, are often referred to as anti-nutritional factors. Phytochemicals were known to show medicinal activity as well as exhibiting physiological activity (Edeoga, Okwu and Mbaebie, 2005). Previous studies have shown that the aqueous

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contains arrays of active principles (Fatoba and Ajigbogun, 2015) which makes the plant useful in phytomedical and confers protection to the plant from microbial, insect, and herbivores damage (Conco, 1999). The physiological and health status of animal needs attention, particularly with regard to reproduction and productivity. Reproductive development is affected by genetics and environmental factors and the interaction between these factors (Land, 1978). The herb *Senna siamea* is a non-nitrogen fixing leguminous tree in the subfamily Caesalpinoideae of the family Leguminosae (Fowler, 2006). The use of *Senna siamea* extract in the prevention and treatment of various diseases associated with some microorganisms prompted the scientific basis for the use of the plant in traditional medicine. Herbal medical science is the main spring of treatment in the rural areas, the facilities of modern science being very limited to the reach of millions in the rural areas of the country. It is necessary to utilize our local herbs as they are cheaper than the imported ones in a manner that such herbs do not inflict damage on the animal subjects but improve performance and productivity. Therefore, the aim of this research is to investigate the toxicity of *Senna siamea* root extracts on the reproductive parameters of wistar rat.

MATERIALS AND METHOD

Collection and Identification of Plant Materials: Naturally grown *Senna siamea* (root) was obtained from Sabo, Okitipupa, Ondo State and was authenticated by Dr. D. O. Aworinde in the Department of Biological Sciences (Botany). Twenty (20) weaned white albino rats (weaners) were obtained from Ile Nla, Ibadan, Oyo State.

Experimental Animals: Six (6) weeks male albino rats weighed between 85-100g were used for this study. The rats were housed in metabolic cages and fed for two weeks and allowed to acclimatize to the environment before commencement of the experiment. The animals were randomly set into five treatments of four animals per treatment for the study. The animals were allowed to feed on commercial feed and water was offered *ad libitum*.

Experimental Site: The experiment was conducted in the Zoological laboratory, Ondo State University of Science and Technology (OSUSTECH), Faculty of Science, Okitipupa, Ondo State.

Preparation of the Extract: The root of *Senna siamea* were uprooted, scraped, air-dried, pound with clean mortar and pestle and kept at room temperature (25ºC). The air-dried sample was later oven-dry to constant weight. Two hundred and fifty (250g) of the powdered plant parts was soaked in one (1) litre of distilled water and allowed to stay for 48 hours. It was filtered with 125mm Whatman ® 42. The resultant solution was kept in the refrigerator till the administration of the extract (Fatoba and Ajigbogun, 2015).

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Administration of Extract: The resulting filtrate (plant extract) of the coarse powder of *Senna siamea* root was administered by oral intubation varying doses (of 0 saline (Control); 2.5ml/KgBW; 5.0ml/KgBW; 7.5ml/KgBW and 10ml/KgBW) of plant extract daily for 10days. They were maintained for twenty- eight (28) days prior to the termination of the study. All the animals were sacrificed at the end of four weeks for various physiological determinations.

Morphometric examination of vital organs: The rats were weighed on electric sensitive scale, the values read and recorded, also livers, heart, stomach, lung, testis and spleen from all the animals were measured using the scale. The measurement of body size and tail lengths were done according to Koolhaas *et al* (1997). The body length is measured from the tip of the nose to the middle of the anus and tail length from the middle of the anus to the tip of the tail, scrotal circumference was measured at the widest part of the pair of testes (Notter, Lucas and McClaugerty, 1981) by tying the thread around it and then extrapolates on the ruler and recorded.

Semen collection and analysis: Semen was collected through the surgical removal of the testes and encapsulated the content into collecting tube (Karagiannidis, Varsakeli, Alexopoulos and Amarantidis, 2000; Oyeyemi, Akusu and Ola Davies, 2001) and semen evaluation was done according to (Karagiannidis, Varsakeli, Alexopoulos and Amarantidis, 2000; Oyeyemi, Akusu and Ola Davies, 2001) procedure. The semen colour was determined by visual assessment. Mass activity was determine within one minute of collection in a drop of concentrated semen without cover slip under low magnification ($\times$ 4).

Statistical Analysis: All data obtained were analyzed by the one-way ANOVA in a Completely Randomized Design (CRD) with the COSTAT program and Duncan Multiple Range Test (DMRT) was used to rank means of treatments (Duncan, 1955).

RESULTS AND DISCUSSION

Table 1 shows the effect of aqueous root extract of the *Senna siamea* on albino rat's visceral organs. The results showed that the animals in the treated groups had better bodyweight than the control. Animals in the 2.5ml/kgBW showed highest bodyweight and the control showed lowest. The values are statistically different when compared. During the period of adjustment after the administration of the extracts, presence of worms suggested to be *Ascaris lumbicoides* was observed in the water of the treated groups. All the organs such as; heart, kidney, liver, lung, testis and pancreas are higher than the control except the intestine in the highest dose. The values of kidney, liver, lung, testis, pancreas and intestine are statistically different ($p<0.05$) except the heart which are similar ($p>0.05$) when tested.

ISSN: 2141-2731

Effect of aqueous root extract of *Senna siamea* on spermiogramic parameters of male albino rats is presented in table 2. The colors of the semen are white and mass activity of the treated are higher than the control. The mass motility and sperm concentration are higher in the treated groups than the control. The values of mass activity, mass mortality and sperm concentration are statistically different ($p<0.05$). The abnormalities (primary, secondary and tertiary) are lowest in the 2.5ml/kgBW than the rest of the treatments and the highest was observed in the highest dose. The values were statistically different when compared. All treatments produced higher mean body weight than the control (Table 1). The bodyweight of the rats in each group generally increased throughout the experimental period when these values tested were found to have significant increased ($p< 0.05$).

The result on the scrotal circumference in the rats is presented in table 2. The net scrotal circumference of the control was lower than the treated groups (Table 3). When these values were tested, it was found that the scrotal circumference of the control and the treated animals were not the same ($p<0.05$). The colour of the ejaculates of the control and the treated groups occurred as white. The mass activity of the semen analyzed increased ($p<0.05$) with the levels of the extracts. The values were tested statistically and the mass activity of the treated groups are same but different from the control ($p<0.05$). The effects of extract on the mass motility of the semen of the tested animals were found to increase with the levels of the extract and the motility of the semen of the control was lower ($p<0.05$) than those of the treated rats. The values of the treatment groups were same ($p>0.05$). The sperm concentration increased with the levels of extract and was there was significant increase ($p<0.05$) from the control. However, extract enhanced increase in the number of sperm per cell with respect to the concentration used. The morphological characteristics are shown in Table 2. There was a significant increase in spermatozoa abnormalities following root plant extract treatment ($p<0.05$). All the abnormalities increase with the level of treatments and significant ($p<0.05$).

Previous study shows that the aqueous extract is safe (Fatoba and Ajigbogun, 2015) for consumption. This may explain the continual use of its root extract in Nigerian folk medicine. The gain in body weights recorded during the period of the study could be attributed to the fact that the rats were maintained on a standard diet throughout the period of the study and also the anthelminthic properties demonstrated by the extract. This result agrees with other works who reported similar observation with seed extract used as worm expeller (Mbatchi *et al.*, 2006; Orwa, Mutua, Kindt, Jamnadass and Anthony, 2009). Also, similar report has shown that the root extract produced hypoglyceamic effect and thereby enhance bodyweight (Odason and Kolawole, 2007). However, the hypoglyceamic mechanism of the plant extract is yet unknown. Histological studies reveal that this plant extract has no toxic effects on the organ examined. The results from this study reveal that the extract of the root of *Senna siamea* did not have deleterious effect on Liver, kidney, heart, stomach, lung, testis and pancrease. The effect of the extract on body weight of rat (treated

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with oral dose daily for ten days) reveals that the extract of *Senna siamea* root has beneficial effect. The increases in body weight observed were due to normal growth resulting from nutritious feeding. The study show that the organs integrity was not compromised by the extract during the treatment periods. The result obtained from this work explains the reason for the continuous use of the root of *Senna siamea* as a safe drug in the management of diseases in traditional medicine. The observed effect of the different doses of extract on bodyweight confirm the efficacy of the extract to enhance such parameters as bodyweight, scrotal circumference, mass activity, mass motility and sperm concentrations. This is supported by several studies such as Notter, Lucas, McClaugerty and Cpenhaver (1985); Sutama and Edey (1985), which have shown close relationship or association of these parameters with sperm production. The increasing activity (stimulatory) of this extract was indicated in the higher body weight of animal treated with extract. The contention of Notter, Lucas, McClaugerty and Cpenhaver (1985) and Sutama and Edey (1985) on the association of bodyweight with testicular development in growing animal are manifest in this study.

The observation in this study on the scrotal circumference in relation to the production of spermatozoa is in line with the reports of Johnson, Robinson and Dillard (1974) and Rahje, Johnson and Lunstra (1995). In line with the opinion of Cameron, Fairnie, Curnow, Keogh and Lindsay (1984) the scrotal circumference as obtained in this study can be used as an index of spermatozoa production under farm condition. According to Smith and Somande (1994) the same parameter can be used to predict the testicular weight. It was observed in this study that rats which had higher bodyweight and scrotal circumference also had increased sperm concentration. This observation is in line with the finding of Belbasaki and Koulmizist (2000) that there is a certain bodyweight and scrotal circumference below which sperm production could be adversely affected. Amann and Schanbacher (1983) and Trejo, Ponce and Vidal (2000) indicate that the scrotal circumference provides a bigger scope for assessing and improving the fertility in the male animals than any other semen characteristics. In addition, the study agrees with the report of Amann and Schanbacher (1983) that semen characteristics increase appreciably with increase in scrotal size.

The increase in sperm motility is in line with the report of Hurd *et al* (1992) that alkaloid increases sperm motility at low concentration, but the ability of alkaloid to decrease the percentage of motile sperm at high concentration may explain the decreased sperm motility associated with the use of alkaloid. The observation that the sperm concentration declined in the treatment group that received a higher dose of extract suggested that a high dose rate such as 10ml/kgBW of extract for rat per day for 10days given in this study could produce suppressive effect on the hypothalamus. A negative feedback may have been established that worked for further decrease in testosterone levels, which in turn reduced the process of spermatogenesis (Ganong, 2005). The observed decrease in sperm concentration following exposure

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to higher dose treatment and the accompanying steady proportion of abnormal spermatozoa indicated that the treatment had adverse effect on the spermatogenic cells. This could be due to presence of barakol which could affects the epididymal sperm and spermatogenic efficiency due to effect on the testes (Osinowo, 2006). The increase in spermatozoa abnormalities following 7.5ml and 108ml treatment in this experiment indicates that extract at this dose caused a high release of immature spermatozoa and inhibited maturation of sperm cells.

Intake of cocaine and marijuana at high doses in growing male animals will cause spermatozoa abnormalities and inhibit sperm fertility (Cone, Kalo and Hillsgrove, 1996), a factor that may be responsible for the significant reduction in sperm concentration. Trejo, Ponce and Vidal (2000) report detrimental effect of cocaine on scrotal circumference at higher dose and abnormalities do occur in the sperm cells at doses of 7.5ml and more. So the level may not be suitable for the rat. The result from this study reveals that the extract of the root of *Senna siamea* did not have deleterious effect on Liver, kidney, heart, stomach, lung, testis and pancreas. The study shows that the organs integrity was not compromised by the extract during the treatment periods. The result obtained from this work explains the reason for the continuous use of the root of *Senna siamea* as a safe drug in the management of diseases in traditional medicine. The histopathological examination reveals that the extract of the root of *S. siamea* did not have significant effect on the organs examined.

CONCLUSION

The crude aqueous extract of the root of *S. siamea* shows no deleterious effect on body organs examined and reproductive parameters evaluated. The finding suggests that the root extract of *Senna siamea*, is relatively not toxic on kidney, liver, lungs and intestine at oral dose of <10ml/kgBW for period of administration and extract did not alter the semen quality. It could be concluded that the root aqueous extract of *Senna siamea* could be prepared as alternative drugs for its cost, safety, bioavailability, accessibility and should be considered as a potential source of useful drugs in industries.

Table 1: Effect of aqueous root extract of *Senna siamea* on white albino rat's organs

		TREATMENTS (ml/kgBW)				
ORGAN	**Control (0)**	**2.5**	**5.0**	**7.5**	**10**	**S.E**
Body weight(g)	150.80^{c}	232.20^{a}	214.70^{b}	199.20^{b}	169.30^{c}	5.6428
Heart	0.50	0.60	0.55	0.60	0.60	0.0547
Kidney	1.00	1.20	1.30	1.20	1.20	0.0596
Liver	5.50	6.50	5.70	6.70	7.80	0.0252
Lung	1.50	2.20	2.20	2.30	2.50	0.0633
Testis	2.00	2.20	2.20	2.30	2.50	0.0633
Pancreas	0.40	0.50	0.60	0.60	0.60	0.07416
Intestine	15.50^{b}	22.00^{a}	18.50^{ab}	16.60^{b}	15.20	0.2394

a,b,c; values along the same row with different superscripts are significant ($p < 0.5$)
S.E = Standard error ***Source:*** Experimentation, 2016

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Table 2: Effect of aqueous root extract of *Senna siamea* on Spermiogramic parameters of white albino rats

	TREATMENTS (ml/kgBW)					
PARAMETER	**Control (0)**	**2.5**	**5.0**	**7.5**	**10**	**S.E**
Colour	White	White	White	White	White	__
Mass activity	2.00	2.50	2.50	2.50	2.25	0.7071
Mass motility	70^{b}	80^{a}	80^{a}	80^{a}	75^{ab}	1.6036
Sperm concentration $\times 10^{7}$	6.8^{c}	7.8^{a}	7.3^{b}	7.1^{b}	7.0^{bc}	2.7306
Sperm abnormality						
1^{0} (Primary)	10^{b}	9^{b}	12^{a}	12^{a}	13^{a}	0.2582
2^{0} (Secondary)	24^{b}	20^{c}	27^{a}	25^{ab}	28^{a}	0.6508
3^{0} (Tertiary)	12^{b}	11^{b}	12^{a}	12^{b}	15^{a}	0.61257

a,b,c; values along the same row with different superscripts are significant (p)
S.E = Standard error

Source: Experimentation, 2016

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