



## Prolificacy of reproductive stimuli in *Senna siamese* methanol crude extract of female *Rattus Norvegicus*

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**Abstract:** Infertility is a persistence ineptitude to develop into pregnancy successively after 12 months of continuous, precarious sex between couples or recurrent sexual intercourse. This study investigates the fecundity potential in *Senna siamea* methanol extract in female Wistar rats. Standard method was inculcated using female Wistar rats weighing 190-210 g. five experimental groups (n=5) were randomly selected after acclimatization. Fertility study was assay for *in-vivo* antioxidant study, hormonal indexes, lipid profile and histopathological study of graded doses at 25, 50, 100 mg/kg *Senna siamea* methanol extract. The analysed antioxidant assay exhibit a broader scavenging effects against radicals' oxidative stress in enzymatic *in-vivo* assay via a significant decrease ( $p > 0.05$ ) in Malondialdehyde (MDA) concentration with a slight increase in superoxide dismutase (SOD), catalyse and glutathione peroxidase levels, which perhaps could be implicated as one of the mechanisms of action through which the extract elicit its efficacy. The extract stimulate the release of oestrogen, follicle stimulating hormone, luteinizing hormone and progesterone with a significant increase ( $p > 0.05$ ) level across the test groups when compared with the untreated control. A slight increase in cholesterol, triglyceride, high density lipoprotein (HDL), low density lipoprotein (LDL) and very low density lipoprotein (VLDL) concentration in the treatment groups when compared with the control and Vitamin E. the histopathological study showed no damaging architectural variation on the testes of the test groups in comparative to the untreated control. In conclusion, the fertility effect of the extract validates the plant folkloric uses for therapeutic purposes.

**Keywords:** Reproductive, Prolificacy, *Senna Siamese*, *Rattus norvegicus*

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### INTRODUCTION

Since ancient times, humans exclusively depend on herbal medicine as therapeutic sources (Kumar et al, 2015). Natural products obtained from plant materials aid in the management of several global diseases. Orthodox system of health preparation involved



in current medical centres due to the present of therapeutic phytochemical finding (Sachin and Choudhary, 2016). Traditional medicine required entire practices, skills and knowledge trotted in plant ethics, aboriginal understandings and principles of different cultures, either with rational or not, of healthy existing, also for the management, diagnosis and prevention of corporeal and mental ailments (World Health Organization, 2000). WHO endorse herbal measures in curing possible health complications, also, are absolutely inexpensive and synchronous to incorporate it into human ethos (World Health Organization, 2013). Discovery of compounds like; ergotamine, yohimbine, vincristine, artemisinin, quinine, and emetine were acquired from herbal medicine expressed as immense potential associated with innovation and mixture of certain new and semi-synthetic ingredient from expected sources (Gevid et al, 2005).

Oxidation are biochemical matters capable of unrestricted existence with a single or numerous unpaired electrons initiated in atomic orbital (Halliwell, 1997). Free radicals could be regularly synthesis via metabolism (Lobo et al, 2010). Most cells exploits oxygen to synthesized energy via mitochondria derivatives produced in the process. The derivatives are characteristically a reactive oxygen species (ROS) with reactive nitrogen species (RNS) resultant to redox cellular development. Free radicals retains divergent affinity for nucleic acids, carbohydrates, lipids and proteins (Velavan, 2011). Anti-oxidant can be defined as some essential constituent liable for deferrals or removal of oxidative damage on selected particle in the generative organs (Halliwell and Gutteridge, 1995). Humans have established an extreme intricate antioxidant assemblies (enzymatic and non-enzymatic) functioning synergistically via combination one or more defensive cells, organ and systems against free radical damage. Antioxidants can either be categorized as exogenous and endogenous materials for diet or alimentary supplements. Designated dietary mixtures which cannot be counteract by free radicals, relatively develop as endogenous property characterised as anti-oxidants (Kurutas, 2016). Endogenous antioxidants exhibits an indispensable character in supporting optimal cellular influence, therefore prone to systemic health and wellbeing. The maximum adept enzymatic anti-oxidants includes; catalase, glutathione peroxidase and superoxide dismutase. Non-enzymatic antioxidants comprises of natural flavonoids, Vitamin E and C, thiol antioxidants (glutathione, thioredoxin and lipoic acid), carotenoids and melatonin (Kurutas, 2016).

*Senna* species are derived from Arabic word 'Sana' defining plants leaves and pods that retains discharging and purgative effects. *Senna siamea* is a large genus of pinnacle plant, which belongs to the legume family to possess essential biological character serving as a biological cause in an ecosystem (Orwa et al, 2009). It happens in diverse forms of coastal forest, usually utilized as shade trees, shelter straps, fodder, windbreak or hedgerows, food, erosion regulator, timber, host plants, intercropping, recuperation, ornamentals, poisons, and as sources of medicine. All of its parts are utilized as tanning in China. Herbalists uses the fruits to calm the intestinal worms and avert seizure in children (Orwa et al, 2009).

Infertility involved the ineptitude development of pregnancy after 12 months of sturdy, unprotected sex between couples or recurrent copulation (Centers for Disease Control and Prevention, 2017). Infertility also can be distinct as the incompetence of couples to attain pregnancy in an average period of per annual (woman below 35 years) or (in a woman exceeding 53 years) in spite of passable, consistent unsafe sexual intercourse. Infertility are usually attributed to woman, man, or both with primary or secondary (Centers for Disease Control and Prevention, 2017). Primary infertility involved couples



not able to conceive; while secondary infertility required a strain conception after being initially conceived (either approved pregnancy or miscarriage). Secondary infertility is in contemporary to the variation of partners in a period of one year, which are associated with irregular balances of infertile. The unfeasibility to have children serves as an anguishes to couples generally and brings about receptive and mental desolation to women and men. Several factors are liable for infertility including; genetic, environmental, physiological and social factors enhancing infertility (Maya et al, 2012). Childbirth and raising up offspring are tremendously significant measures in every individual's life having a sturdily link with decisive goals of wholeness, pleasure and family assimilation. It is broadly putative to human actualities extents to wholeness via a child accomplishment of individual's prerequisite for reproduction. Infertility in females can be attributed to underlying medical ailment that may impair fallopian tubes, inhibits ovulation or triggered hormonal difficulties. World Health Organization (WHO) state infertility as a sexual transmitted ailments or reproductive infections primary to Latin America and Africa (World Health Organization, 2000). Varied causes are typically assessed in semen analysis to spare head infertility in men. Semen analysis currently serves as a chief fertility evaluation with persistently semen quality like viability, sperm motility, morphology and sperm count (Khatun et al, 2018). These medical situations like pelvic inflammatory ailment, endometriosis, impulsive ovarian botch, uterine fibroids, polycystic ovarian illness and environmental causes (Centers for Disease Control and Prevention, 2017). The foremost roots of infertility is related to men including; testicular syndrome or ejaculatory protagonist: and the caused might perhaps be varicocele (testicular veins to broaden the result of over-heating (heat interruption, quantity or sperm formation); testicular trial; ghoulish conducts involving alcoholism, smoking, anabolic steroid; cancer chemotherapy; surgical exclusion of testicles; radiation, medical condition include; cystic fibrosis, diabetes, convinced sets of autoimmune syndromes; ; sperm antibodies; incidence of anti-thyroid (Centers for Disease Control and Prevention, 2017).

## METHODS

*Plant Materials:* Freshly harvested leaves of *Senna siamea* was obtained in the Northern part of Nigeria. The plant was properly identified and authenticated by Dr. Timothy Odaro in the herbarium unit of Plant Biology and Biotechnology, Life Sciences, University of Benin with Voucher number GE:V205 of the deposited specimen. *S. siamea* leaves were rinsed with distilled water and air dried in a shade. It was crushed into powder using a mechanical grinder, then prepared for extraction.

*Preparation of extracts:* The powdered samples was maceration using methanol solvent for 72 hours. The filtrate obtained from the solvent extraction was fix dried to a semisolid extract. Percentage yield of 109.7 gram was achieved and conserved until ready for use (Mukherjee, 2002).

*Experimental animals:* Twenty five Wistar rats weighing 190-215 were gotten from the Department of Pharmacology and house in the Animal section of Biochemistry, University of Benin, Benin City Nigeria, in a spacious and well ventilated plastic cages under proper temperature, with constant grower chew and water with comparative humidity for 14 days during acclimatization. Ethical approval for proper handling and the use of experimental animals was sorted for in Life Sciences ethical committee, with ethical number LS020163.



*Experimental protocol for fertility study:* Female albino rats obtained and indiscriminately divided in five groups (n = 6). Treated groups received 25, 50, 100 mg/kg of *Senna siamea* extract orally. 20 mg/kg Vitamin E and untreated control

Group A: administered 25 mg/kg *Senna siamea* extract.

Group B: administered 50 mg/kg *Senna siamea* extract.

Group C: administered 100 mg/kg *Senna siamea* extract.

Group D: administered 20 mg/kg Vitamin E orally.

Group E: administered 5 mL/kg vehicle orally.

These substances were given daily to the respective groups throughout the periods of 28 days. The animals were sacrificed under mild chloroforms anaesthetic. Blood samples and uterus were isolated for analysis.

*Oestrogen assay:* Secure the desired number of coated wells in the holder. Dispense 10  $\mu$ l of standards, specimens and controls into appropriate wells. Dispense 100  $\mu$ l of oestrogen -HRP Conjugate Reagent into each well. Dispense 50  $\mu$ l of the anti- oestrogen reagent to each well. Thoroughly mix for 30 seconds. It is very important to mix them completely. Incubate at 37°C for 90 minutes. Remove the incubation mixture by flicking plate contents into a waste container. Rinse and flick the microtiter wells 5 times with deionized or distilled water. Do not use tap water. Strike the wells sharply onto absorbent paper or paper towels to remove all residual water droplets. Dispense 100  $\mu$ l of oestrogen Reagent into each well. Gently mix for 5 seconds. Incubate at room temperature for 20 minutes. Stop the reaction by adding 100  $\mu$ l of Stop Solution to each well. Gently mix 30 seconds. It is important to make sure that all the blue colour changes to yellow colour completely. Read absorbance at 450 nm with a microtiter well reader within 15 minutes (Choudhary and Steinberger 1975).

*Progesterone assay:* All reagents should be allowed to reach room temperature (18-25°C) before use. Pipette 50  $\mu$ l of standards (ready to use) and diluted samples into appropriate wells within 5 minutes. Add 100  $\mu$ l of progesterone Enzyme Conjugate Solution to each well (except those set for blanks). Mix well for 30 sec. and incubate for 60 minutes at 37°C. You may use par film to cover the wells or use appropriate zip-lock bag to store the plate during the incubation. Discard the contents of the wells and wash the plate 5 times with Wash Solution (250-300  $\mu$ l) per well. Invert plate, tap firmly against absorbent paper to remove any residual moisture. Add 100  $\mu$ l (TMB) Substrate solutions to all wells. Remember to follow the pipetting order. Incubate the plate at room temperature (18-28°C) for 10 minutes without shaking. Stop reaction by adding 50  $\mu$ l of Stopping Solution to wells in the same sequence that the Substrate Solution was added and gently mixed. Read the absorbance at 450 nm with a microwell reader.

*Luteinizing hormone (LH):* A standard method described by Zegers-Hochschild *et al.* (2009) was used to determine the level of LH in the serum samples.

*Follicle stimulating hormone:* Centrifuge samples were assayed using a microplate reader set to 450 nm. This procedure was described by Zegers-Hochschild *et al.* (2009).

*Lipid profile:* Total cholesterol was determined using enzymatic method using wet reagents diagnostic kits. This uses a modified method of Trinder, (1969). Total



triglycerides were determined using enzymatic method with wet reagent diagnostic kits. This is a modification of the method of Tietz, (1995). High density lipoprotein was determined using the enzymatic method. A precipitating agent consisting of 25 mmol/l magnesium chloride and phosphotungstic acid at 0.55 mmol/l were used (Friedwald et al, 1972).

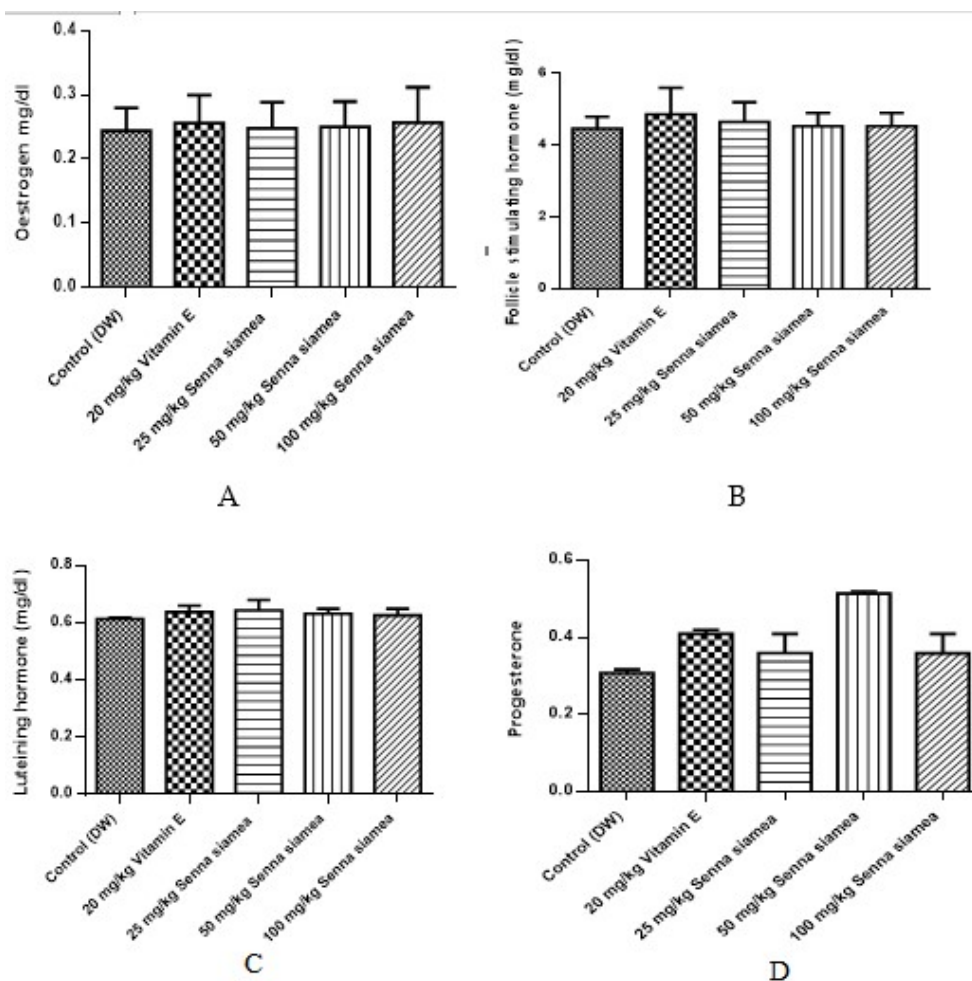
*Determination of anti-oxidant property of the extract:* Superoxides Dismutase (SOD) method was described by Bagul et al, (2005) Principle; Auto-oxidation with heamatoxylin (increases the absorbance at 560 nm wavelength) inhibited SOD effect assay at pH 7.8; Percentage level of SOD standard within specific ranges. SOD activity in the sample is determined by measuring the amount of heamatin present. The assay used Bagul et al, (2005) method. Test principle: Catalase scavenging hydrogen peroxide, converted into molecular oxygen and water. The determination of MDA effect using method of Bagul et al, (2005) Test principle: The MDA assay is based on the reaction of MDA with thiobarbituric acid (TBA); forming an MDA-TBA<sub>2</sub> adduct that absorbs strongly at 532 nm. Glutathione peroxidase property was calculated in relations to the initial directive rate constant for tetra-butyl hydroperoxide decay.

*Histopathological analysis:* Organs such as uterus and ovary was affixed using buffered Bouie's fluid. Affixed uterus and ovary were utterly dehydrated with 99.9 % ethanol along with 70 % ethanol, 96 % ethanol and washed using distilled water. 4  $\mu$ m slices were set, fixed in haematoxylin-eosin dye stained. Stained tissues were captured with (Leica MC170 HD, Leica Biosystems, Germany) optical photomicroscope, viewed using x 400 magnification (Drury and Wallinton, 2013).

*Statistical analysis:* Results obtained were analysed via Mean  $\pm$  SEM using 6 version of graph pad prism. Data were further analysed via ANOVA and Dunnett test. Significant differences were measured at  $p < 0.05$ .

## RESULTS

Plant materials over the years have been useful in promoting fertility via an increase in progesterone and oestrogen level. The level of progesterone and oestrogen showed a significant increase with dose dependent of *Senna Siamese* extract when compared with the control. This also explicated the exploration of *Senna Siamese* with an increased in the level of luteinizing and follicle stimulating hormone when compared with the control. Thereby it signified that the extract either excite or synthesize the implicated hormone required for fertility. Transaminases bio-markers are the scavenging redox factor liable for enzymatic antioxidant activity and the aptitudes against macromolecule oxidative stress. Oxidation stimulate damages related to cellular membranes in thiobarbituric acid receptive substances (TBARS) assay. The assay aid in the measurement of malondialdehyde (MDA) level of *Senna Siamese* against lipoperoxidation (LPO). *Senna Siamese* reduces over-discharge of free radicals into the systems, therefore sustained MDA levels at tolerance ranges in graded doses of the extract. Toxic plants investigation showed depletion in GSH content in plasma samples, thereby acting as a pro-oxidant effects of the *Senna Siamese*, to overcome free-radical stress, GSH aids as first line protection against oxidation. Superoxide Dismutase and Catalase establish a major enzymatic defensive mechanisms, catalyzing and decomposing ROS.



**Figure 1A, B, C, and D:** Effect of methanol *Senna Siamese* herbal remedy on reproductive hormones

Cholesterol level in humans is known as a steroidal metabolic hormones acting as an activator (aldosterone, cortisol, estrogens and androgens) that enormously regulate their physiologic functions. Formation of the hormonal level can potential increase when Triglycerides, Total Cholesterol, Very Low Density Lipoproteins, High density Lipoproteins and Low Density Lipoproteins are secreted in considerable quantity. Methanol extract of *Senna Siamese* at graded doses significantly ( $p < 0.05$ ) regulate TAG, TC and LDL level with slight increase in HDL values when compared with untreated control. Their actions could be as a result of an increased inhibition of cholesterol in intestine, which disrupted lipoprotein synthesis, therefore promote hepatic metabolism of LDL and other bad fats receptors.

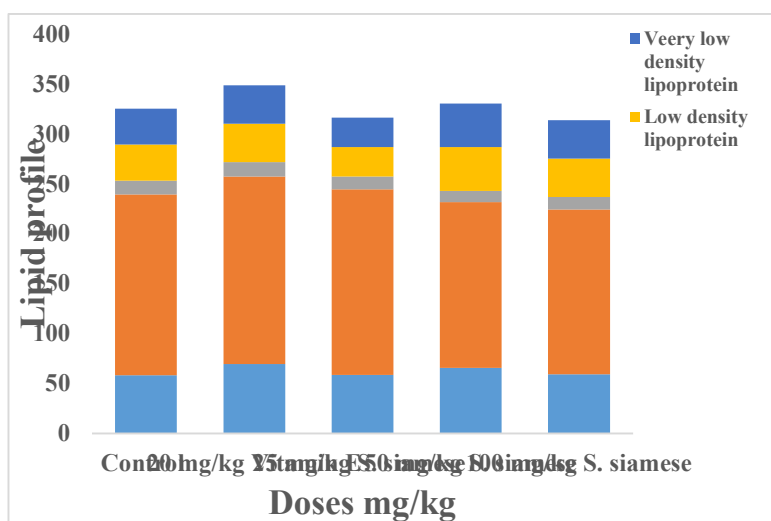


Figure 2: Effect of methanol *Senna Siamese* herbal remedy on lipid profile parameters

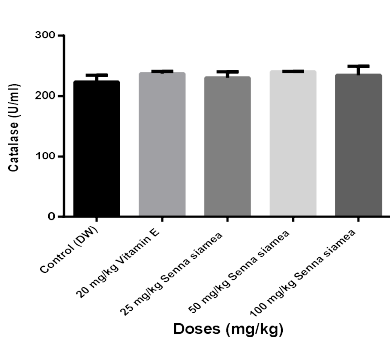


Figure 3: Effect of methanol *Senna siamea* herbal

methanol *Senna siamea* herbal remedy on catalase *in-vivo* enzymatic antioxidant

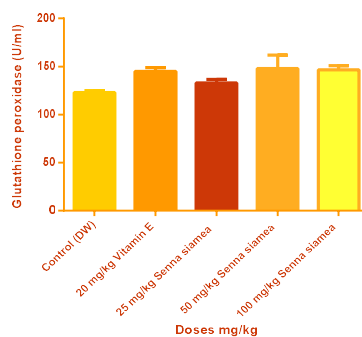


Figure 4: Effect of

methanol *Senna siamea* herbal remedy on glutathione peroxidase *in-vivo* enzymatic antioxidant

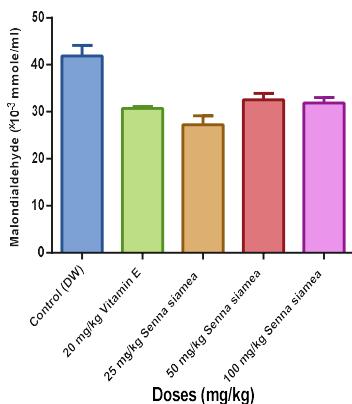


Figure 5: Effect of methanol *Senna siamea* herbal

*Senna siamea* herbal remedy on malondialdehyde *in-vivo* antioxidant

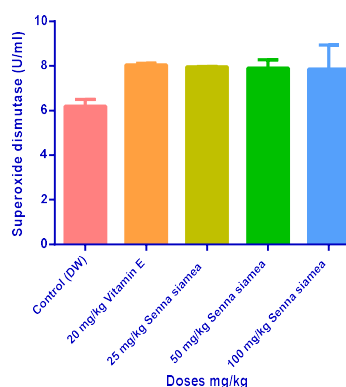
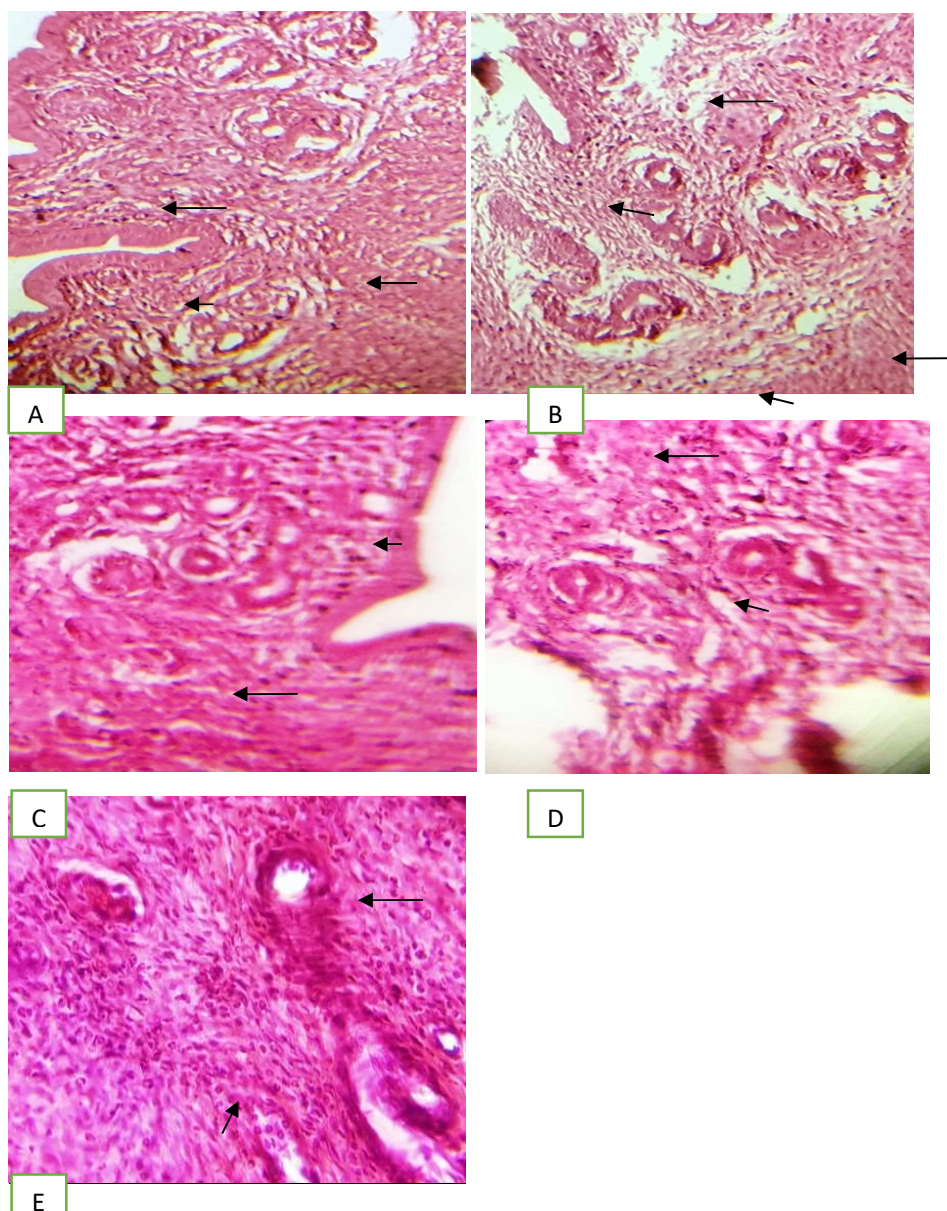


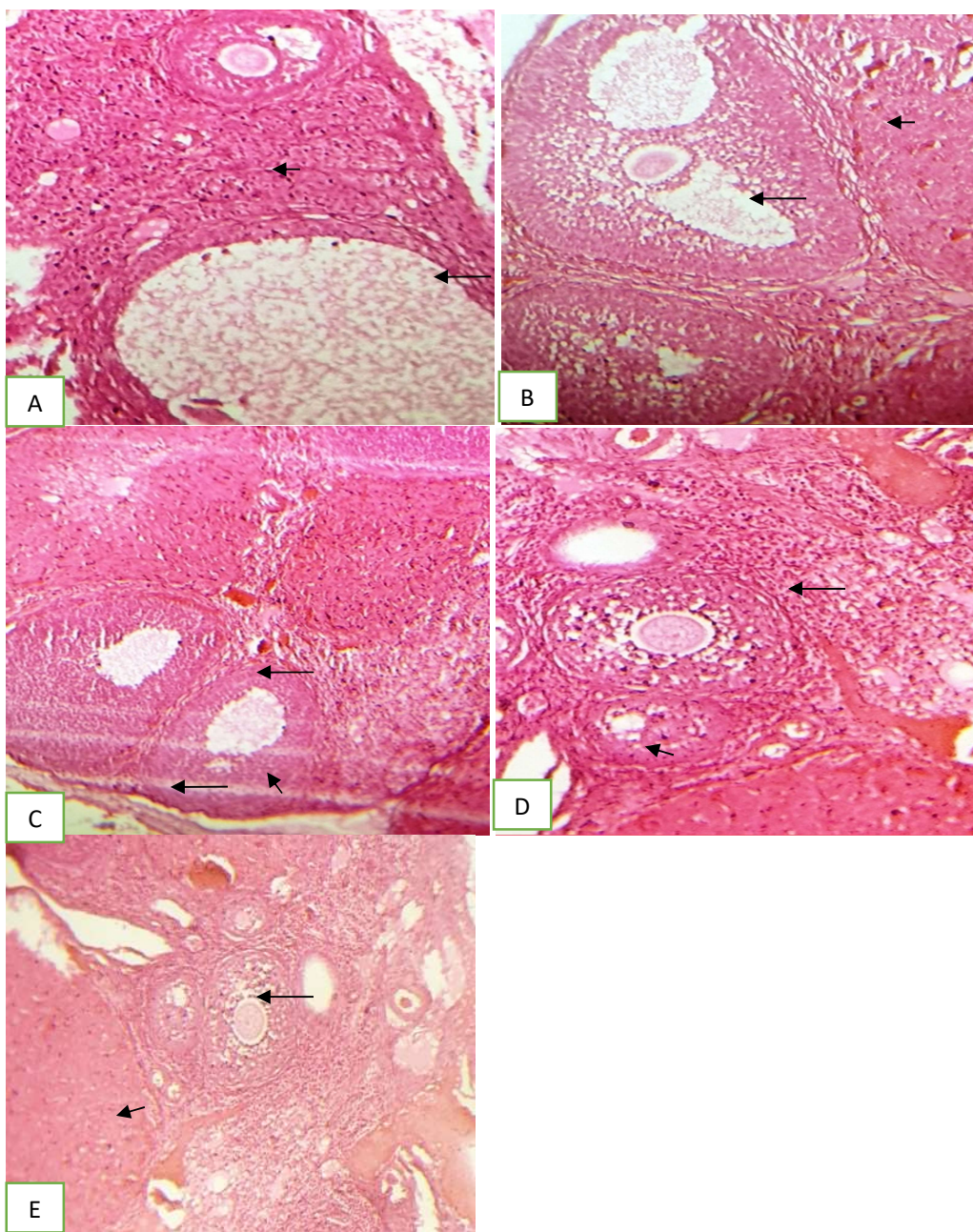
Figure 6: Effect of methanol

*Senna siamea* herbal remedy on superoxide dismutase *in-vivo* enzymatic antioxidant



**Plate 1:** Effect of *Senna siamea* on fertility indexes of the uterus

A. 25 mg/kg extract; Uterus histology reveals visible endometrial glands (long arrow) embedded in the lamina propria (short arrow), there is visible close up of simple columnar epithelium and lamina propria. B. 50 mg/kg extract; Uterus histology reveals visible numerous endometrial glands (long arrow) embedded in the lamina propria (short arrow), there is visible close up of simple columnar epithelium and lamina propria. C. 100 mg/kg extract; Uterus histology reveals visible numerous endometrial glands with mild proliferative changes (long arrow) embedded in the lamina propria (short arrow), there is visible close up of simple columnar epithelium and lamina propria. D. 20 mg/kg ascorbate: Uterus histology reveals visible numerous endometrial glands with mild proliferative changes (long arrow) embedded in the lamina propria (short arrow), there is visible close up of simple columnar epithelium and lamina propria. E. Control; UTERUS histology reveals not so prominent endometrial glands (long arrow) embedded in the lamina propria (short arrow), there is visible close up of simple columnar epithelium and lamina propria.



**Plate 2:** Effect of *Senna siamea* on fertility indexes of the ovary

**A.** 25 mg/kg extract: Ovary above reveals prominent numerous corpus luteum (long black arrow). There is thick germinal epithelium and zona granulosa (short arrow) with corona with a small eccentrically located oocyte. **B.** 50 mg/kg extract; Ovary above reveals large corpus luteum (long black arrow). There is thick germinal epithelium and zona granulosa (short arrow) with corona with an eccentrically located oocyte. **C.** 100 mg/kg extract; Ovary above reveals large corpus luteum with visible cyst (long black arrow). There is thick germinal epithelium and zona granulosa (short arrow) with corona with an eccentrically located oocyte. **D.** 20 mg/kg ascorbate; Ovary above reveals large corpus luteum (long black arrow). There is thick germinal epithelium and zona granulosa with corona with an eccentrically located oocyte (short arrow) and pools of atretic follicle (arrow head). **E.** Control; Ovary reveals prominent enlargement of the corpus luteum (long black arrow). There is dense germinal epithelium and zona granulosa with the corona eccentrically positioned in the oocyte (short arrow) and pools of atretic follicle (arrow head).



*Senna siamea*

## DISCUSSION

Conventional methods of egg formation can be measured as the main choice of assessing fertility condition and it elucidate egg quality (morphology and viability) (Zegers-Hochschild et al, 2009). Oestrogen, the chief hormone liable to promote sexual entreaty in parading indispensable roles in egg development. Findings displayed that it generated sexual fervour and sustain virginal tissues that assist sexual arousal (Aversa et al, 2000). Findings have certified that increased serum level of oestrogen serves as one of the major sex hormone responsible for the stimulation of fertility properties. This study observed in fertility reproductive investigation, that the female animals treated with 25, 50 and 100 mg/kg of *Senna siamea* herbal remedy showed a slight significant increase in the concentration of serum oestrogen when compared with standard and untreated control. This recommends the product capable to stimulate the secretion of oestrogen concentration by increase in production (Figure 1A). Some plant extracts that promote an increase in oestrogen and progesterone level, possess aphrodisiac and fertility effects (Yakubu et al, 2005). A significantly increase in oestrogen level is relatively in dose dependent form as indicated by *Senna siamea* leaf extract across graded doses of the treated groups when compared with the control, also increase in follicle stimulating hormone, luteinizing hormone and progesterone stimulate the release of oestrogen indicating the *Senna siamea* leaves extract possess fertility enhancing potentials as shown in Figure 1A-D. Studies from Yakubu et al, (2005) showed that female sexual dysfunction is interconnected to some factors like; oestrogen inefficiency. Similarly, with regards to fertility test, *S. siamea* herbal remedy triggered increase luteinizing hormone and follicle stimulating hormone concentrations in female animals and partially in male. *Senna siamea* herbal remedy significantly increase luteinizing and follicle stimulating hormone across the graded doses when compared with the control groups (Figure 1B and C), certified the product with promoting or synthesizing effect associated with hormonal secretion needed for fertility. Persistent ingestion of *S. siamea* herbal remedy showed pronounced plasma concentration increase of progesterone in females (Figure 1D). More so, an increase in the level of progesterone in the treated groups, showed it promoting fertility effect (Figure 1D). Hence, the product displayed a potentiating efficacy responsible for its fertility property. Progesterone agents (hormonal exchange therapy) revealed the development of sexual character and libido. Hyperlipidaemia surmount to an abnormal increase in blood lipids level. These lipids are subdivided into cholesterol, triglycerides, lipoprotein and phospholipids. Mostly they move in large molecules called lipoproteins. Humans cholesterol leads to steroidal hormones metabolic pioneer including; aldosterone, cortisol,



oestrogens and androgens) that standardize its physiologic roles. High cholesterol level (above 200 mg/dl) serves as a threat to trigger coronary heart diseases. Lipid profile is a prominent factor involve in the evaluation of fertility property associated Triglycerides TAG, Total Cholesterol TC, Very Low Density Lipoproteins, High density Lipoproteins HDL and Low Density Lipoproteins LDL. Hyperlipidemia occurrence is as a result of abrupt increase in blood lipids level triggered by certain plant forms to increase or decrease the dose. Lipids encompasses cholesterol, lipoprotein, triglycerides and phospholipids. They are conveyed in larger particles characteristically known as lipoproteins (Iyer and Patil, 2011) Humans cholesterol is a metabolic steroid hormones include, aldosterone, oestrogens, androgens and cortisol) that normalise massive physiologic traits. Increased cholesterol level (above 200 mg/dl) aids as a risk factor to activated coronary heart illnesses. *Senna siamea* methanol leaves extract at graded doses (25, 50 and 100 mg/kg) regulate TAG, TC and LDL level within standard ranges, showed an insignificant increased ( $p>0.05$ ) across grade doses when compared with untreated control (Figure 2). The control of TC, TAG and LDL concentration in typical quantity proposed its capability to improve steroidal hormones necessary for fertility. This study showed that *Senna Siamese* herbal remedy at graded doses (25, 50 and 100 mg/kg) significantly ( $P<0.05$ ) increased the level of TAG, TC, LDL and HDL concentration at a maintained range when compared with the control groups (Figure 2). The physiological value of TC, TAG, LDL and HDL levels exhibited significant increase, which proposes the ameliorate effect of *Senna Siamese* herbal remedy in the management of fertility and related problems (Figure 2). Subsequently, the classical use of bio-markers including transaminases, have evaluated the redox state of organs by antioxidant activity enzymes and measurements of macromolecule oxidation. It is obvious that oxidation triggers damages the cellular membranes of a cell. The assay was conducted using the thiobarbituric acid reactive substances (TBARS) assay. This assay quantified the amount of malondialdehyde (MDA) which is a product of lipoperoxidation (LPO) present. Antioxidant property such as flavonoids have been a chemical responsible for the reproductive effects (Sahreem *et al.* 2013) either acted indirectly on oestrogen release or by triggering or inhibiting pituitary glands and hypothalamus therefore compelling spermatogenesis and other role related to other glands. Gauthaman and Ganesan, (2008) Findings have revealed that saponins could be liable for intermediate character in oestrogen synthesis to facilitate the pituitary gland from secreting luteinizing hormone (LH) improving progesterone synthesis via Leydig cells (Gauthaman and Ganesan, 2008). Our study found that the *Senna Siamese* herbal remedy did not cause overproduction of free radicals to the systems rather it reduces the MDA levels values across the graded doses of 25, 50 and 100 mg/kg of the product (Figure 5) when compared with the control groups. *S. Siamese* herbal remedy also controlled the level of oxidants, probably because of the presence of natural antioxidant compounds found in the plant. Some studies have reported that some plants investigated in chronic study like this, shows that GSH content present in visceral is depleted principally due to the pro-oxidant effects of plants at higher doses, and to overcome this free-radical stress, GSH is being utilized as first line of defense as shown in this study. Other radicals such as catalase together with Super Oxide Dismutase and glutathione peroxidase (GPx) constitute the primary enzymatic defense, possible of catalysing ROS. The potency of *S. Siamese* herbal remedy showed an increased in GPx, CAT and SOD activities with greater scavenging capacity when compared standard and untreated control (Figure 4 and 6). Flavonoids are implicated in sustaining oestrogen production via inhibiting  $17\beta$ -estradiol aromatase, an enzyme complex in altering testosterone into oestrogen. The present study showed the fertility properties of *Senna siamea* against inhibitory effect of productivity (Kumar *et al.* 2010). From previous study flavonoids and polyphenols shows a capable effect on female fertility owing to their sturdy antioxidant activities reported by Seddiki



and Moreira da Silva, (2017) Findings from Silberstein et al, (2016) also exhibit antioxidants effects implicated in sperm level and motility. Conventional uses of biomarkers like transaminases aid in the evaluation of redox state of plasma and organs using antioxidant enzymes action with macromolecule oxidation determinant (Barcelos et al, 2011; Moran *et al.* 2001) Oxidation implicated by cellular membranes injury retrieved by thiobarbituric acid reactive substances (TBARS) assay. This assay explain malondialdehyde (MDA) in association with lipoperoxidation (LPO). *Senna siamea* methanol leaves extract inhibits free radicals production to regulate normal plasma MDA values across treatment groups when compared with control groups (Table 5). *Senna siamea* leaves extract aid in the control of oxidation, perhaps due to the present of antioxidant compounds in the plant. These constituents could be implicated in radical scavenging effect as ancillary deactivated transcription factors responsible for the regulation of expressed genes encrypted by antioxidant enzymes (Barcelos et al, 2011). Tissue sulfhydryl act contrary to reactive oxygen species (ROS) linked to toxic tissues triggered by some oxidative phytochemicals in plant. The major NPSH is made up of approximately 90 % of the entire intracellular NPSH reduced in glutathione (GSH) (Moran et al, 2001). GSH showed essential function implicate in antioxidant defense mechanisms, possibly due to direct radical-scavenging effects, vital constituent of glutathione peroxidase (GPx) systems, elimination of diverse hydro-peroxides (Dickinson and Forman, 2002). Poisonous plants evaluated in chronic study deplete GSH materials found in several visceral cells, tissues and organs with a pro-oxidant activity at increased doses to suppress free-radical stress, GSH is useful as initial defense against several diseases (Barcelos et al, 2011) as shown in this study. Non-enzymatic defences, showed no significance changes in thiols content (NPSH), due to synergistic antioxidant effect between NPSH and SBSB phytochemicals in visceral tissue. Catalase (CAT) and super oxide dismutase (SOD) antioxidant activities were evaluated across treatment groups. CAT together with SOD and GPx constitute enzymatic defence, catalysing decomposition of ROS against diseases. *Senna siamea* methanol leaves extract at graded doses elicited increased CAT and SOD effects when compared with control (Figure 3 and 6) (Bhor et al, 2004). Theoretically, SOD and CAT activity rises as compensatory mechanism to scavenge free-radical stress (Bhor et al, 2004). Modifications in the circulating level of oestrogen may distort the basic and efficient capability of reproductive tissues subsequent with an initiate on the egg formation (Chinoy et al, 1982). Alteration in reproductive organ indexes uses a marker to improved circulating concentration of oestrogen, since reproductive glands can be particularly complex to oestrogen levels. Histopathological analysis of female reproductive organ (ovary and uterus) exhibited standard anatomical structure when compared with the control Plate 1 and 2. Treated organs at 25, 50 and 100 mg/kg of the extracts exhibited improved architecture when compared with the control. This recommends that, the *Senna siamea* methanol leaves extract promotes physiological architecture of the ovary and uterus in contrast with the biochemical results of significant increase ( $P < 0.05$ ). These remarks might be endorsed to antioxidant property and possible phytoconstituents (Koffi et al, 2014).

## CONCLUSION

*Senna siamea* methanol leaves extract contains several bioactive agents with antioxidant properties that are possibly responsible to improve semen indexes to further potentiated fertility by promoting sperm number, quality, and improved serum oestrogen concentration. This study hence advances confidence of this extract as a potent female fertility enhancer in line with folklore reports.



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## DECLARATION OF CONFLICT OF INTEREST

We hereby declare that the study does not encompass any conflict of interest.

## REFERENCES

- Aversa, A., Andrea, M.I., Fabrini, E., De-Martin, M. 2000. Androgen and penile erection: Evidence for a direct relationship between free testosterone and cavernosa vasodilation in men with erectile dysfunction. *Clinical Endocrinology*. 53: 517-522.
- Bagul, M.S., Niranjani, S.K., Rajani, M. 2005. Evaluation of free radical scavenging properties of two classical polyherbal formulations, *Indian Journal of Experimental Biology*. 43:732-36.
- Barcelos, G.R., Angeli, J.P., Serpeloni, J.M., Grotto, D., Rocha, B.A., Bastos, J.K., Knasmüller, S., Júnior, F.B. 2011. Quercetin protects human-derived liver cells against mercury-induced DNA-damage and alterations of the redox status. *Mutat. Res.* 726: 109–115.
- Bhor, V.M., Raghuram, N., Sivakami, S. 2004. Oxidative damage and altered antioxidant enzyme activities in the small intestine of streptozotocin-induced diabetic rats. *Int. J. Biochem. Cell Biol.* 36: 89–97.
- Centers for Disease Control and Prevention. Infertility, 2017. Retrieved 2017 from *Website*: <http://www.cdc.gov/reproductivehealth/infertility/index.htm>.
- Chinoy, N.J., Sheth, K.M., Seethalakshmi, L. 1982. Studies on reproductive physiology of animals with special reference to fertility control. *Comparative Physiology and Ecology*. 7:325.
- Choudhary, A.K., Steinberger, E. 1975. Effect of 5 $\alpha$  reduced androgens on sex accessory organs. Initiation and maintenance of spermatogenesis in the rat. *Biol. Reprod.*, 12: 609-617.
- Dickinson, D.A., Forman, H.J. 2002. Cellular glutathione and thiols metabolism. *Biochem. Pharmacol.* 64:1019–1026.
- Drury, R.A.B., Wallinton, E.A. 2013. *Carletons Histological Technique*, 16<sup>th</sup> Edn, Oxford University Press, London, Pp124-136.
- Friedwald, W.T., Levy, R.I., Friedrickson, D.S. 1972. Estimation of the concentration of low density lipoprotein cholesterol in plasma without the use of preparative centrifuge. *Clin chem.* 18:499-502.
- Gauthaman, K., Ganesan, A.P. 2008. The hormonal effects of *Tribulus terrestris* and its role in the management of male erectile dysfunction – an evaluation using primates, rabbits and rat. *Phytomedicine*. 15: 44-54.
- Gevid, A., Abebe, D., Debella, A., Makonnen, Z., Abera, F., Teka, F., Kebede, T., Urga, K., Yersaw, K., Biza, T., Manam, B., Guta, M. 2005. Screening of some medicinal plants of Ethiopia for their antimicrobial properties and chemical profiles. *Journal of Ethnopharmacology*. 97:421-427.
- Halliwell, B. 1997. Antioxidants and human disease: a general introduction. *Nutri Rev.* 5 (1- 2):S44– 9.
- Halliwell, B., Gutteridge, J.M.C. 1995. The definition and measurement of antioxidants in biological systems. *Free Radic Biol Med.* 18:125–126. doi: 10.1016/0891-5849(95)91457-3.
- Iyer, D., Patil, U.K. 2011. Effect of *Evolvulus Alsinoides* L. ethanolic extract and its fraction in experimentally induced hyperlipidemia in rats. *Pharmacologyonline*. 1:573-80.
- Khatun, A., Rahman, M.S., Pang, M.G. 2018. Clinical assessment of the male fertility. *Obstetrics & gynaecology science*, 61(2):179-191.
- Khojasteh, S.M.B., Khameneh, R.J., Houresfsnd, M., Yaldagard, E. 2016. A Review on Medicinal Plants Used for Improvement of Spermatogenesis. *Biology and Medicine (Aligarh)*. 8:292.
- Koffi, C., kamagate, M., Kouame, N.M., Akoubet, A., Yao, N.A.R., Diekakau, H.M. 2014. Ethnobotany, phytochemistry, pharmacology and toxicology profiles of *Cassia siamea* Lam. *The journal of phytopharmacology*. 3: 57-76.
- Kumar, B.S., Sathyanarayana, J., Estari, M., Reddy, M.K., Prasad, M.S.K. 2010. Effect of alkaloids of *Achyranthes aspera* (Linn.) on fertility in male albino rats (*Rattus norvegicus*). *Asian Journal of Animal Science*. 5 (2):126-130.
- Kumar, S., Paul, S., Walia, Y., Kumar, A., Singhal, P. 2015. Therapeutic Potential of Medicinal Plants: A Review. *Journal of Biological and Chemical Chronicles*. 1:46-54.



- Kurutas, E. 2016. The importance of antioxidants which play the role in cellular response against oxidative.
- Lobo, V., Patil, A., Phatak, A., Chandra, N. 2010. Free radicals, antioxidants and functional foods: Impact on human health. *Pharmacog rev.* 4(8): 118-126.
- Maya, N.M., Seth, R.F., Ties, B., Sheryl, V., Gretchan, A.S. 1990. National, Regional and Global Trends in Fertility Prevalence Since A Systemic Analysis of 277 health Surveys. *Plos Medicine*, 2012; 9 (12):1-3.
- Moran, L.K., Gutteridge, J.M.C., Quinlan, G.J. 2001. Thiols in cellular redox signaling and control. *Curr. Med. Chem.* 8:763–772.
- Mukherjee, P.K. 2002. Quality control of herbal drugs (an approach to evaluation of botanicals), *Business Horizon's*, New Delhi: p. 380- 421.
- Orwa, C., Mutua, A., Kindt, R., Jamnadass, R., Anthony, S. 2009. Agroforest tree database: A tree reference and selection guide version 4.0. Nairobi: The World Agroforestry Centre. [Available online] at <http://www.worldagroforestry.org/sites/treedbs/treedatabases.asp>.
- Sachin, G.P., Choudhary, D.K. 2016. Medicinal plants with potential anti-fertility activity: A review. *International Journal of Green Pharmacy.* 9 (4):223.
- Sahreen, S., Khan, M.R., Khan, R.A., Shah, N.A. 2013. Effect of *Carissa opaca* leaves extract on lipid peroxidation, antioxidant activity and reproductive hormones in male rats. *Lipids in Health and Disease.* 12:90.
- Seddiki, Y., Moreira da Silva, F. 2017. Antioxidant Properties of Polyphenols and Their Potential Use in Improvement of Male Fertility: A Review. *Biomedical Journal of Science and Technology Research.* 1(3):612-615.
- Silberstein, T., Har-Vardi, I., Harlev, A., Friger, M., Hamou, B., Barac, T., Levitas, E., Saphier, O. 2016. Antioxidants and Polyphenols: Concentrations and Relation to Male Infertility and Treatment Success. *Oxidative Medicine and Cellular Longevity.* Article ID 9140925.
- Tietz, N.W. 1995. *Clinical Guide to Laboratory Test.* Philadelphia: WB Sanders Company. 3<sup>rd</sup> edition, pp. 518-519.
- Trinder, P. 1969. Determination of glucose in blood using glucose oxidase with an alternative oxygen receptor. *Annals Clin Biochem.* 6:24-27.
- Velavan, S. 2011. Free radicals in health and diseases. *Pharma online*, 1062- 1077.
- World Health Organization, 2000. Programme on Traditional Medicine. *General guidelines for methodologies on research and evaluation of traditional medicine.* Geneva: World Health Organization. <http://www.who.int/iris/handle/10665/66783>.
- World Health Organization, 2000. WHO Manual for Standardized Investigation, Diagnosis and Management of the Infertile Male. Cambridge, UK: Cambridge University Press.
- World Health Organization, 2013. WHO traditional medicine strategy: 2014-2023. World Health Organization, Geneva Switzerland.
- Yakubu, M.T., Akanji, M.A., Oladiji, A.T. 2005. Aphrodisiac potentials of the aqueous extract of *Fadogia agrestis* (Schweinf. Ex. Hiern) stem in male albino rats. *Asian Journal of Andrology.* 7(4):399-404.
- Zegers-Hochschild, F., Adamson, G.D., de Mouzon, J., Ishihara, O., Mansour, R., Nygren, K. 2009. International Committee for Monitoring Assisted Reproductive Technology (ICMART) and the World Health Organization (WHO) revised glossary of ART terminology. *Fertility and Sterility.* 92:1520–1524.