

## PHYTOCHEMICAL SCREENING, ACUTE TOXICITY STUDY AND EVALUATION OF THE N-HEXANE EXTRACT OF *Brassica oleracea* Linn. ON THE STAGES OF PREGNANCY AND PARTURITION IN EXPERIMENTAL ANIMALS

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### Abstract

*Brassica oleracea* popularly referred to as white cauliflower is used traditionally as food and in the treatment of infertility. At present there is no scientific report on its use in the treatment of infertility and miscarriages in females. The aim of this study was to investigate the phytochemical content, toxicity study in mice and determine effect of the n-hexane extract of *Brassica oleracea* on the stages of pregnancy in female albino Wistar rats. Preliminary phytochemical screening was carried out using standard methods. Acute toxicity test was carried out using the Organization for Economic and Co-operation Development (OECD) method. Pregnancy outcome tests were carried out using standard procedures. Result obtained from the phytochemical screenings showed the presence of saponins, flavonoids, alkaloids, phenolics, steroids and tannins. After 72 hours administrations of 5000 mg/kg the extract to the experimental group of mice, there was no sign of toxicity nor did mortality occur. The pregnancy outcome study, showed significant increases in the weight of dams, number of implantation sites, width of uterine horns and serum progesterone levels respectively in the treatment groups at the first and second trimester. After parturition, it was revealed that there was significant increase in birth weight of pups, crown-rump length, tail length and onset of labor. In conclusion, this study revealed that n-hexane extract of *B. oleracea* possesses vital and safe phytochemicals which could be useful in pregnancy development and as a tocolytic agent to prevent preterm birth.

**Keywords:** *Brassica oleracea*; pregnancy outcome; phytochemical screening; gravid rats; tocolytic agent

### Introduction

The uteri are the primary organ and structure of reproductive system. It is a pear-shaped organ which is positioned between the lower intestine and bladder. It comprises of two main fragments; the cervix and body. In pregnancy, the wall of the uterus pushes apart as fetus grows as against when it is about the size of a fist and flattened when a woman is not pregnant [1].

After puberty, a woman begins to menstruate and this causes her capability to bring forth children [2]. In females of child bearing age, the fertile window is 6 days long, starts 2

days before ovulation, and ends 2 days after ovulation [3]. The egg survives 12 -24 hours unless a sperm fertilizes it [4]. Two to four days after an egg is fertilized, it is transferred into the uterus from the fallopian tube [5]. The egg is implanted in the uterine lining by the placenta which nourishes the fertilized egg as it grows [6]. As the fetus grows, estrogen and progesterone levels continue to increase by the corpus luteum [7] which is the yellow tissue formed from the ruptured follicle [8].

Infertility is the failure of a couple to attain pregnancy or carry a pregnancy to term and delivery of a live baby over a period of twelve

months in spite of suitable unprotected sex [9]. Infertility may be from the female, male, or both; it may also be primary or secondary factor [10].

*Brassica oleracea* Linn. (Cauliflower) is of the family Brassicaceae. It is an annual plant that grows up to 0.5 meters tall and bears large rounded leaves that resemble collard and known to have evolved from the cabbage flower. It was native to Asia Minor and later spread to the Mediterranean region, mostly Italy and Turkey. Although cauliflower is often considered a vegetable suited for temperate climate, it has been spread to tropic areas of Africa Central America and South America. It requires cool consistent temperature of about 16 °C to produce heads [11]. The plant produces crossed -shaped yellow flowers and bear seeds in dry capsules. White cauliflower grows best in nitrogen rich soil and will produce small head if stressed with drought [12]. It has been used traditionally as food and medicinally around the world for the treatment of various illnesses such as infertility, malaria, constipation, sore throat, ulcer and epilepsy [13]. At present there is no scientific report on the use of White Cauliflower in the treatment of infertility and miscarriages in females, thus this study was carried out to investigate the phytochemicals, toxicity study and determine the outcome of *Brassica oleracea* Linn. on the stages of pregnancy in female albino Wistar rats

## **Materials and Methods**

### **Ethical approval**

Ethical approval for this study was sought and received from the Ethical Review Committee of Life Sciences, University of Benin, Benin City, Edo State, Nigeria. Proper procedures were observed to ensure negligible discomfort or pain of mice used in this research. The ethical approval number was LS19114 and the research was carried out in accordance with the internationally accepted principles for laboratory animal use and care by the Organization of Economic Co-operation Development (OECD) Guidelines of the care and use of animals for investigation.

### **Collection of Plant**

Fresh white *Brassica oleracea* used in this research was purchased in March 2023, from vegetable market on airport road, Benin City, Nigeria. The plant was identified and confirmed by Prof. H. Akinnibosun, a taxonomist in the Department of Plant Biology and Biotechnology, University of Benin, Benin city and a voucher number of UBH-B660 was allotted. The whole flowers of *B. oleracea* were dried at room temperature for 14 days, air dried in the oven for 24 hours at 40 °C. The dried sample was then grounded and stored in an air tight container for future use [14].

### **Preparation and extraction**

One kilogram (1 kg) of the powder was extracted with n-hexane (2.5 Litres) manufactured by Pharmatrend Nigeria Limited using Soxhlet apparatus at 45°C for forty-eight (48) hours. The resulting extract was concentrated to dryness using a rotary evaporator at 40°C for 48 hours. The percentage yield was calculated with reference to the dried powder used. Twenty grams (20 g) of the extract was dissolved in 100 ml of distilled water daily to obtain a stock solution (200 mg/ml) from which dilutions were made and calculated doses administered to the animals during the experimental procedures [15].

### **Phytochemical study**

The n-hexane extract of White *Brassica oleracea*, was tested for glycosides, saponins, flavonoid, alkaloids, tannins, steroids, terpenoids and phenolics compounds using standard Phytochemical procedures by Sofowora [16].

### **Acute toxicity study**

Acute toxicity study was carried out by methods of Organization of economic co-operation development (OECD) guidelines. 6 male mice and 6 female mice each were administered 5000 mg/kg of the extract respectively and observed for 72 hours for possible signs of toxicity, mortality or morbidity. In OECD method, a single high dose is administered to laboratory animals

and observed for 72 hours and the study is concluded if no death occurs [17].

### **Pregnancy Study**

#### **Experimental animals**

A total of 180 adult albino Wistar rats consisting of 90 males and 90 females with average weight of 150-180 g were obtained from the animal house of the Department of Pharmacology and Toxicology, Faculty of Pharmacy, University of Benin. The animals were kept in wooden cages at ambient temperature and maintained under standard laboratory conditions; 12-hour light and 12-hour dark conditions. The rats were fed with standard pelletized layers mash (Manufactured by Top-feed Limited, Ibadan) and clean water for two weeks as acclimatization period prior to the experimental study [18].

#### **Grouping and mating of animals**

The weights of the female Wistar rats were measured using an electronic weighing balance and were grouped into six (6): I, II, III, IV, V and VI of 5 rats each for the first, second and third trimesters of pregnancy. Male Wistar rats obtained were introduced into each group for mating in a ratio 1:1 (monogamous mating). Only female rats at pro-estrus after microscopic (UIS450, USA) examination were mated. The female rats were left overnight with their male counterparts [18].

#### **Examination of vaginal smear**

The next morning after mating, vaginal smear was taken from each female rat in each group and observed by microscopic examination for the presence of sperm. Pipette containing little distilled water was inserted into the vagina of each rat and the vagina fluid was taken, smeared on the glass slides, covered with cover slips and viewed under the light microscope. The presence of sperm cells in the vaginal fluid confirmed a positive sperm test and also a successful mating and was thereby taken as day 0 of pregnancy [18].

### **Administration of extract**

Extract was freshly prepared every morning and administered orally to rats by carefully inserting an orogastric tube into the oral cavity of the rats. The animals were grouped into three trimester groups; first trimester (<sup>a</sup>), second trimester (<sup>b</sup>) and third trimester (<sup>c</sup>), divided into 3 sub-groups (Group I<sup>a-c</sup>, II<sup>a-c</sup>, III<sup>a-c</sup>, IV<sup>a-c</sup>, V<sup>a-c</sup> and VI<sup>a-c</sup>) consisting of 5 animals each.

Group I (Normal control) - Distilled water (2 ml/kg)

Group II- Positive control (10 mg/kg diethylstilbestrol) [18]

Group III- Negative control (10 IU of oxytocin) [10]

Group IV, V and VI (10, 100 and 1000 mg/kg of the extract respectively after acute toxicity study).

Throughout the period of administration, food and water were given to the rats. For the first trimester group, the extracts were administered to the pregnant dams on day 7, 8 and 9 of pregnancy and the rats were sacrificed on the 10<sup>th</sup> day of pregnancy.

For the second trimester group, the extracts were administered on day 14, 15 and 16 of pregnancy and the rats were sacrificed on the 17<sup>th</sup> day of pregnancy.

For the third trimester group, the extracts were administered on day 17, 18, 19 and 20 and the rats were left to litter from the 21<sup>st</sup> day of pregnancy.

The weights of the rats in the control groups and the treatment groups were recorded at day 0, 7, 10, 17 and day 21 of the gestation period. Cage side examination were performed daily to detect signs of toxicity which include; salivation, lacrimation, writhing, convulsion, tremors, yellowing of fur, loss of hair, bleeding, and/or mortality.

#### **Determination of serum progesterone level**

Blood samples were withdrawn from the animals on day 10 and 17 of pregnancy via cardiac puncture, centrifuged at 3000 revolutions per minute for 10 minutes and serum obtained was analyzed using an Enzyme linked immunosorbent assay

(ELISA) kit to determine serum progesterone levels according to [19].

**Pregnancy outcome**

On the 10<sup>th</sup> and 17<sup>th</sup> day of gestation, the female rats were laparotomized under chloroform anesthesia. The lower abdomen was cut open and the uterus was examined for number of implantation sites and width of uterine horns on day 10 and day 17 of pregnancy respectively [20].

**Parturition**

After parturition, the number of live and still born pups was recorded. All pups were evaluated for gross external abnormalities such as open eyelids, tail anomalies and club foot. The birth weight, gestation length, litter size, crown-rump length and tail length of the pups were recorded according to Oshomoh and Obaro, 2019 [14].

**Data analysis**

The results from the study are expressed as the mean ± SEM. Statistical analysis was carried out using United Kingdom's Graph Pad prism 8.2.1 software. Comparisons between the control and treated groups was analyzed using one-way ANOVA, Dunnett's multiple comparisons test.  $P \leq 0.05$  was regarded as indicating significant difference.

**Results and Discussion**

**Qualitative Phytochemical Screening**

**Table 2:** Acute toxicity profile of n-hexane extract of white *Brassica oleracea*

Groups	Dose (mg/kg)	Gender	Signs of toxicity such as: Grooming, nausea and writhing	Mortality after 72 hours of administration
Control	2 ml/kg	3 males/ 3 females	3 None	0/6
NHEWBO	5000	3 males/ 3 females	3 None	0/6

*Note:* NHEWBO = n-hexane extract of White *Brassica oleracea*; n=6.

Administration of 5000 mg/kg n-hexane Extract of *B. oleracea* to mice for 72 hours were without signs of toxicity such as: grooming, nausea, writhing, and no mortality

**Table 1:** Qualitative phytochemical constituents of n-hexane extract of *Brassica oleracea*

Phytochemicals	Inference
Flavonoids	+
Phenolics	+
Tannins	+
Glycosides	+
Steroids	+
Saponins	+
Alkaloids	+
Terpenoids	+

*Note:* += Present, -= Absent

Phytochemical screenings of n-hexane extract of White *Brassica oleracea*, showed the presence of saponins, flavonoids, alkaloids, phenolics, steroids and tannins. Glycosides and terpenoids have been reported as phyto-estrogens responsible for the pro-fertility effects in some medicinal plants [21, 22]. They may be useful during the developmental stages of pregnancy, producing uterine smooth muscle relaxant effects; this result correlates with the findings of Obaro-Onezeyi and Emmanuel, 2019 [23].

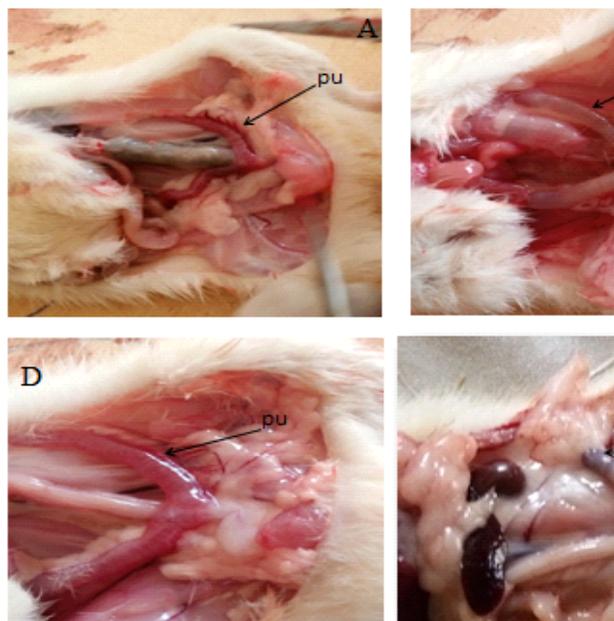
**Acute toxicity profile**

Acute toxicity profile disclosed that single oral dose of 5000 mg/kg of the n-hexane extract of *Brassica oleracea* administered to mice and observed for 72 hours were without signs of toxicity such as: grooming, nausea, writhing, and no mortality (Table 2).

revealing that *B. oleracea* had no toxic effect on acute exposure of mice [22].

**Effect of n-hexane extract of White *Brassica oleracea* (NHEWBO) on implantation at 1<sup>st</sup> trimester of pregnancy**

Results obtained after three (3) days of administration of extract from day 7 to the 10<sup>th</sup> day of pregnancy, revealed significant



**Plate 1:** Effect of white *Brassica Oleracea* on implantation at 1<sup>st</sup> trimester of pregnancy

**Note:** A= Control; B= Diethylstilbestrol 10 mg/kg; C= Oxytocin 0.5 IU; D= NHEWBO 50 mg/kg; E= NHEWBO 250 mg/kg and F= NHEWBO 500 mg/kg. Pu = Pregnant uterus, Npu = Non-pregnant uterus.

**Table 3:** Effect of n-hexane extract of white *Brassica oleracea* on body weight of pregnant rats in first trimester

Dose (mg/kg)	Day 0 Weight (g)	Day 7 Weight (g)	Day 10 Weight (g)
<b>Control</b>	163.8 ± 1.88	169.2 ± 1.39	177.8 ± 2.69
<b>Diethylstilbestrol 10</b>	168.0 ± 3.46	174.4 ± 2.96	180.6 ± 2.99*
<b>Oxytocin 0.5 IU</b>	172.0 ± 2.76	161.2 ± 2.76	150.0 ± 2.76

( $P \leq 0.05$ ) increases in weight of the extract treated gravid dams compared to that of the control (Plate 1 and Table 3). There were also significant ( $P \leq 0.05$ ) increases in the Width of the left and right uterine horns of isolated uteri of the gravid dams compared to control dams (Table 4).

Dose (mg/kg)	Weight (g)	Width of left uterine horn (cm)	Width of right uterine horn (cm)
<b>Control</b>	171.2 ± 1.16	2 ± 2.69	3.02 ± 1.16*
<b>NHEWBO 50</b>	175.0 ± 1.00	175.0 ± 1.00	182.8 ± 1.16*
<b>NHEWBO 250</b>	172.8 ± 3.83	165.8 ± 4.14	199.8 ± 2.22*
<b>NHEWBO 500</b>	175.6 ± 2.73	166.8 ± 2.85	190.0 ± 2.61*

Values are expressed in mean ± SEM as compared with control, n=5. \* = ( $P \leq 0.05$ )

**Note:** NHEWBO = n-hexane extract of White *Brassica oleracea*; n=6

**Table 4:** Effect of n-hexane extract of *B. oleracea* on implantation and width of uterine horns of gravid dams in 1<sup>st</sup> trimester

Dose (mg/kg)	Width of left uterine horn (cm)	Width of right uterine horn (cm)
<b>Control</b>	0.73 ± 0.03	0.79 ± 0.04
<b>Diethylstilbestrol 10</b>	0.82 ± 0.04*	0.80 ± 0.04
<b>Oxytocin 0.5 IU</b>	0.28 ± 0.03	0.27 ± 0.02*
<b>NHEWBO 50</b>	1.10 ± 0.06*	1.10 ± 0.04*
<b>NHEWBO 250</b>	1.14 ± 0.05*	1.12 ± 0.06*
<b>NHEWBO 500</b>	1.20 ± 0.03*	1.22 ± 0.04*

Values are expressed in mean ± SEM as compared with control, n=5. \* =  $p \leq 0.05$

**Note:** NHEWBO = n-hexane extract of White *Brassica oleracea*; n=6.

Pregnancy development of pregnant dams in

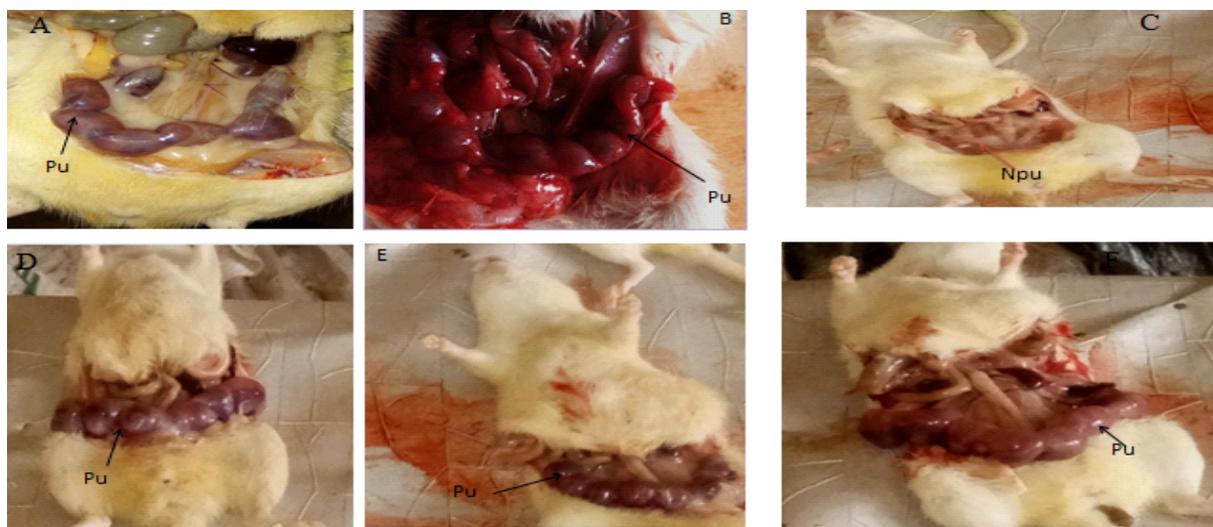
first trimester revealed that the oral administration of n-hexane extract of *W.B. oleracea* did not halt the progressive implantation of pregnancy (Plate 1 and Tables 3 and 4). The pregnant dams administered the extract from day 7<sup>th</sup> -10<sup>th</sup> of pregnancy had increases in body mass gains relating progression of developmental pregnancy (Table 3) [24, 25].

The body mass gains revealed that oral administration of n-hexane extract of White *Brassica oleracea* supported implantation of pregnancy at day 10<sup>th</sup> as dams were seen with signs of pregnancy implantation at early stage comparable to the control [24]. The administration of n-hexane extract of White *Brassica oleracea* displayed no deleterious effect on pre-implantation of pregnancy. Weight loss was observed in the negative control group on administration of oxytocin

from day 7- 10<sup>th</sup> at a dose of 0.5 IU indicating abortion because as at day 10<sup>th</sup> of pregnancy; there were no signs of pregnancy over the 10 days of the experiment [7].

**Effect of n-hexane extract of White *Brassica oleracea* (NHEWBO) on implantation at 2<sup>nd</sup> trimester of pregnancy**

Results obtained after three (3) days of administration of extract from day 14 to the 17<sup>th</sup> day of pregnancy, revealed significant ( $P \leq 0.05$ ) increases in weight of the extract treated gravid dams compared to that of the control (Plate 2 and Table 5). There were also significant ( $P \leq 0.05$ ) increases in the implantation sites and the width of the left and right uterine horns of isolated uteri of the gravid dams compared to control dams (Table 6).



**Plate 2:** Effect of n-hexane extract of white *Brassica oleracea* (NHEWBO) on the pregnancy of gravid dams at 2<sup>nd</sup> trimester.

**Note:** A= Control; B= Diethylstilbestrol 10 mg/kg; C= Oxytocin 0.5 IU; D= NHEWBO 50 mg/kg; E= NHEWBO 250 mg/kg and F= NHEWBO 500 mg/kg. Pu =pregnant uterus, Npu =Non-pregnant uterus.

**Table 5:** Effect of n-hexane extract of white *Brassica oleracea* (NHEWBO) on weight of pregnant dams at second trimester

Dose (mg/kg)	Day 7	Day 14	Day 17
Control	167.4 ± 2.14	178.4 ± 2.38	185.8 ± 2.06
Diethylstilbestrol 10	160.2 ± 1.16	169.4 ± 2.46*	187.4 ± 2.48*
Oxytocin 10 IU	171.6 ± 1.47	153.8 ± 1.50*	137.8 ± 2.22*
NHEWBO 50	169.8 ± 3.47	183.6 ± 2.62*	190.8 ± 2.22*
NHEWBO 250	168.6 ± 3.97	178.8 ± 3.73*	188.2 ± 2.40*

NHEWBO 500  $172.2 \pm 3.20$   $184.4 \pm 2.25^*$   $196.0 \pm 1.76^*$   
 Values are expressed in mean  $\pm$  SEM as compared with control, n=5. \* =  $p \leq 0.05$   
**Note:** NHEWBO = White *Brassica oleracea*

**Table 6:** Effect of n-hexane extract of white *Brassica oleracea* (NHEWBO) on implantation and width of uterine horns of gravid dams at 2<sup>nd</sup> trimester of pregnancy

Dose (mg/kg)	No. of implantation sites	Width of uterine horn (cm)	Width of uterine horn (cm)
Control	6.00 $\pm$ 0.51	9.70 $\pm$ 0.10	8.79 $\pm$ 0.04
Diethylstilbestrol 10	7.00 $\pm$ 0.30	10.45 $\pm$ 0.01	0.80 $\pm$ 0.04
Oxytocin 0.5 IU	0.00 $\pm$ 0.00	1.00 $\pm$ 0.02	1.20 $\pm$ 0.01
NHEWBO 50	10.21 $\pm$ 0.40	12.10 $\pm$ 0.06*	11.40 $\pm$ 0.04*
NHEWBO 250	12.01 $\pm$ 0.61	15.14 $\pm$ 0.05*	12.12 $\pm$ 0.06*
NHEWBO 500	12.00 $\pm$ 0.45	17.20 $\pm$ 0.03*	12.22 $\pm$ 0.04*

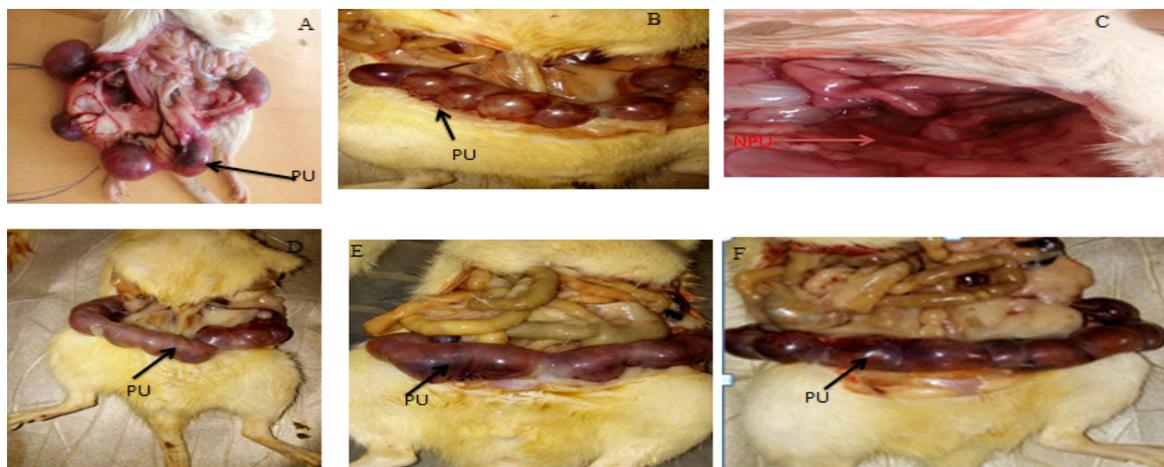
Values are expressed in mean  $\pm$  SEM as compared with control, n=5. \* =  $p \leq 0.05$   
 Key: NHEWBO = White *Brassica oleracea*

The dams treated from day 14<sup>th</sup> -17<sup>th</sup> of pregnancy orally received n-hexane extract of White *Brassica oleracea* were grossly better in weight at the point of sacrifice on day 17<sup>th</sup> the extracts treated dams were had more developed litters as well as larger litter sizes up to twelve litter per dams (Plate 2 and Tables 5 and 6) [25]. The negative control dams, which received oxytocin intra-peritoneally, had no litters present. The increased litter's size present in-utero in uterine horns of n-hexane extract of White *Brassica oleracea* treated dams was healthier compared to control and those of the standard Diethylstilbestrol. Remarkably, at day 17<sup>th</sup> n-hexane extract of White *Brassica oleracea* treated dams had extremely high number of litters presence up to 12 per a dam the results did not corroborate with the findings of Oshomoh and Obaro, 2019 [14]

who reported the contraceptive and abortifacient effect of the crude extract of *pleurotus* species.

**Effect of n-hexane extract of White *Brassica oleracea* (NHEWBO) on implantation at 3<sup>rd</sup> trimester of pregnancy**

Results obtained after three (3) days of administration of extract from day 19 to the 21<sup>st</sup> day of pregnancy, revealed significant ( $P \leq 0.05$ ) increases in weight of the extract treated gravid dams compared to that of the control (Plate 3 and Table 7). There were also significant ( $P \leq 0.05$ ) increases in the implantation sites and the width of the left and right uterine horns of isolated uteri of the gravid dams compared to control dams (Table 8).



**Plate 3:** Effect of white *Brassica Oleracea* on implantation at 3<sup>rd</sup> of pregnancy

A= Control, B= Diethylstilbestrol 10 mg/kg, C= Oxytocin 0.5 IU, D= *B. oleracea* 50, E= *B. oleracea* 250 mg/kg and F= *B. oleracea* 500 mg/kg.

**Table 7:** Effect of n-hexane extract of white *Brassica oleracea* (NHEWBO) on weight of pregnant dams at third trimester

Dose (mg/kg)	Day 14	Day 19	Day 21
Control	189.8 ± 6.42	195.4 ± 3.87	198.8 ± 3.58
Diethylstilbestrol 10	188.4 ± 4.58	193.4 ± 4.76	207.4 ± 4.53*
Oxytocin 10 IU	187.8 ± 4.27	192.8 ± 5.08	140.8 ± 3.42*
NHEWBO 50	189.8 ± 5.12	193.6 ± 4.82	210.8 ± 3.51*
NHEWBO 250	188.2 ± 4.98	194.8 ± 3.36	211.2 ± 5.43*
NHEWBO 500	186.0 ± 6.76	193.4 ± 5.43	217.0 ± 6.61*

Values are expressed in mean ± SEM as compared with control, n=5. \* =  $p \leq 0.05$

**Note:** NHEWBO = White *Brassica oleracea*

**Table 8:** Effect of n-hexane extract of white *Brassica oleracea* (NHEWBO) on implantation and width of uterine horns of gravid dams at 3<sup>rd</sup> trimester of pregnancy

Dose (mg/kg)	No. of implantation sites	Width of uterine horn (cm)	Width of uterine horn (cm)
Control	7.00 ± 0.19	11.98 ± 1.32	10.75 ± 1.32
Diethylstilbestrol 10	8.00 ± 0.25	18.45 ± 1.43	10.64 ± 1.19
Oxytocin 0.5 IU	0.00 ± 0.00	01.39 ± 0.01	01.37 ± 0.02
NHEWBO 50	10.21 ± 0.43*	20.53 ± 2.13*	15.88 ± 3.45*
NHEWBO 250	12.01 ± 0.87*	21.48 ± 2.32*	16.54 ± 2.86*
NHEWBO 500	12.00 ± 0.59*	22.76 ± 3.41*	18.77 ± 2.52*

Values are expressed in mean ± SEM as compared with control, n=5. \* =  $p \leq 0.05$

Key: NHEWBO = White *Brassica oleracea*

The obtained results from Dams in the parturition study had n-hexane extract of White *Brassica oleracea* treated dams from

day 17<sup>th</sup> - 20<sup>th</sup> had received oxytocin an hour after oral administration of two doses of the n-hexane extract of White *Brassica oleracea*.

It was observed that onset of labor was delayed for up to 70 hours when compared with the control, this was indicative that n-hexane extract of *W.B .oleracea* caused the delay in onset of delivery thus n-hexane extract of White *Brassica oleracea* may be remedy for management of miscarriage [25] .

**Effect of n-hexane extract of White *Brassica oleracea* (NHEWBO) on Birth Parameters after Parturition**

Results obtained after maternal exposure of n-hexane extract of White *Brassica oleracea* (NHEWBO) from 19 to the 21<sup>st</sup> day of pregnancy, revealed significant ( $P \leq 0.05$ ) increases in weight of the extract treated gravid dams compared to that of the control (Tables 9). There were also significant ( $P \leq 0.05$ ) increases in the implantation sites and the width of the left and right uterine horns of isolated uteri of the gravid dams compared to control dams (Table 8).

**Table 9:** Effect of n-hexane extract of White *Brassica oleracea* (NHEWBO) on Birth Parameters after parturition (3<sup>rd</sup> trimester)

Treatment (mg/kg)	Birth weight of pups (g)	Life birth index (%)	Head circumference (cm)	Body length (cm)	Gestation length (days)	Tail length (cm)	Number of pups born
Control	4.2±0.5	75	2.0±0.2	4.0±0.7	21.0±0.4	1.9±0.7	8.0±0.5
NHEWBO 50	5.8±0.7*	100	2.1±0.7	5.4±0.4*	22.0±0.5	2.0±0.6	10.0±0.4*
NHEWBO 250	6.0±0.3*	100	2.2±0.5	5.8±0.2*	23.0±0.6*	2.2±0.3*	10.0±0.5*
NHEWBO 500	6.6±0.2*	100	2.4±0.4*	6.0±0.3*	25.0±0.7*	2.7±0.2*	11.0±1.1*

Values are expressed in mean ± SEM as compared with control, n=5. \* =  $p \leq 0.05$

Key: NHEWBO = White *Brassica oleracea*

The pups delivered by the Dams treated with the different doses of n-hexane extract of White *Brassica oleracea* was observed to be grossly better in size, appearance and more in number and in weight [25] . The obtained results supports the uses of n-hexane extract of White *Brassica oleracea* as phyto-antenatal care agent and the delay in

onset of delivery of dams treated with the extract shows the possible tocolytic activity of n-hexane extract of White *Brassica oleracea* [25]

**Effect of n-hexane extract of White *Brassica oleracea* (NHEWBO) on Pups Parameters after Weaning**

**Table 10:** Some pups Parameter off springs after weaning from maternal rats exposed to n-hexane extract of White *Brassica oleracea* (NHEWBO)

Dose (mg/kg)	Weight of pups after weaning (g)	Crown rump length (cm)	No. of Alive Pups after weaning
Control	14.20 ± 0.58	8.20 ± 0.37	6.00 ± 2.77
Diethyl stilbesterol 10	14.70± 0.71	10.00 ± 0.32	9.00 ± 4.53
Oxytocin 0.5 IU	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
NHEWBO 50	16.80 ± 0.37*	11.40 ± 0.24*	10.00 ± 3.00*
NHEWBO 250	18.00 ± 0.32*	12.80 ± 0.20*	10.00 ± 2.90*

NHEWBO 500

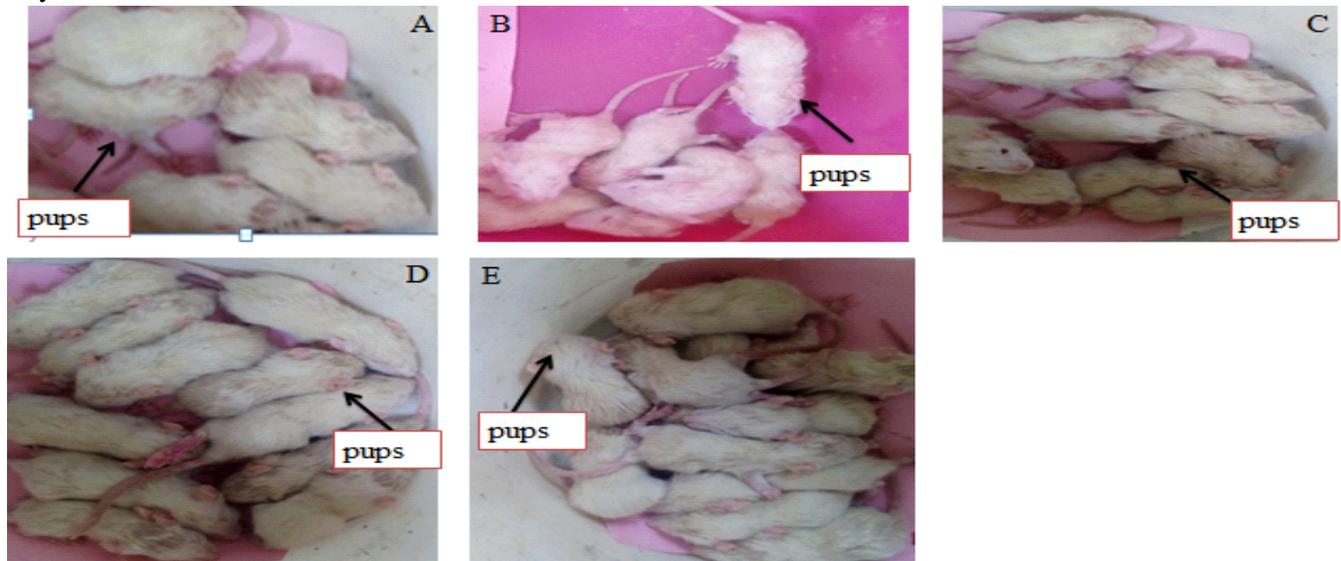
19.00 ± 0.32\*

12.00 ± 0.51\*

10.00 ± 1.40\*

Values are expressed in mean ± SEM as compared with control, n=5. \* =  $p \leq 0.05$

Key: NHEWBO = White *Brassica oleracea*



**Plate 4:** Effect of white *Brassica Oleracea* on pups born after weaning

A= Control, B= Diethylstilbestrol 10 mg/kg, C= *B. oleracea* 50, D= *B. oleracea* 250 mg/kg and E= *B. oleracea* 500 mg/kg

The pups weaned by the Dams treated with the different doses of n-hexane extract of White *Brassica oleracea* was observed to be grossly better in size, appearance and more in number and in weight after at 14 days old [26, 27].

### Conclusion

This study revealed that n-hexane extract of white *Brassica oleracea* was safe at all stages of pregnancy, improved the outcome of pregnancy development and prolonged the onset of labour thus could be useful as a tocolytic agent to prevent preterm birth as it did not cause abortion in the first, second and third trimesters of pregnancy but prolonged the onset of delivery in gravid rats.

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### Contending interests

Authors declare that they have no contending interests.

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