

Prophylactic Effect of *Physalis angulata* Fruit on Hormone-Induced Uterine Fibroids in Wistar Rats

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Abstract: *Physalis angulata* is a medicinal plant with many benefits, which is used for the treatment of infertility related issues in traditional medicine. This study seeks to assess the prophylactic effect of *Physalis angulata* fruit extract on Hormone-induced uterine fibroids in Wistar rats. 60 animals were randomly divided into ten groups. The groups were as follows: Group I- Control group received distilled water for 6 weeks. Group II - Animals were induced with uterine fibroid by administering Diethylstilbesterol (1.35 mg/kg/d) every day for 6 weeks orally using oral gavage, Progesterone injection of 1.0mg/180g in intramuscularly three times a week (Monday, Wednesday and Friday) for 5 weeks. 0.9 mg/kg/d adrenal hydrochloride injection was given intramuscularly in the last two weeks of the experiment. Group III, IV - animals were treated with 500 mg/kg and 1500 mg/kg body weight of *Physalis angulata* fruit extract respectively for 6 weeks respectively before inducement of fibroids for 6 weeks. Group V, VI - 500 mg/kg and 1500 mg/kg of body weight of fruit extract respectively daily for 6 weeks, Group VII- received Mifepristone only. Plant extracts were administered orally using oral gavage. Animals were sacrificed 24 hours after the last administration. Photochemical studies, gross morphology of the uterus, histological assessment of the uterus using H and E stains, apoptotic assessments were carried out using BAX and BCL₂ and hormonal assay were assessed. Results showed increased levels of estrogen (16.38±0.80) and progesterone (9.66±0.58) in fibroid induced group which was reduced in low dose prophylactic groups (Estrogen= 10.99, Progesterone = 6.59) and high dose prophylactic groups (Estrogen= 10.33, Progesterone = 6.33) P≤0.05. Histopathological changes were observed in the uterus. Increased apoptotic marker reaction was seen in the low dose prophylactic group. The study successfully reduced the development of the uterine fibroid, evident by reduction of the uterine horn width, decreased estrogen and progesterone levels, down regulation of BCL₂, and up regulation of BAX and altered endometrial histology. Extract has the ability to inhibit increase in the size of the uterine horn width and hormonal imbalance associated with fibroid development. *Physalis angulata* fruit extract has a promising potential as a supplement for the prevention of uterine fibroid development.

Keywords: Progesterone, Adrenal Hydrochloride, *Physalis Angulata* Fruit, Apoptosis.

INTRODUCTION

Uterine fibroids also known as leiomyomas are non cancerous growth found in the uterus (Gordon & Riebe, 2016). About 80 % of black women and nearly 70 % of White women by the time they reach 50 years of age will have had at least one fibroid tumor, and about 15 to 30 % of these women will develop severe symptoms (Sefah *et al.*, 2022). Currently, effective

drugs/supplements for complete treatment of uterine fibroids are not available, patients are demanding for a non-surgical approach to the treatment of uterine fibroid (Aamir, *et al.*, 2014).

The fibroids sometimes grow back after the surgery thus subjecting the individual to further surgery on the same condition leading to traumatization. *Physalis angulata* is a medicinal plant with many benefits

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(Novitasari *et al.*, 2024). It has been reported to exhibit antitumour, anticancer and antiproliferative properties (Victor *et al.*, 2025). This property makes *Physalis angulata* fruit an attractive candidate for investigating its potential in the prevention of uterine fibroid development.

There is a growing need for effective and sustainable therapeutic strategies for the management of uterine fibroids, a common gynaecological disorder affecting millions of women worldwide. Despite the availability of conventional treatments, they are often invasive, expensive and associated with drawbacks (Mettler *et al.*, 2012). This study seeks to assess the therapeutic and prophylactic potentials of *Physalis angulata* fruit extract, which has been reported to possess antitumour, antiproliferative and anticancer properties. Anecdotal studies have reported that *Physalis angulata* fruit extract is used for the treatment of infertility related problems which further justifies the need for the study.

This research will contribute to the existing body of knowledge on alternative therapies for the management of uterine fibroids. The results of the present study will provide valuable insights into the therapeutic potential of *Physalis angulata* fruit extract, which may lead to the development of novel, effective and sustainable treatment options for hormone induced uterine fibroids. Ultimately, this research has the potential to improve health outcomes, symptoms and quality of life of women suffering from uterine fibroids.

MATERIALS AND METHODS

Plant Collection

Fruits of *Physalis angulata* were obtained from the University of Calabar farm located in Calabar, Nigeria. A voucher sample was deposited in the herbarium located in the Department of Botany. The fruits were identified by a botanist of the Department of Botany, University of Calabar, and assigned a voucher number of Bot/Herb/UCC/021.

Preparation of Plant Extract

Physalis angulata fruit was air dried in a room, weighed, and pulverized into a fine powder using an electric blender. Known grams was soaked in of 80 % ethanol solvent. The ratio of plant powder to solvent volume was 40g:250ml (Krukru *et al.*, 2025). The mixture was periodically shaken at intervals to achieve maximum extraction (Krukru *et al.*, 2025). Whatman No.1 filter paper was used to filter the solution after 72 hours. The filtrate was concentrated in water bath at 40°C. Dried semi solid obtained was weighed and kept in the fridge at 4°C.

With reference to the report of Victor *et al.*, (2025), which stated that, the LD50 of Ethanolic Extract of *Physalis angulata* was over 5000 mg/kg. 500 mg/kg and 1500 mg/kg were adopted as effective doses for the present study.

Experimental Animals

A total number of four two (42) Wistar rats weighing 200 ± 20g were used for this study. Animals were obtained from the Department of Pharmacology, University of Calabar, and housed in wooden cage with wire mesh tops. Animals were allowed to acclimatize for two weeks under standard conditions of temperature and pressure, light and darkness cycles, later randomly assigned to groups. Animals had free access to water and food (rat chow)

Inducement of a Rat Model of Uterine Fibroids (Victor *et al.*, 2025 Method)

Fibroid was induced by injecting animals with:

- i. Diethylstilbestrol (1.35 mg/kg/d) every day for six (6) weeks orally by gavage.
- ii. Progesterone injection, 1.0mg/180g and above in the lateral leg intramuscularly three times a week for 5 weeks.
- iii. 0.9 mg/kg/d adrenal hydrochloride injection was given intramuscularly in the last two weeks of the experiment.

Experimental Protocol

Group I: Control group received 0.5ml of distilled water for 6 weeks.

Group II: Animals were induced with uterine fibroid by administering Diethylstilbestrol (1.35 mg/kg/d) every day for 6 weeks orally using oral gavage, Progesterone injection of 1.0mg/180g in intramuscularly three times a week (Monday, Wednesday and Friday) for 5 weeks. 0.9 mg/kg/d adrenal hydrochloride injection was given intramuscularly in the last two weeks of the experiment.

Group III, IV: Animals were treated with 500 mg/kg and 1500 mg/kg body weight of *Physalis angulata* fruit extract respectively for 6 weeks respectively before inducement of fibroids for 6 weeks.

Group V, VI: 500 mg/kg and 1500 mg/kg of body weight of fruit extract respectively daily for 6 weeks,

Group VII: Received Mifepristone only.

Group VII: Received Mifepristone 6 weeks before inducement of uterine fibroids.

Animal Sacrifice

Sacrifice done 24 hours after the last administration using 0.4ml (20mg/100g) ketamine hydrochloride by intramuscular injection.

Blood samples were withdrawn by cardiac puncture for assay, hormonal/electrolyte concentrations and oxidative stress markers.

Tissue Processing (Victor *et al.*, 2025)

The uterus and ovaries were dissected out, weighed, and preserved in 10 % buffered formalin.

Tissues were processed through the routine processes for H and E stains by dehydration in ascending grades of alcohol, clearing, impregnation and embedding in paraffin wax.

Sections were cut, stained and viewed under light microscope.

Immunohistochemical stain for BAX and BCL2 were using the paraffin wax bases immunohistochemical procedure.

Investigation for Apoptosis (BAX) in the Uterus of Wistar Rats

From Immunohistochemical stain (BAX) sections, stain indicated reaction for apoptosis which were graded into four grades (negative, <25; weakly positive +, 26-50 %; medium/moderate positive ++, 51 - 75 %; strongly positive +++, > 76 %) using Fromowitz's 10 Comprehensive Scoring (Proportion and Staining intensity of Positive cells) (Ju and Xiao, 2016).

Investigation for Anti Apoptosis (BCL2) in the Uterus of Wistar Rats

Stains indicate reaction for anti apoptosis which were graded into four (negative, <25; weakly positive +, 26-50 %; medium/moderate positive ++, 51 - 75 %; strongly positive +++, > 76 %) using Fromowitz's 10 Comprehensive Scoring (Proportion and Staining intensity of Positive cells) (Ju and Xiao, 2016).

Statistical Analysis

Data were expressed as Mean \pm SEM. One-way analysis of variance (ANOVA) was used to determine differences. Values were considered statistically significant at P is less than or equal to 0.05 ($P \leq 0.05$). Ducan post hoc test was used. SPSS version 21 was used.

RESULTS

Table 1:

GROUPS	Height of the Uterine Horn (cm)	Width of the Uterine Horn (cm)	Height of Uterine Body (cm)	Width Uterine Body (cm)
Control	5.83 \pm 0.22	0.21 \pm 0.01	0.9 \pm 0.14	0.31 \pm 0.04
Fibroid Induced	4.54 \pm 0.28	0.61 \pm 0.01 ^a	1.91 \pm 0.31	0.66 \pm 0.16
Prophylactic low dose (500 mg/kg of Fruit Extract)	4.82 \pm 0.07	0.31 \pm 0.07 ^b	1.42 \pm 0.28	0.44 \pm 0.04
Prophylactic low dose (1500 mg/kg of Fruit Extract)	5.05 \pm 0.15	0.21 \pm 0.01 ^b	1.15 \pm 0.13	0.45 \pm 0.09
<i>Physalis angulata</i> Fruit Extract (500mg/kg)	4.82 \pm 0.17	0.21 \pm 0.01 ^b	1.24 \pm 0.42	0.3 \pm 0.01
<i>Physalis angulata</i> Fruit Extract	5.02 \pm 0.34	0.22 \pm 0.01 ^b	1.63 \pm 0.01	0.27 \pm 0.03
p-value	0.254	0.002*	0.444	0.181

Prolactin decreased significantly in the animals administered with *Physalis angulata* 500mg/kg, and 1500mg/kg before the inducement of fibroids when compared to Mifepristone + Fibroid (Figure 1).

Progesterone levels in animals induced with fibroids (FI) group (9.66 \pm 0.59) and Mifepristone only (9.66 \pm 0.58) were significantly ($p < 0.05$) higher compared with the control. Progesterone levels in Mifepristone + Fibroid, Fibroid + prophylactic low and high dose

extracts groups significantly reduced when compared with fibroid group (Figure 2).

Estrogen levels in fibroid groups (FI) were significantly higher compared to control. In the Mifepristone + Fibroid, prophylactic groups given 500 mg/kg and 1500 mg/kg of fruit extract before fibroid was induced, estrogen levels significantly reduced when compared to fibroid group (Figure 4).

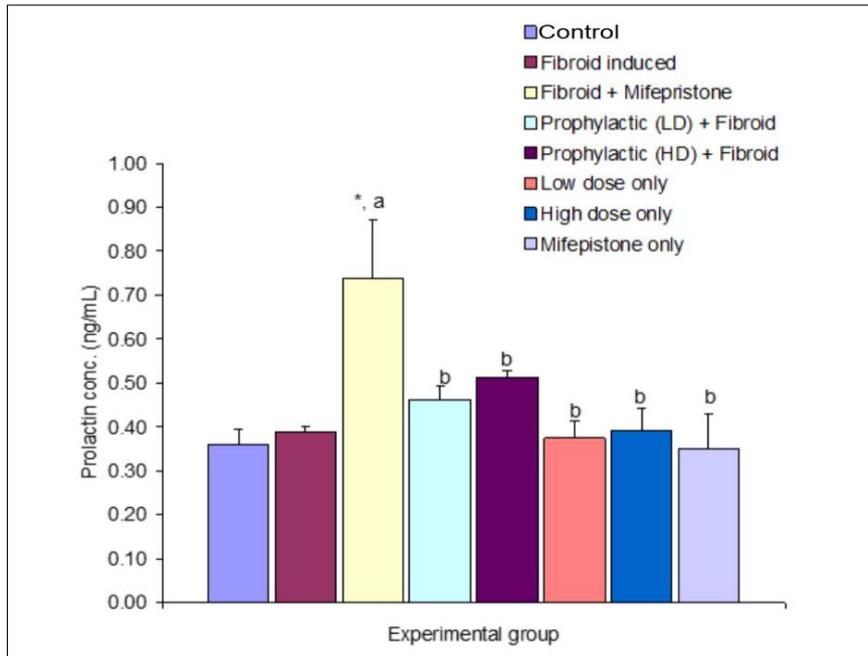


Fig. 1: Prolactin hormone concentration prophylactic studies

Prolactin levels increased significantly in Mifepristone treatment when compared to fibroid group and control. Prolactin decreased significantly in the animals administered with prophylactic (low and high

dose), *Physalis angulate* (500mg/kg, and 1500mg/kg) when compared to Mifepristone + Fibroid.

Values are expressed as Mean ± SEM, n=5.

*= significantly different from control at $p \leq 0.05$

a= significantly different from fibroid induced at $p \leq 0.05$

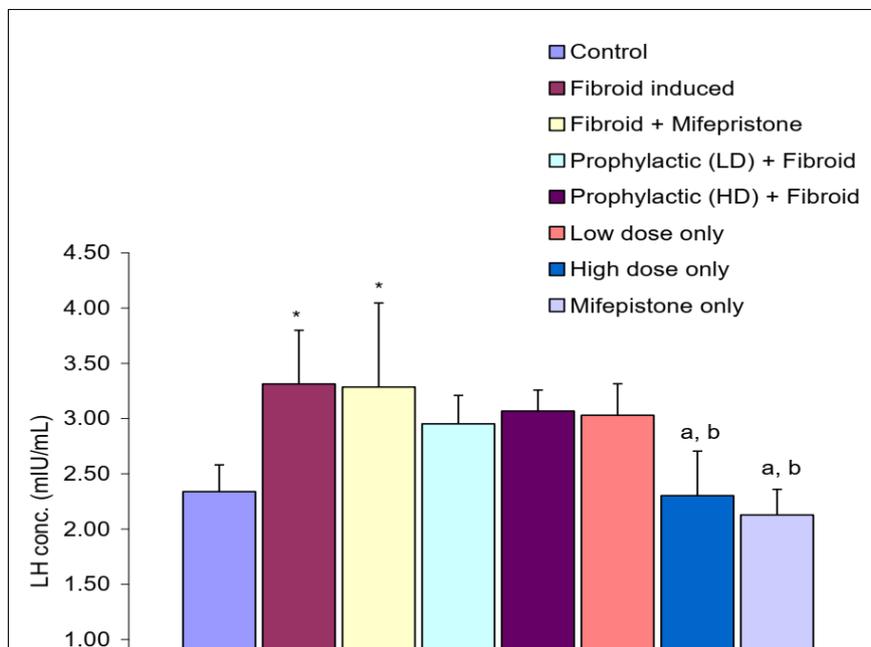


Fig. 2: Luteinizing hormone concentration in the prophylactic studies

Values are expressed as mean ± SEN, n=5

*=significantly different from control at $p < 0.05$

a= significantly different from fibroid-induced at $p < 0.05$

b= significantly different from fibroid + Mefiprostone at $p < 0.05$

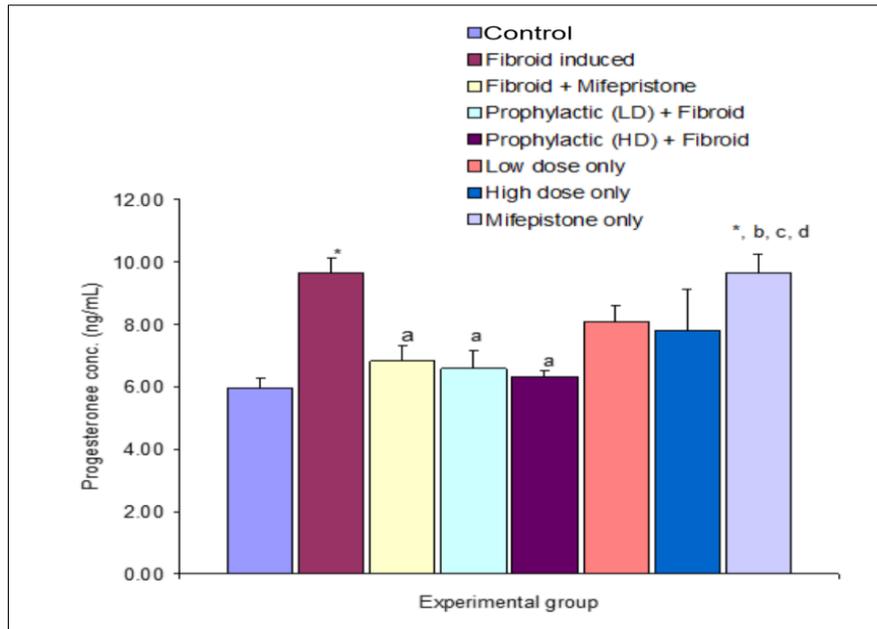


Fig. 3: Progesterone hormone concentration prophylactic studies

Progesterone levels in fibroids (FI) group and Mifepristone only were significantly higher compared with the control. Progesterone levels in Mifepristone treatment and prophylactic (low and high dose) groups significantly reduced when compared to fibroid group.

Values are expressed as Mean ± SEM, n=5.

*= significantly different from control at $p \leq 0.05$

a= significantly different from fibroid induced at $p \leq 0.05$
 b=significantly different from Fibroid + Mifepristone at $p \leq 0.05$

c= significantly different from Prophylactic (LD) + Fibroid at $p \leq 0.05$

d=significantly different from Prophylactic (HD) + Fibroid at $p \leq 0.05$

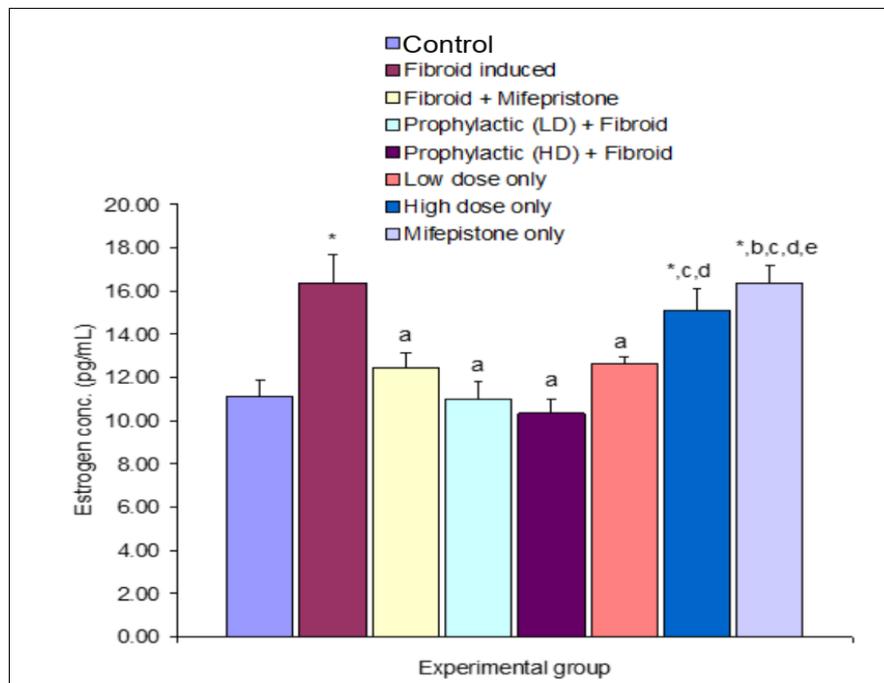


Fig. 4: Estrogen hormone concentration in the prophylactic studies

Estrogen levels in fibroids (FI) group and Mifepristone only were significantly higher compared with the control. Estrogen levels in Mifepristone

treatment and prophylactic (low and high dose) groups significantly reduced when compared to fibroid group.

Values are expressed as Mean ± SEM, n=5.

*= significantly different from control at $p \leq 0.05$

a= significantly different from fibroid induced at $p \leq 0.05$

b=significantly different from Fibroid + Mifepristone at $p \leq 0.05$

c= significantly different from Prophylactic (LD) + Fibroid at $p \leq 0.05$

d=significantly different from Prophylactic (HD) + Fibroid at $p \leq 0.05$

e= significantly different from low dose only at $p \leq 0.05$

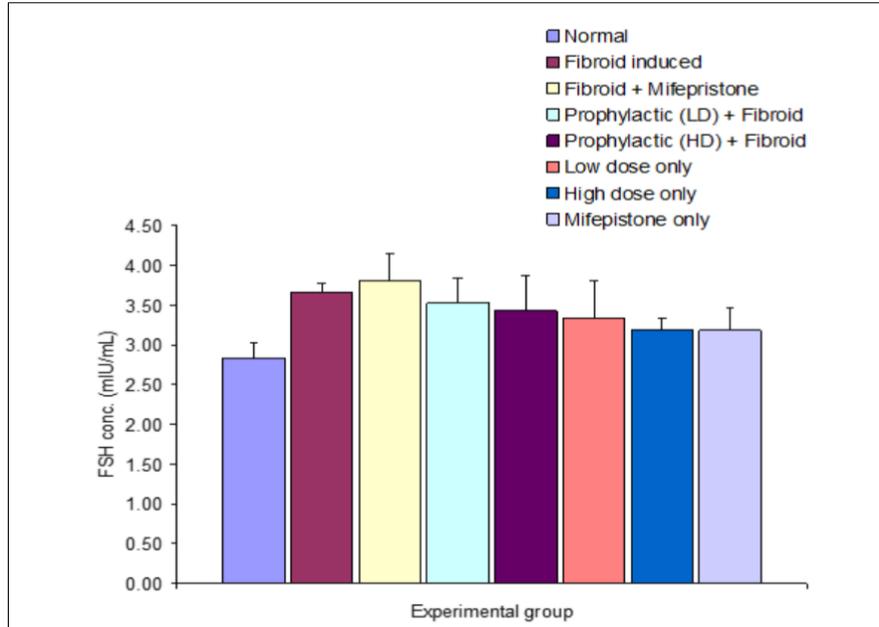


Fig. 5: FSH concentration in the prophylactic studies

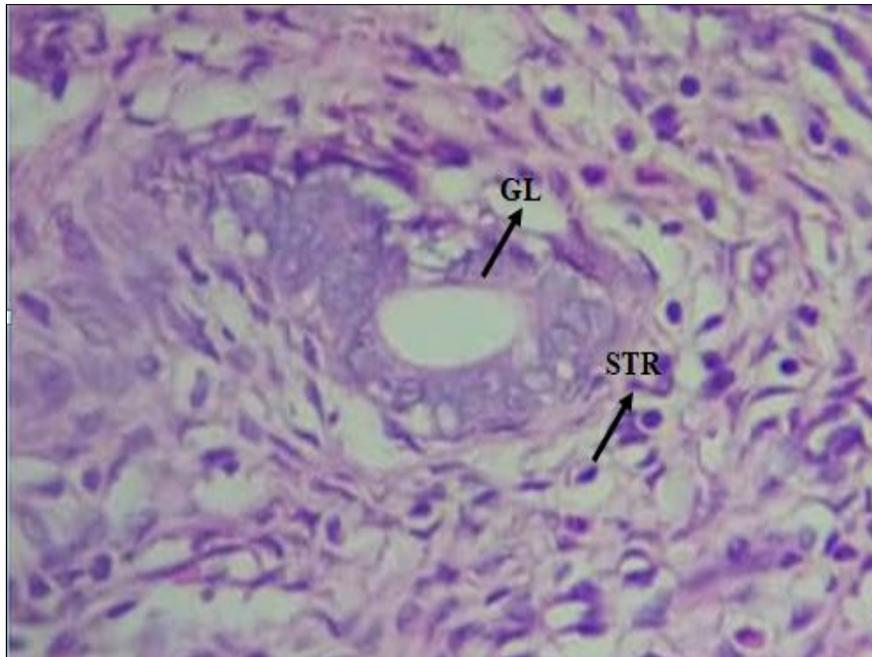


Plate 1: Section of the Uterus from animals in the control showing endometrium lined by Simple Columnar Epithelium and contains endometrial glands. The glands are separated by moderate population of stromal cells. Basilar cells (BC); Lumen of the uterus (L). G- Glands. H&E stain X400.

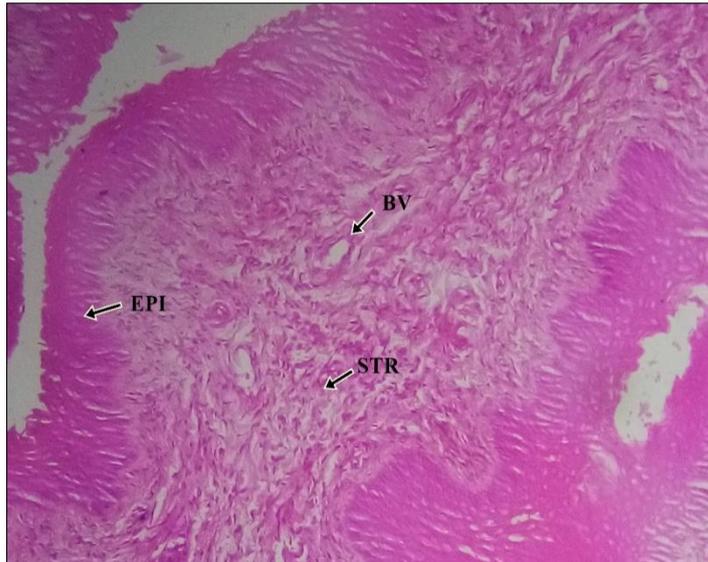


Plate 2: Section of the Uterus from animals induced with fibroid. Section showed stratified epithelium. The underlying Stroma Is Fibrocollagenous with Sparsely Populated Stroma Cells and thin-walled blood vessels. GL- Glands, EPI – Epithelium, STR –Stroma, BV-Blood vessels; H&E stain X 400.

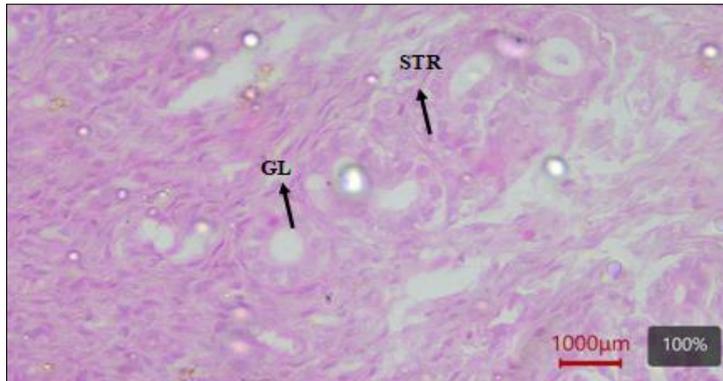


Plate 3: Section of the Uterus from the animals given Mifepristone for 6 Weeks. An Abundant endometrial stroma with sparsely populated tubular glands lined by cuboidal cells. GL- Glands, EPI – Epithelium, STR –Stroma BV- Blood vessels. H and E x 400

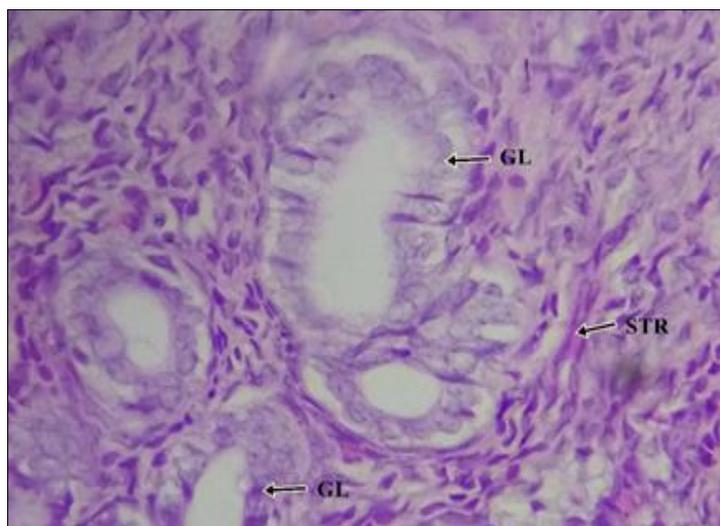


Plate 4: Section of the Uterus from animals given Fruit Extract (500 mg/kg) for 6 Weeks before Fibroid Inducement. An abundant stroma and glands. GL- Glands, EPI – Epithelium, STR –Stroma. H&E x 400

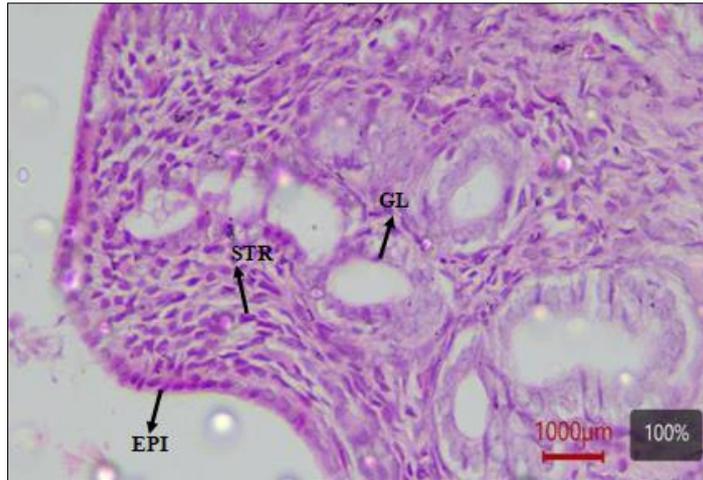


Plate 5: Section of the Uterus from animals given Fruit Extract (1500 mg/kg) for 6 Weeks before Fibroid Inducement. An intact epithelium with an abundant stroma and widely spaced tubular glands lined by benign epithelium. GL- Glands, EPI – Epithelium, STR –Stroma BV-Blood vessels. H&E x 400

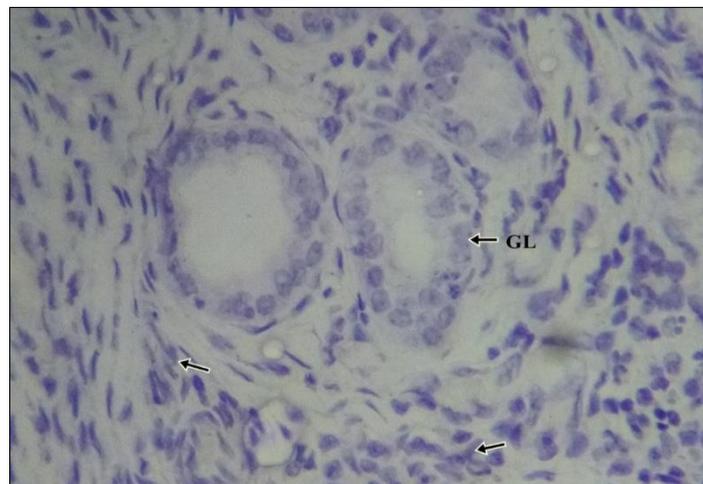


Plate 6: Section of the ovary from the animals Induced with Fibroid + Mifepristone administration for 6 Weeks showing a negative reaction (Arrows) for BAX suggesting Negative apoptosis. No reaction noted both for the stroma. $\leq 25\%$ --NEG. Cells lining the Uterine glands = 0 %. Stroma cells = 0 % GL= Gland. BAX X 400.

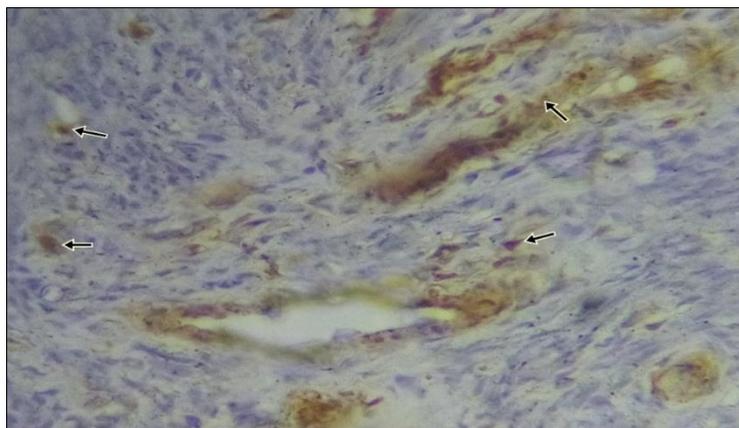


Plate 7: Section of the uterus from animals given Mifepristone for 6 Weeks showing a strong positive BAX reaction (Arrows) for stromal and epithelial cells lining the glands suggesting Strong apoptosis. 76–100% --strong positive. Cells lining the Uterine glands = 77.5 %.Stroma cells = 13.1 % .BAX X 400.

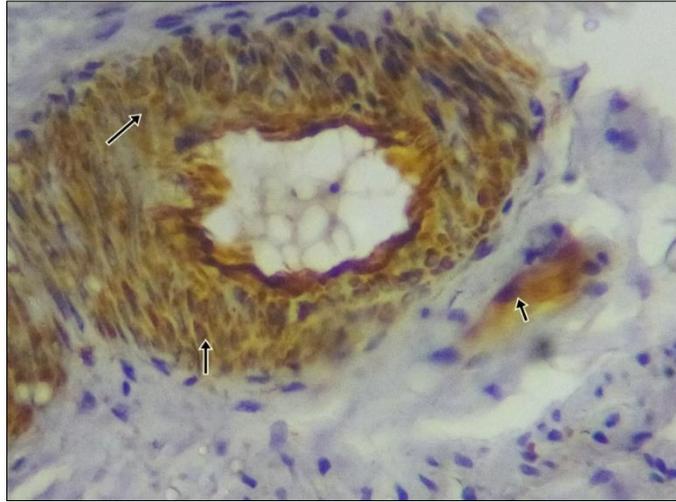


Plate 8: Section of the uterus from the animals given Fruit Extract (500 mg/kg) for 6 weeks + Fibroid Inducement showing a strong positive reaction (Arrows) for the cells surrounding the ducts and few stroma cells suggesting strong apoptosis. 76–100% --strong positive. Cells lining the Uterine glands = 98.6 %. Stroma cells = 9.3 % .GL— Gland. BAX X 400.

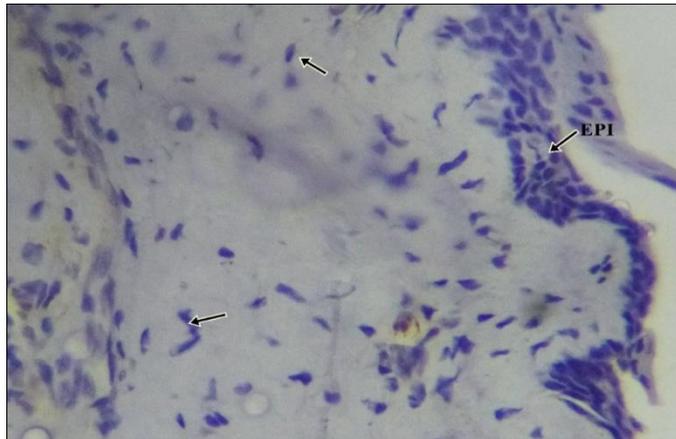


Plate 9: Section of the uterus from the animals given Fruit Extract (1500 mg/kg) for 6 weeks before Fibroid Inducement showing a weak positive tissues reaction (Arrows) for some of the stroma cells suggesting Negative apoptosis. ≤ 25%--NEG. Cells lining the Uterine glands = 0 %. Stroma cells = 9.2 % GL= Gland. BAX X 400.

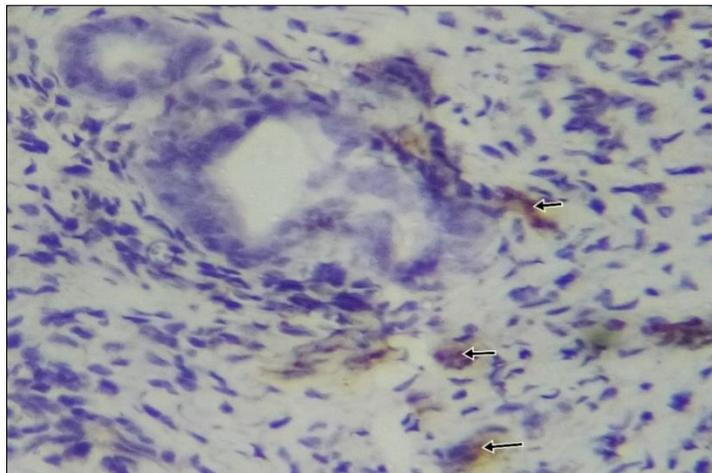


Plate 10: Section of the uterus from animals given Mifepristone for 6 Weeks showing a weakly positive reaction (Arrows). The stroma cells and cells lining the glands are faintly stained brown suggesting weak anti apoptosis. 26–50% --Weak Positive; Cells lining the Uterine glands = 18.1 %. Stroma cells = 23.4 % BCL2 X 400

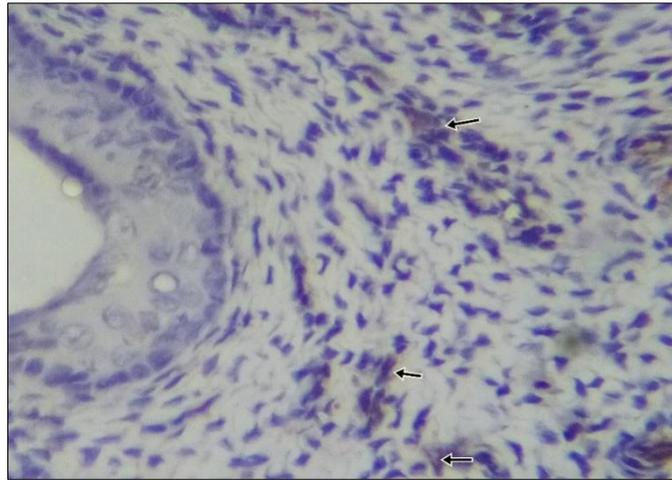


Plate 11: Section of the uterus from animal given Fruit Extract (1500 mg/kg) for 6 weeks before Fibroid Inducement. Section shows a weakly positive (Arrows) reaction for BCL2. All the stroma cells and cells lining the glands are faintly stained brown suggesting weak anti apoptosis. 26–50% --Weak Positive Cells lining the Uterine glands = 26 %. Stroma cells = 45.2%. BCL2 X 400

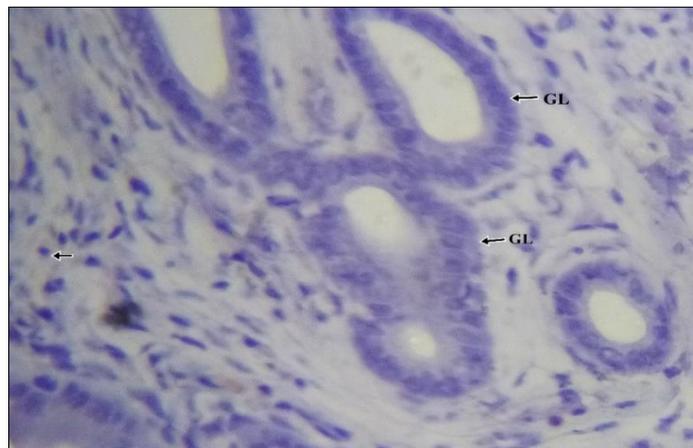


Plate 12: Section of the uterus from animal given Fruit Extract (500 mg/kg) for 6 weeks before Fibroid Inducement. Section shows negative reaction for BCL2, suggesting absence of anti apoptosis. Endometrium consisting of stromal cells and glands (GL). ≤ 25%--NEG; Cells lining the Uterine glands = 0 % Stroma cells = 0 %. BCL2 X 400

DISCUSSION

The reduction in the size of the uteri of animals in the group pretreated with extract before inducing fibroid can be attributed to the presence of some phytochemicals capable of inhibiting proliferation, inducing apoptosis, inhibiting tumour growth. This finding is in agreement with Yanxia *et al.*, (2016). They reported that kaempferol exhibits inhibitory effects on cell proliferation and induces apoptosis.

Results from prophylactic low and high dose groups showed that pretreatment with *Physalis angulata* significantly reduced the level of estrogen. This implies that the aromatase enzyme which contributes to the development of hormone-induced fibroids may have been inhibited, suggesting that the extract may be effective in the inhibition of estradiol associated with fibroid growth and development, and thus potent in the prevention of the development of fibroids.

Histopathology of the uteri sections in prophylactic groups revealed cystically dilated glands. This distortion or disorganisation/structural changes can be attributed to the administration of DES and progesterone. This also agrees with Zhao *et al.*, (2018), they reported that the uteri treated with DES and progesterone showed disordered endometrium, inflammatory infiltrates and vascular degeneration, hypertrophy and hyperplasia.

In the prophylactic low dose group, BAX was upregulated for stroma cells and BCL2 down regulated. This implies that apoptosis was induced by some phytochemicals constituents (flavonoids) of the *Physalis angulata*. This agrees with Ju and Xiao (2016), they reported flavones (amentoflavone), a type of flavonoids promotes leiomyoma cell death by boosting BAX expression and reducing BCL₂ expression.

CONCLUSION

Physalis angulata fruit extract was effective in the prevention of the development of uterine fibroids in rats. It induced apoptosis in the cells and corrected hormonal imbalance associated with fibroid inducement.

REFERENCES

- Aamir, K. T., Shehmar, M., & Gupta, J. K. (2014). Uterine fibroids: Current perspectives. *International Journal Womens Health*, 6, 95-114.
- Abdillah, H., & Van Staden, J. (2013). Application of medicinal plants in maternal healthcare and infertility: A South African perspective. *Plantation Medicine*, 79(7), 591-599. DOI: 10.1055/s-0032-1328504
- Bailon-Moscoco, N., Cevallos-Solorzano, G., Romero-Benavides, J. C., & Orellana, M. I. (2017). Natural compounds as modulators of cell cycle arrest: application for anticancer chemotherapies. *Current Genomics*, 18(2), 106-131
- Cragg, G. M., & Newman, D. J. (2013). Natural products: A continuing source of novel drug leads. *Biochimica et Biophysica Acta (BBA)*, 1830, 3670–3695. [Google Scholar] [CrossRef] [Green Version]
- Dai, Z. J., Gao, J., Li, Z. F., Ji, Z. Z., Kang, H. F., Guan, H. T., Diao, Y., Wang, B. F., & Wang, X. J. (2011). *In vitro* and *in vivo* antitumor activity of *Scutellaria barbata* extract on murine liver cancer. *Molecules*, 16, 4389-4400. doi: 10.3390/molecules16064389.[DOI] [PMC free article]
- Dar, R. A., Shahnawaz, M., Rasool, S. R., & Qazi, P. H. (2017). Natural product medicines: A literature update. *The Journal of Phytopharmacology*, 6(6), 340-342.
- Gordon and Riebe, (2016). Tumours of the female reproductive organs. *Family and Community Medicine*, 1395–1410. 10.1007/978-3-319-04414-9_112
- Jean-Paul, G. (2005). Better prepared than synthesized. Adolf butenandt and schering AG: Turning sex steroids into drugs. *Studies in History and Philosophy of the Biological and the Biomedical Sciences*, 36, 612-44.
- Ju, Y., & Xiao, B. (2016). Chemical constituents of *Cyperus rotundus* L. and their inhibitory effects on uterine fibroids. *African Health Sciences*, 16(4), 1000-1006.
- Kirtikar, K. R., & Basu, B. D. (2001). Evaluation of phenolic content and antioxidant property of *Crossandra infundibuliformis* leaves extracts. *Indian medicinal plants*. (2nd edition). Oriental Enterprises, Uttaranchal, Volume 8, 2604.
- Lee, T. K., Kim, D. I., Song, Y. L., Lee, Y. C., Kim, H. M., & Kim, C. H. (2004). Differential inhibition of *Scutellariabarbata* D. Don (Lamiaceae) on HCG-promoted proliferation of cultured uterine leiomyoma and myometrial smooth muscle cells. *Immunopharmacology and Immunotoxicology*, 26, 329–342. doi: 10.1081/IPH-200026841.[DOI] [PubMed] [Google Scholar].
- Mann, J. (2002). Natural products in cancer chemotherapy: Past, present and future. *Natural Review on Cancer*, 2(2), 143-148. DOI: 10.1038/nrc723.
- Mettler, L., Schollmeyer, T., Tinelli, A., Malvasi, A., & Alkatout, I. (2012). Complications of uterine fibroids and their management, surgical management of fibroids, laparoscopy and hysteroscopy versus hysterectomy, haemorrhage, adhesions, and complications. *Obstetrics and Gynaecology International*, 791248. Doi: 10.1155/2012/791248. PMID: PMC3348525 PMID: 22619681.
- Newman, D. J., & Cragg, G. M. (2007). Natural products as sources of new drugs over the last 25 years. *Journal of Natural Products*, 70(3), 461-77.
- Novitasari, A., Rohmawaty, E., & Rosdianto, A. M. (2024). *Physalis angulata* Linn. as a medicinal plant (Review). *Biomedical Reports*, 20(3), 47. https://doi.org/10.3892/br.2024.1735.
- Sefah, N., Ndebele, S., Prince, L., Korasare, E., Michael Agbleke, M., Nkansah, A., Thompson, H., Al-Hendy, A., & Agbleke, A. A. (2022). Uterine fibroids - causes, impact, treatment, and lens to the African perspective. *Frontiers in Pharmacology*, 13, 1045783. doi: 10.3389/fphar.2022.1045783.
- Talukdar, A., Kalita, R. D., Gohain, N., Saikia, K., & Kalita, M. C. (2018). Nephroprotective activity of the ethnomedicinal plants *Caesalpinia bonduca* and *Momordica dioica* from North-East India against cisplatin induced chemotherapeutic toxicity. *International Journal of Pharmacy and Pharmaceutical Sciences*, 10(6), 256-267.
- Yanxia L., Zhaoxia, D., & Chuanzhong, W. (2016). Mechanistic study of the inhibitory effect of kaempferol on uterine fibroids. *In vitro Med Sci Monit.*, 22, 4803–4808. doi: 10.12659/MSM.898127
- Zhao, H., Li, Y., Xu, Q., Peng, F., Zhao, J., Webb, R. C., Peng, C., & Yu, C. (2018). Establishment of a rat model for uterine leiomyomas based on Western and traditional Chinese medicine theories. *Brazilian Journal of Medicine and Biological Research*, 51(9), 7627-7632.