Infertility Effects of methanol extract of Abrus Precatorius seeds on Reproductive, Hepatic and Renal function in female albino rats

Venkataramanaiah Poli
Sri Venkateswara University
Srinivasulu Reddy Motireddy (pvr9490641036@gmail.com)
Sri Venkateswara University

Research Article

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Abstract

Background

Abrus precatorious is a member of the leguminous family with characterstic red and black seeds. The leaves, roots and seeds of *Abrus precatorious* are used medicinally. The aim of this study was to investigate the antifertility activity of crude extract of *A. precatorius* seeds (extracted in to 70% Methanol) in female albino rats.

Methods

The female rats were grouped into two with six rats of each. Control group received normal saline. Female albino rats were administered APS (45 and 50 mg/kg) by oral gavage daily for a period of 30 days and body weights were recorded.

Results

All the results showed that the reproductive parameters were such as Body weight, Organ Weight, Estrous cycle, Hormonal Concentrations, Antioxidant Enzymes (Tissue), Enzymatic Activities (Tissue), Serum Biochemical indices (Liver and Kidney panel) and Hematological parameters analysed were found to show a significant difference ($p < 0:05$) between the means of the treated groups.

Conclusion

The study provides evidence for the potential ameliorative effects of *A. precatorius* seeds may possess anti-fertility effect in female rats.

Introduction

Plants and their derivatives have long been used by humans as active ingredients in industrial, environmental, and medicinal applications. For basic medical care, almost 75% of the world's population uses herbal medicine. Moreover, the creation of infertility medications derived from plants is seen favorably due to its low toxicity and cost-effectiveness [1]. Plant extracts have a significant therapeutic effect in the treatment of numerous human diseases because of their secondary metabolites. There is a vast array of physiologically active chemicals found in natural products, most of which are derived from plants. Despite significant advancements in contemporary medicine, the creation of novel medications from natural sources is still seen as crucial. 70,000 plants are thought to have therapeutic uses. Ayurveda treats a wide range of illnesses using about 2000 different plant species. The Encyclopedia of Traditional Chinese Medicine lists 5757 plants that serve as the foundation for the Chinese medical system. A wide variety of therapeutic herbs are also used in the medical systems of Korea and Japan. More than 2,000 natural products of medicinal relevance are included in the Indian Material Medica, 400 of which are derived from minerals or animals and the remaining 400 from plants. India is dubbed the "botanical garden of the world" for good reason-it is arguably the world's largest producer of medicinal plants.

Ayurveda and other traditional medical systems prescribe therapeutic medications made from about 1250 Indian medicinal herbs [2].The use of herbal ingredients to treat infertility is well known in traditional medicine around the world. *Abras precatorius*, commonly known as precatori bean, rosary pea, or ratti, is an indigenous traditional medicinal plant, the stem of a plant whose powdered seeds are used as an oral contraceptive by Ayurvedic practitioners. Regarding *A. precatorius* infertility treatment activities, the use of seed extract in male rats has been reported, but there is no documented evidence available in case of female rats.

A. precatorius seeds are also reported to have anticancer, antifertility, antitumor, antispermatogenic, antibacterial, antidiabetic, antioxidant, nephroprotective, antiarthritic, antimicrobial, and antimalarial activities. Despite its popularity in folk medicine, its toxicity profile has not yet been explored [3]. *Abrus precatorius* is widely used in various traditional systems due to its potential effects on reproductive health as it contains several bioactive compounds including flavonoids such as abrin, precatorine, abraline, abrectine, abrusogenin, kaempferol, quercetin, and isorhamnetin. These compounds exhibit different pharmacological properties and may contribute to effects on fertility [4]. Systematic studies are needed to understand the contraceptive mechanism of *A. precatorius* seed powder in rural women. As a first step, it is important to test the anti-reproductive effects of *A. precatorius* seed extract in female rats (Fig. 1). Therefore, the aim of the present study was to evaluate the anti-reproductive activity of Methanol extracts of *A. precatorius* seeds and to investigate the reproductive parameters such as hormonal profile (LH, FSH, estrogen), major reproductive organs and also to investigate the impact on and other important organs. Therefore, the present study was aimed to understand the effect of the methanol (70%) extract of *A.precatorius* seeds in female albino rats.

Materials and methods

Chemical reagents

All chemicals and reagents used for the study were of analytical grade and procured from approved organizations.

Seed collection and authentication

Abrus precatorius seeds (APS) were collected from a local market in Tirupati, Andhra Pradesh, India. The seeds were authenticated by Dr. J. Kamakshamma, Department of Botany, SVU College of Sciences, Sri Venkateswara University, Tirupati, and a voucher specimen was deposited there for future reference. The seeds were cleaned and washed with distilled water in order to remove the impurities and were shade dried. The seeds were then coarsely powdered in a mixer grinder.

Preparation of methanol (70%) seed extract

Dried coarse powder of APS (250 g) was defatted with petroleum ether and the marc remaining was extracted successively with methanol (70%) using cold maceration. The filtrate obtained was evaporated

in a rotary evaporator under reduced pressure and was vacuum dried. The dried extract was packed in an air-tight container and stored in a refrigerator (2–4°C) until needed for the experiment.

Maintenance of experimental animals

Female albino rats weighing 120–180 g were used for this study. The animals were kept in properly numbered large polypropylene cages with a stainless steel top grill. They were maintained under standard laboratory conditions (24 ± 2°C; 50 ± 5% humidity; 12 hours light/12 hours dark cycle) with standard diet (obtained from M/S Sai Durga Feeds, Bangalore) and water *ad libitum* and were acclimatized to the laboratory conditions for a week before starting the experiment. Paddy husk was used as bedding material and it was changed twice a week.

Experimental setup

Eighteen (18) female albino rats were used in this experiment. They were divided into three groups of six (n = 6) animals each. The extract was orally (gavage) administered for a period of 30 days as follows;

Group 1: Control, saline solution (10 mL/kg of body weight)

Group 2: Methanol extract of *APS* (45 mg/kg/day BW)

Group 3: Methanol extract of *APS* (50 mg/kg/day BW)

Measurement of Body weight

Body weight of rat from each group was taken after treatment at every 10 days interval.

Collection of blood and tissue samples

After the last oral dose in the first set of experiment, all the rats were waited for the onset of estrous phase and then their blood was collected directly from retro-orbital puncture after mild ether anesthesia and finally they were sacrificed with decapitation. For ovary, uterus, liver, kidney were collected from sacrificed rats.

Assessment of estrous cycle

The unstained smear method after Marcondes (2002) [5] was employed to determine the different stages of the estrous cycle.

Hormonal profiling

The stored serum was used to measure the level of follicle stimulating Hormone (FSH), luteinizing hormone (LH), Prolactin, Estradiol and Progesterone concentrations by Chemi Luminescent Immuno Assay (CLIA) and Enzyme Linked Immunosorbent Assay (ELISA) (Bangalore, India). The experiment was performed as per the manufacturer's instructions.

Antioxidant Enzyme Assay

The Antioxidant Enzyme parameters such as Malondialdehyde (MDA) [6], Catalase (CAT) [7], Superoxide dismutase (SOD) [8], Glutathione peroxidase (GPx) [9], Glutathione reductase (GR) [10] and Glutathione S-transferase (GST) [10] were analyzed in homogenates of ovary.

Estimation of enzymes activities & Serum biochemical parameters

Estimation of total cholesterol [11], total ascorbic acid content [12], Glucose-6- Phosphate Dehydrogenase activity [13] and Δ^5-3β- Hydroxy Steroid Dehydrogenase activity [14] were analyzed in homogenates of ovary.

The serum was assayed for assayed for Bilirubin, Glutamic oxaloacetic transaminase (SGOT) activity, Glutamic pyruvate transaminase (SGPT) activity, Alkaline phosphatase (ALP) activity, Total protein, Albumin, Globulin, Urea, Uric acid, Creatinine, and Calcium using clinical autoanalyzer (Erba Magnum EM200) (Bangalore, India).

Hematological investigations

The blood or hematological parameters analysed were of follows [15]. White blood cell (WBC), Red blood cell (RBC), Hemoglobin (Hb) concentration, erythrocyte sedimentation rate (ESR) and Clotting Time.

Statistical analysis

The data were analyzed with one-way ANOVA (analysis of variance), followed by the Tukey and Scheffe tests. Statistical analysis was done with SPSS v. 17.5 software; $P < 0.05$ was considered as statistically significant difference.

Results

Body weight changes

The final body weights of control and treated female rats showed a significant decrease ($p < 0.05$) compared to the initial body weight. The body weight of APS in both administrations decreased significantly compared to the control group ($p < 0.05$) (Table 1).

Table 1
Effect of APS (70% methanol extract) administered in female albino rats

Dose (mg/Kg)	Body weight (g)	
	Initial	Final
Control	175 ± 12.35	184 ± 14.79
APS-45	189 ± 14.64	174 ± 12.58
	+ 8.00[b]	-5.43 [b]
APS-50	191 ± 15.37	171 ± 11.35
	+ 9.14 [b]	– 7.06 [b]
All values are expressed as mean ± SEM, n = 6 rats in each group.		
+ and – percent increase and decrease respectively over control.		
P values b = P < 0.05 as compared with control.		
The significance were determined by One-way ANOVA was used to analyze the data.		

Organ Weight changes

APS at both doses presented showed a significant reduction ($p < 0.05$) in the weight of the ovaries, liver and kidneys compared to the control group (Table 2).

Table 2
Effect of APS (70% methanol extract) administered in female albino rats

Dose (mg/Kg)	Organ Weight (mg/gm bwt)		
	Ovary	Liver	Kidney
Control	22.82 ± 1.63	3.29 ± 0.21	0.537 ± 0.03
APS-45	18.48 ± 1.35	3.08 ± 0.19	0.513 ± 0.02
	-19.01[a]	-6.38 [b]	-4.46 [b]
APS-50	17.17 ± 1.14	3.02 ± 0.17	0.511 ± 0.02
	-24.75 [a]	-8.20 [b]	-4.84[b]
All values are expressed as mean ± SEM, n = 6 rats in each group.			
+ and – percent increase and decrease respectively over control.			
P values a = P < 0.05 as compared with control.			
The significance were determined by One-way ANOVA was used to analyze the data.			

Estrous cycle study

Estrous cycle analysis revealed APS in both administrations, the duration of Proestrus, Estrus, Metestrus and Diestrus in APS in both administrations significantly increased ($p < 0.05$) compared to the control group (Table 3).

Table 3
Effect of APS (70% methanol extract) administered in female albino rats

Dose (mg/Kg)	Total duration in each phase (in days)			
	Proestrus	Estrus	Metestrus	Diestrus
Control	16 ± 0.91	18 ± 1.01	26 ± 1.32	57 ± 3.43
APS-45	22 ± 1.25	24 ± 1.37	34 ± 2.38	82 ± 5.47
	+ 37.50 [a]	+ 33.33 [a]	+ 30.76 [a]	+ 43.85 [a]
APS-50	24 ± 1.36	26 ± 1.31	38 ± 2.56	86 ± 5.84
	+ 50.00 [a]	+ 44.44 [a]	+ 46.15 [a]	+ 50.87 [a]
All values are expressed as mean ± SEM, n = 6 rats in each group.				
+ and – percent increase and decrease respectively over control.				
P values a = P < 0.05 as compared with control.				
The significance were determined by One-way ANOVA was used to analyze the data.				

Hormonal effects

The mean values of reproductive hormone levels were presented in Table 4. Serum levels of FSH, LH Prolactin, and Estradiol significantly reduced ($p < 0.05$) in APS Administered group compared to control group. Serum Progesterone concentration significantly increased ($p < 0.05$) in the APS-treated group compared to the control group.

Table 4
Effect of APS (70% methanol extract) administered in female albino rats

Dose (mg/Kg)	Hormonal Concentrations				
	FSH (mIU/ml)	LH (mIU/ml)	Prolactin (ng/ml)	Estradiol (ng/ml)	Progesterone (ng/ml)
Control	7.36 ± 0.48	6.18 ± 0.39	148.52 ± 9.64	487.29 ± 36.25	46.72 ± 2.92
APS-45	4.87 ± 0.29	4.12 ± 0.22	106.47 ± 6.23	349.84 ± 24.86	68.93 ± 4.61
	-33.83 [a]	-33.33 [a]	-28.31 [a]	-28.20 [a]	+ 47.53 [a]
APS-50	4.38 ± 0.25	3.84 ± 0.19	103.63 ± 6.01	337.69 ± 22.42	73.27 ± 4.94
	-40.48 [a]	-37.86 [a]	-30.22 [a]	-30.70 [a]	+ 56.82 [a]
All values are expressed as mean ± SEM, n = 6 rats in each group.					
+ and – percent increase and decrease respectively over control.					
P values a = P < 0.05 as compared with control.					
The significance were determined by One-way ANOVA was used to analyze the data.					

Antioxidant Enzyme effects

Antioxidant parameters, measured in the ovarian tissue of the rat groups, are shown in Table 5. APS administration significantly increased ($p < 0.05$) ovarian MDA compared to the control group. The concentration of ovarian CAT, SOD, GPx, GR, GST significantly decrease ($p < 0.05$) in APS in both administered rats compared to the control group.

Table 5
Effect of APS (70% methanol extract) administered in female albino rats

Dose (mg/Kg)	Antioxidant Enzymes (Tissue)					
	MDA (μmol/g protein)	CAT (U/mg protein)	SOD (U/mg protein)	GPx (U/mg protein)	GR (U/mg protein)	GST (U/mg protein)
Control	7.07 ± 0.42	4.97 ± 0.24	9.75 ± 0.51	3.84 ± 0.23	4.62 ± 0.31	6.49 ± 0.36
APS-45	10.28 ± 0.53	2.85 ± 0.16	6.28 ± 0.32	2.27 ± 0.13	3.03 ± 0.19	2.82 ± 0.16
	+ 45.40 [a]	-42.65 [a]	-35.58 [a]	-31.51 [a]	-34.41 [a]	-56.54 [a]
APS-50	11.12 ± 0.63	2.46 ± 0.10	5.97 ± 0.26	2.03 ± 0.11	2.81 ± 0.15	2.56 ± 0.14
	+ 57.28 [a]	-50.50 [a]	-38.76 [a]	-47.13 [a]	-39.17 [a]	-60.55 [a]
All values are expressed as mean ± SEM, n = 6 rats in each group.						
+ and – percent increase and decrease respectively over control.						
P values a = P < 0.05 as compared with control.						
The significance were determined by One-way ANOVA was used to analyze the data.						

Enzymatic Activities effects

The Cholesterol and Ascorbic acid contents in the ovarian tissues showed to be significantly increased ($p < 0.05$) in APS administered group compared to the control group. Ovarian G6PD and Δ^5-3β-HSD showed a significant decrease ($p < 0.05$) between the control and experimental groups (Table 6).

Table 6
Effect of APS (70% methanol extract) administered in female albino rats

Dose (mg/Kg)	Enzymatic Activities (Tissue)			
	Cholesterol (µg/mg)	Ascorbic acid (µg/mg)	G-6-PDH (IU/mg)	Δ^5 -3β-HSD (IU/mg)
Control	48.79 ± 2.86	66.35 ± 4.32	4.03 ± 0.26	1.26 ± 0.06
APS-45	74.35 ± 4.85	88.76 ± 6.13	2.47 ± 0.14	0.65 ± 0.03
	+ 52.38 [a]	+ 33.77 [a]	-38.70 [a]	-48.41 [a]
APS-50	81.62 ± 5.92	89.57 ± 6.74	1.92 ± 0.11	0.59 ± 0.02
	+ 67.28 [a]	+ 34.99 [a]	-52.35 [a]	-53.17 [a]
All values are expressed as mean ± SEM, n = 6 rats in each group.				
+ and – percent increase and decrease respectively over control.				
P values a = P < 0.05 as compared with control.				
The significance were determined by One-way ANOVA was used to analyze the data.				

Biochemical changes

Biochemical parameters of liver and kidney tissues were presented in Tables 7 and 8. APS in both rats administered groups showed a significant increase ($p < 0.05$). Where as in serum biochemical parameters such as Bilirubin, SGPT, SGOT, Alkaline Phosphate, Albumin, Globulin, Urea Creatinine, showed a significant increase between the control and experimental groups. A significantly decrease ($p < 0.05$) in serum Total Protein, Uric acid, Calcium were APS in both both treated rats compared to the control group.

Table 7
Effect of APS (70% methanol extract) administered in female albino rats

Dose (mg/Kg)	Biochemical indices (Liver panel)						
	Bilirubin mg/dl	SGPT IU/L	SGOT IU/L	Alkaline Phosphate IU/L	Total Protein mg/dl	Albumin mg/dl	Globulin mg/d
Control	0.72 ± 0.03	27.18 ± 1.34	34.62 ± 1.75	192.85 ± 9.83	5.67 ± 0.28	2.64 ± 0.11	2.59 ± 0.10
APS-45	0.94 ± 0.05 + 30.55	39.36 ± 1.98 + 44.81 [a]	47.37 ± 3.02 + 36.82 [a]	137.69 ± 7.41 -28.60 [a]	3.42 ± 0.18 -39.68 [a]	3.72 ± 0.19 + 40.90 [a]	3.68 ± 0.18 + 42.08 [a]
APS-50	0.98 ± 0.06 + 36.11 [a]	42.13 ± 2.97 + 55.00 [a]	49.85 ± 3.14 + 43.99 [a]	131.87 ± 6.83 -31.62 [a]	3.04 ± 0.16 -46.38 [a]	3.95 ± 0.21 + 49.62 [a]	3.85 ± 0.20 + 48.64 [a]
All values are expressed as mean ± SEM, n = 6 rats in each group.							
+ and – percent increase and decrease respectively over control.							
P values a = P < 0.05 as compared with control.							
The significance were determined by One-way ANOVA was used to analyze the data.							

Table 8
Effect of APS (70% methanol extract) administered in female albino rats

Dose (mg/Kg)	Biochemical indices (Kidney panel)			
	Urea mg./dl	Uric acid mg/dl	Creatinine mg/dl	Calcium mg/dl
Control	22.38 ± 1.35	0.87 ± 0.05	3.57 ± 0.19	7.98 ± 0.45
APS-45	33.64 ± 1.96 + 50.31 [a]	0.51 ± 0.03 -41.37 [a]	4.96 ± 0.25 + 38.93 [a]	4.36 ± 0.21 -45.36 [a]
APS-50	35.86 ± 2.02 + 60.23 [a]	0.47 ± 0.02 -45.97 [a]	5.13 ± 0.36 + 43.69 [a]	4.08 ± 0.20 -48.87 [a]
All values are expressed as mean ± SEM, n = 6 rats in each group.				
+ and – percent increase and decrease respectively over control.				
P values a = P < 0.05 as compared with control.				
The significance were determined by One-way ANOVA was used to analyze the data.				

Hematological effects

The Hematological parameters of the treated groups and the control group are presented in Table 9. The APS in both treated rats showed a significant decrease ($p < 0.05$) in RBC, Hb, ESR and Clotting Time compared to control rats, while it significantly increase ($p < 0.05$) in WBC compared to control rats.

Table 9
Effect of APS (70% methanol extract) administered in female albino rats

Dose (mg/Kg)	Hematological parameters				
	RBC (Count $\times 10^6/mm^3$)	WBC (Count $\times 10^3/mm^3$)	Hb (gm/dl)	ESR (mm/hr)	Clotting Time (sec)
Control	5.37 ± 0.22	4.02 ± 0.19	11.76 ± 0.69	2.26 ± 0.17	36.58 ± 2.26
APS-45	3.26 ± 0.17 -39.29 [a]	5.57 ± 0.23 + 38.55 [a]	8.34 ± 0.48 -29.08 [a]	1.52 ± 0.11 -32.74 [a]	24.23 ± 1.65 -33.76 [a]
APS-50	3.15 ± 0.13 -41.34 [a]	5.84 ± 0.26 + 45.27 [a]	7.98 ± 0.33 -32.14 [a]	1.43 ± 0.09 -36.72 [a]	23.81 ± 1.47 -34.90 [a]
All values are expressed as mean ± SEM, n = 6 rats in each group.					
+ and – percent increase and decrease respectively over control.					
P values a = P < 0.05 as compared with control.					
The significance were determined by One-way ANOVA was used to analyze the data.					

Discussion

There are very few and speculative studies on the impact of plant products on the female reproductive system and fertility. There has never been a bigger need for contraception from the standpoint of public health.

The present study was conducted to investigate the antifertility effect of APS in two different dose administrations in to female albino rats and showed that the body weight of female rats decreased due to the effects of estrogen and progesterone. In the present study, rats given APS, decreased ovarian, liver and kidney functions. A significant reduction in ovarian reduction in the administration of APS at these dose levels may be due to the absence or reduced availability of ovarian steroid hormones and gonadotropins [16]. The liver weight of APS administrations rats was significantly reduced due to loss of water and glycogen [17]. In the present study, the organ weights of kidneys of the APS administrations rats were significantly decreased from those of the control rats. This may be because some of the bioactive substances in PSA studies have weight loss properties [18]. However, APS causes significant reduction in the weights of liver and kidney, suggesting the risk of acute toxicity [19].

In the estrous cycle study, there was a significant increase in the duration of Proestrus, Estrus, Metestrus and Diestrus in APS rats given both controls. Disruption of the estrous cycle can be caused by APS administration of estrogen/progesterone. Exogenous estrogen (or estrogen-like) causes a decrease in gonadtrophins (FSH, LH) through a negative feedback mechanism. This will cause anovulation and a decrease in the weight of the ovaries [20]. This interruption of the estrous cycle may be due to the effect of APS administration on the ovary which controls the ovarian functions and the estrous cycle through ovarian and extra-ovarian hormones. The diestrous phase is maintained by the activity of the corpus luteum which produces progesterone in the absence of pregnancy and may be responsible for maintaining the diestrous phase [21].

The results of the Hormonal Profile study show the APS administrations in female rats showed a decrease in serum concentrations of FSH, LH, Prolactin and Estradiol and a decrease in progesterone in rats receiving APS compared to control, which showed a significant decrease in FSH, LH and estradiol levels caused a decrease and the number of developing follicles and increased the number of atretic follicles in the ovary [22]. Prolactin levels were significantly increased in the APS administrations compared to the control group. These findings have also been supports that the combination of increased prolactin and suppressed LH secretion is due to the prolongation of the estrus cycle. An imbalance in endogenous estrogen and progesterone levels may be responsible for Anti-implantation activity [23]. Progesterone levels were significantly increased in the APS administrations compared to the control group. APS caused the survival of the corpus luteum and dilated its granulosa lutein cells' smooth endoplasmic reticulum (SER) that responds to high secretion of progesterone [24]. Administration of APS increases serum prolactin levels and significantly decreases estradiol, progesterone, FSH and LH. This shows a negative effect on follicle maturation and ovulation and therefore shows that the substance can be used as a contraceptive [25].

The data obtained in the study were based on the effects of APS Administration on ovarian antioxidant enzyme levels in female albino rats showed that MDA was significantly increased in APS Administration rats compared to controls. MDA is an end-product of lipid peroxidation. Lipid peroxidation is known to be the most damaging effect of free radicals on the cell. It has been reported that APS causes oxidative damage in the ovarian tissue, increasing the concentration of MDA [26]. In the ovaries of rats receiving APS, the levels of CAT, SOD, GPx, GR and GST decreased compared to the control group. The over production of oxygen free radicals during ovulation leads to the activities of CAT, SOD, GPx, GR, GST enzymes. These results indicate that the decrease in the level of antioxidant enzymes may be one of the factors that lead to infertility in female rats. Reports show that an increase in the ROS levels is associated with successful ovulation [27].

In our study, the effect of APS Administration on ovary enzymes activity levels in female albino rats showed that ovarian tissue cholesterol and ascorbic acid increased in rats receiving APS. The result of ovarian stimulation with some gonadotrophic hormones and the reduction of ascorbic acid from the ovary, as well as the reduction / elimination of the secretion of gonadotrophic hormones and ovarian atrophy are also present. Therefore, in the present study, the concentration of cholesterol and ascorbic

acid in the ovaries of the treated rats indicates ovarian hypofunction (hypofunction of ovarian steroidogenic activity). In our study, for ovarian tissue in rats receiving APS, the levels of G-6-PDH and Δ^5-3β-HSD decreased. It has been shown that gonadotrophins, by activating the metabolism of G-6-PDH, increase the production rate of NADPH, necessary for the hydroxylation reaction and the formation of gonadal steroids from cholesterol in the ovarian tissue. Thus, G-6-PDH is an important factor in ovarian steroidogenesis. It has been shown that, in corporalutea animals, there is a positive relationship between progesterone synthesis and increased activity of Δ^5-3β-HSD and G-6-PDH in the luteal tissue. The Δ^5-3β-HSD is an important enzyme in the production of steroid hormones. The presence of the enzyme indicates that the steroidogenic activity of the tissue and estrogen synthesis in increased amount is associated with heightened Δ^5-3β-HSD and G-6-PDH activities in the follicular granulose cells of the polycystic ovaries and in the ovaries of rats [28].

The results showed that APS administration affected many biochemical functions of blood serum, liver and kidney. In the present study, liver function showed that Bilirubin, SGPT, SGOT, Albumin and Globulin were elevated and Alkaline Phosphate and total protein levels were reduced in the APS compared to Control group. Evidence of liver damage and serum enzyme levels. Such damage can be linked to the permeability of hepatocyte membranes, the result of the generation of certain lesions following the association of glycidamide with the same function of membrane proteins [29]. Another important aspect of this study is related to kidney function parameters such as urea and creatinine. Decreased levels of uric acid and calcium, which indicate kidney function. Kidney function may be due to the decreased functional capacity of tubular secretion [30].

In this study, the Hematological analysis such as reduction of RBC, Hb, ESR and Clotting Time and increase of WBC in rats receiving APS compared to controls. It has antifertility properties but it disturbed the hematological parameters due to which a loss of body weight observed in the treated rats [31].

Conclusions

The current study shows that the effect of APS administrations on the estrous cycle, hormonal concentrations, antioxidant enzymes (Tissue), enzymatic activities (Tissue), serum biochemical indices (liver and kidney panel) and hematological parameters significance disturbance in ovary tissue, liver and kidney. The effects of APS that appear may be due to disrupt the estrous cycle pattern, reduce the serum levels of gonadotropins and may affected folliculogenesis and steroidogenesis in the ovary. The results of the present study provide evidence of the infertility effects of action of APS administration and its effects on female rats. Hence this study is justified.

Abbreviations

APS Abrus precatorius seeds

FSH Follicle Stimulating Hormone

LH Luteinizing Hormone

MDA Malondialdehyde

CAT Catalase

SOD Superoxide dismutase

GPx Glutathione peroxidase

GR Glutathione reductase

GST Glutathione S-transferase

G-6-PDH Glucose-6- Phosphate Dehydrogenase

Δ5 -3β-HSD Δ5-3β- Hydroxy Steroid Dehydrogenase

SGOT Glutamic oxaloacetic transaminase

SGPT Glutamic pyruvate transaminase

ALP Alkaline phosphatase

WBC White blood cell

RBC Red blood cell

Hb Hemoglobin

ESR Concentration, Erythrocyte Sedimentation Rate

Declarations

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Authors' contributions

PVR Investigation, Writing-original draft and Methodology; MSR Conceptualization, Data analysis, Supervision, Writing - review & editing; All authors read and consented to the final manuscript.

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Ethics of approval and consent to participate

The Institutional Animal Ethics Committee has approved the Experimental protocols, and animal use (Resolution No. 60b/2012/(i)/a/CPCSEA/ IAEC/SVU/ MSR–RS dt. 08.07.2012), Sri Venkateswara University, Tirupati, Andhra Pradesh, India.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Consent for publication

Consent for publication was obtained from all study participants at the time of consenting for participation in the study.

Availability of data and materials

All data associated with this study are present in the paper.

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Figures

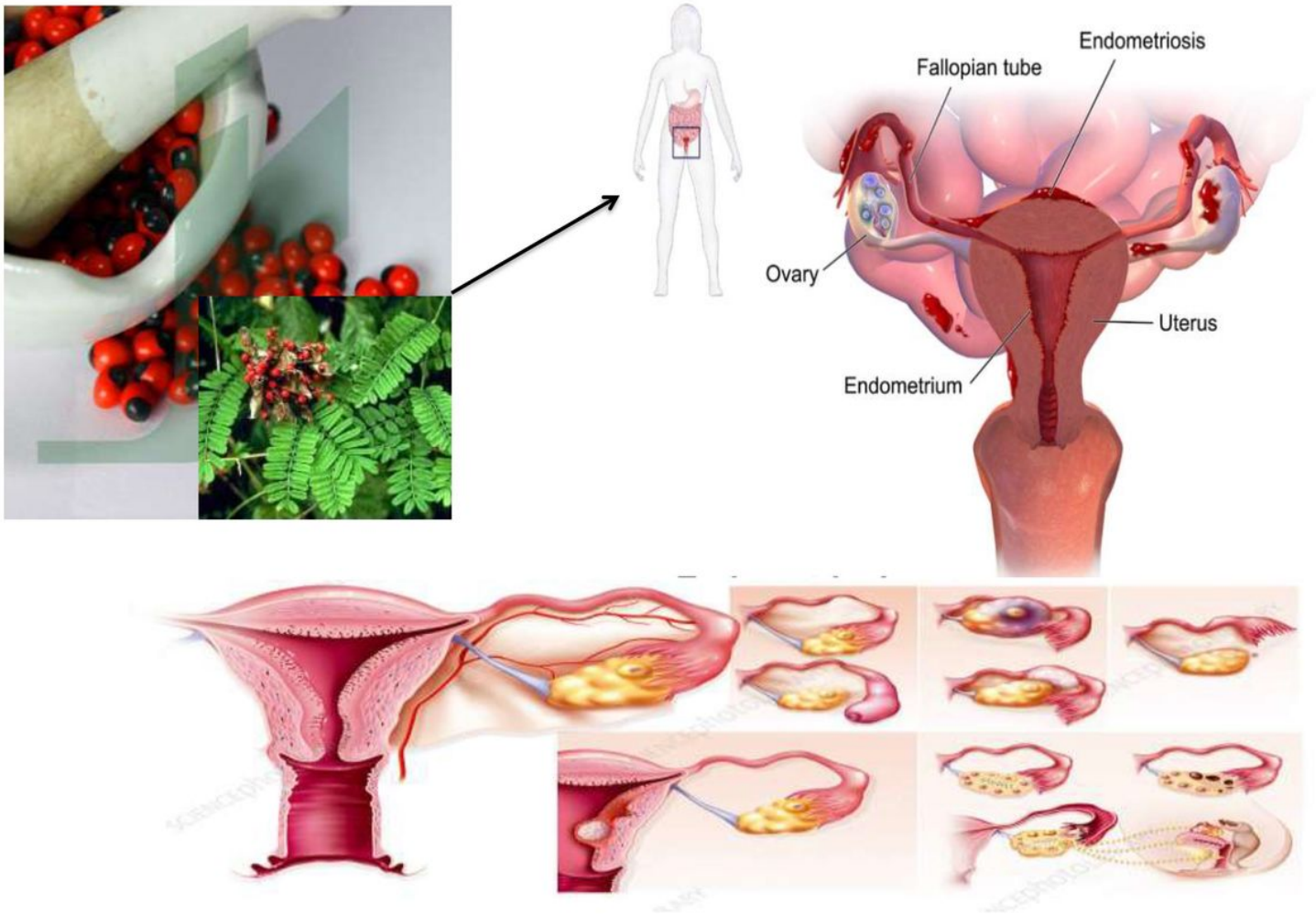

Figure 1

Female infertility