



Effects of purwoceng (*Pimpinella alpina*) root extract administered during pregnancy on offspring growth and female reproductive development in rats

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ABSTRACT: Purwoceng (*Pimpinella alpina*) is a medicinal plant with phytoestrogenic properties that may affect reproductive development. This study aimed to evaluate the effects of purwoceng root extract administered during pregnancy on offspring growth and sexual maturation in rats. The measured parameters were body weight gain in male and female offspring, age at vaginal opening, and estrous cycle length in female offspring. The results demonstrated that maternal administration of purwoceng extract increased body weight gain in offspring and accelerated the onset of puberty, as indicated by earlier vaginal opening, while no significant differences were observed in estrous cycle length. In conclusion, purwoceng root extract exhibits anabolic and estrogenic effects that promote growth and sexual maturation in offspring without disrupting the normal estrous cycle.

Keywords:

phytoestrogen, pregnancy, purwoceng, offspring growth, reproductive development

■ INTRODUCTION

Purwoceng (*Pimpinella alpina*) is a medicinal plant known to contain bioactive compounds, particularly flavonoids, which have phytoestrogenic activity. Phytoestrogens are plant-derived compounds that mimic endogenous estrogen by binding to estrogen receptors. In addition to flavonoids, purwoceng also contains steroids, triterpenoids, and alkaloids, which may affect the reproductive system (Timotius *et al.* 2023). Previous studies have suggested that such compounds may modulate reproductive physiology and endocrine activity in several experimental animal models (Sukardiman *et al.* 2025).

The gestational period is critical for fetal growth, including the development of the reproductive system. Early exposure to exogenous compounds during this phase may induce long-term effects on offspring phenotype, including growth and sexual maturation. Phytoestrogen exposure during prenatal development has been reported to influence puberty onset and reproductive parameters (Canivenc-Lavier & Bennetau-Pelissero 2023), highlighting the importance of evaluating such effects. Therefore, this study aimed to investigate the effects of purwoceng root extract administered during pregnancy on offspring growth, timing of puberty (as indicated by vaginal opening), and estrous cycle characteristics in female rat offspring.

■ MATERIALS AND METHODS

Thirty pregnant rats were divided into three groups (n = 10 per group): control, pre-placentation treatment (administered purwo-ceng extract from gestation days 1–13), and post-placentation treatment (administered purwoceng extract from gestation days 13–21). The treatment groups received purwoceng root extract at 83.25 mg/kg body weight. All animals were maintained under standard laboratory conditions, allowed to deliver naturally, and handled according to the guidelines for the care and use of laboratory animals (World Medical Association 2013). After parturition, offspring were collected from litters of approximately 7–9 days of age. All offspring weighing 5–6 g were included in the study. Pup weights were recorded at weeks 1 (pre-weaning), 3 (weaning), 7 (early puberty), and 9 (adulthood). In females, puberty onset was determined by daily observation of vaginal opening, after which vaginal smears were collected for 15 consecutive days to evaluate the estrous cycle length and duration of each phase.

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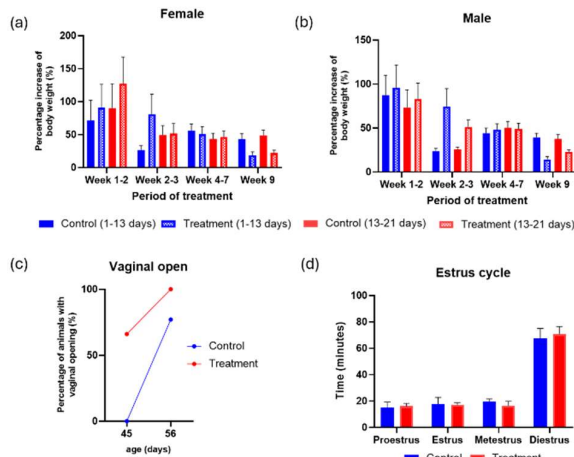


Figure 1. Effects of purwoceng root extract on offspring: (a) female and (b) male weight gain after pre- and post-placentation exposure, (c) vaginal opening at 45 and 56 days, and (d) estrous duration.

RESULTS AND DISCUSSION

Purwoceng extract tended to increase offspring growth, as evidenced by increased weight (Figures 1a and 1b). Male and female offspring in the treatment group gained more weight than controls during gestation periods (days 1–13 and 13–21), although differences were not significant ($p > 0.05$). Weight gain declined with age, indicating postnatal effects. Enhanced growth suggests an anabolic effect of purwoceng flavonoids and phytoestrogens, which mimic estrogen and enhance signaling (Canivenc-Lavier & Bennetau-Pelissero 2023). Phytoestrogens bind estrogen receptors, stimulating proliferation, protein synthesis, and growth. Purwoceng may support embryonic and fetal development. Timing may affect outcomes: pre-placentation (days 1–13) may optimize the uterine environment, whereas post-placentation (days 13–21) may support fetal growth and maturation. Flavonoids may reduce oxidative stress (Nasihun & Widayati 2016). Estrogenic activity, including estriol (E3), contributes to uterine development and nutrient transfer (Chen *et al.* 2022). Weight gain may be associated with purwoceng, although the mechanisms remain uninvestigated.

Sexual maturation was evaluated by monitoring vaginal opening (VO) and estrous cyclicity in female offspring (Figure 1c). Vaginal opening is a well-established external marker of puberty onset in rats (Cora *et al.* 2015). Female offspring from the purwoceng-treated group tended to exhibit earlier VO than controls (Figure 1c). On postnatal day 45, VO was observed in 66% of treated females, whereas no control females had undergone VO. By postnatal day 56, all treated females had reached VO, compared with 77% of controls, suggesting accelerated pubertal onset following maternal exposure to purwoceng. This suggests that purwoceng influences the hypothalamic-pituitary-ovarian (HPO) axis, likely through estrogenic activity. Flavonoid-induced stimulation of ovarian follicle development may increase estrogen secretion, thereby advancing the onset of puberty (Sukardiman *et al.* 2025).

The estrous cycle characteristics were evaluated by daily vaginal smear analysis (Figure 1d). The estrous cycle consists of four stages: proestrus, estrus, metestrus, and diestrus, each distinguished by specific cellular morphology (Pop *et al.* 2024). The results (Figure 1D) showed no significant differences ($p > 0.05$) in the duration of each estrous phase (proestrus, estrus, metestrus, and diestrus) or total cycle length between the control and purwoceng-treated groups. These findings indicate that although purwoceng accelerates puberty onset, it does not disrupt normal estrous cyclicity, reproductive hormonal regulation, or homeostasis despite earlier sexual maturation.

CONCLUSION

Purwoceng extract during pregnancy enhances offspring growth and reproductive maturation without affecting estrous cycle regulation, supporting purwoceng's phytoestrogenic, anabolic, and reproductive-modulating effects during critical developmental windows.

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