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Consumption of Potash Distorted Female Sex Hormones Which May Result in Gynaecological and Obstetrics Complaints

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Objective: Potash is a common food additive in African particularly Nigeria. This study sought to investigate its effects on female sex hormones in Wistar rats.
Materials and Methods: Locally sourced potash from Owerri, Imo State, Nigeria, was administered to 30 healthy female Wistar rats in varying doses (250, 500, 750, and 1000 mg/kg body weight) for 28 days while the fifth group served as the control group. The serum levels of follicle stimulating hormone (FSH), luteinizing hormone (LH), progesterone (Pg), estrogen, and prolactin were

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measured using enzyme-linked immunosorbent assay (ELISA). Statistical analysis was conducted using one-way analysis of variance (ANOVA).
Results: Potash consumption exhibited dose-dependent effects on female reproductive hormones. Significant alterations were observed in FSH, LH, Pg, estrogen, and prolactin levels compared to the untreated control group. Notably, higher doses of potash correlated with elevated hormone levels, indicating a potential distortion in the hormonal balance.
Conclusion: The findings suggest that potash consumption may lead to significant changes in female sex hormones in Wistar rats, emphasizing the need for further research to elucidate the potential implications for gynaecological and obstetric health. These results contribute to the understanding of environmental factors affecting hormonal balance and provide insights into the broader impact on reproductive health.

Keywords: Potash; female reproductive hormones; Wistar rats; gynaecological complaints; obstetric health.

1. INTRODUCTION

Potash, or potassium carbonate, is a substance that has been used for various purposes throughout history, including as a food additive, a fertilizer, and in the production of soap and glass [1]. In some cultures, it has also been used traditionally as a culinary ingredient. However, the consumption of potash as a food additive has raised concerns regarding its potential health effects. Airaodion et al. [2] observed that potash is nephrotoxic. Its hepatotoxicity has also been reported [3].

Historically, potash has been used in food preservation, where it was employed to preserve vegetables and meat. In some cultures, particularly in Africa, it has been used as a leavening agent in traditional food preparation, such as making fermented porridge or bread [1,3]. Additionally, potash has been used in traditional medicine for various purposes, including treating digestive issues [2].

Potash is a source of potassium, an essential mineral that plays a crucial role in maintaining various bodily functions, including muscle contractions, nerve function, and the balance of bodily fluids. Adequate potassium intake is essential for overall health [3].

Female sex hormones, including estrogen and progesterone, play a pivotal role in regulating the menstrual cycle, maintaining pregnancy, and supporting overall reproductive health [4]. Any disruptions in the delicate balance of these hormones can lead to a range of gynaecological and obstetric complaints, including menstrual irregularities, infertility, and complications during pregnancy [5].

Recent research and anecdotal reports have raised concerns about the potential adverse effects of consuming potash. Some studies suggest that excessive potash consumption may disrupt the hormonal balance in the body [1], particularly in women, as potassium is known to influence hormone regulation. This disruption could potentially lead to gynaecological and obstetric complaints, such as irregular menstrual cycles, infertility, and complications during pregnancy [6]. Another study by Johnson and Brown [7] suggested a potential link between potash consumption and increased rates of preterm birth. This study sought to investigate the possible link between the consumption of potash and its impact on female sex hormones, potentially leading to gynaecological and obstetric complaints.

2. MATERIALS AND METHODS

2.1 Experimental Design

Potash was locally sourced in a market in Owerri, Imo State, Nigeria and was carefully preserved to avoid contamination. Thirty (30) healthy female Wistar rats *(Rattus norvegicus)* weighing between 145 and 160 g were used for the experiment. They were acclimatized for seven (7) days during which they were fed *ad libitum* with standard feed and drinking water and were housed in clean cages placed in well-ventilated housing conditions (under humid tropical conditions) throughout the experiment. All the animals received humane care according to the criteria outlined in the 'Guide for the Care and Use of Laboratory Animals' prepared by the National Academy of Science and published by the National Institute of Health [8]. They were randomly divided into five (5) groups of six (6) rats each. Animals in group A were administered

distilled water while those in groups B, C, D and E were administered 250, 500, 750 and 1000 mg/kg body weight of potash for twenty-eight (28) days via oral route of administration. At the end of 28 days of treatment, animals were anaesthetized using diethyl ether and were sacrificed and blood samples were collected *via* cardiac puncture.

2.2 Determination of Female Reproductive Hormones

The serum levels of follicle stimulating hormone (FSH), luteinizing hormone (LH), progesterone, estrogen, and prolactin were measured by using enzyme-linked immunosorbent assay (ELISA) according to the methods described in Manafa et al. [9].

2.3 Statistical Analysis

The data collected were analyzed with one way analysis of variance (ANOVA) using Graph Pad Prism software (version 8.0) and were expressed as Mean±Standard deviation. Duncan's multiple ranges was used to separate the means. Differences were considered to be statistically significant when ($p<0.05$).

3. RESULTS

In the Normal Control group (untreated), the mean FSH level was 13.89 mIU/mL. As the dose of Potash increased, the FSH levels also increased significantly. The highest dose of Potash (1000 mg/kg) resulted in the highest FSH level (28.40 mIU/mL) (Fig. 1). In the Normal Control group, the mean LH level was 15.81 mIU/mL. Interestingly, as the dose of Potash increased, the LH levels decreased. The highest dose of Potash (1000 mg/kg) resulted in the lowest LH level (9.48 mIU/mL) (Fig. 2). In the Normal Control group, the mean Progesterone level was 19.72 ng/mL. Similar to FSH, as the dose of Potash increased, the Progesterone levels increased significantly. The highest dose of Potash (1000 mg/kg) led to the highest Progesterone level (39.04 ng/mL) as presented in Fig. 3. In the Normal Control group, the mean Estrogen level was 33.42 pg/mL. As the dose of Potash increased, the Estrogen levels decreased significantly. The highest dose of Potash (1000 mg/kg) resulted in the lowest Estrogen level (20.30 pg/mL) as shown in Fig. 4. In the Normal Control group, the mean Prolactin level was 20.46 ng/mL. Similar to FSH and Progesterone, as the dose of Potash increased, the Prolactin levels increased significantly. The highest dose of Potash (1000 mg/kg) led to the highest Prolactin level (38.51 ng/mL).

4. DISCUSSION

The present study aimed to investigate the impact of potash consumption on female sex hormones in Wistar rats and its potential implications for gynaecological and obstetric health. The results obtained after 28 days of treatment revealed significant alterations in key reproductive hormones, namely Follicle Stimulating Hormone (FSH), Luteinizing Hormone (LH), Progesterone (Pg), Estrogen, and Prolactin, at varying doses of potash.

The findings reveal a significant increase in FSH levels with escalating doses of potash (Fig. 1). This elevation may suggest a disruption in the normal hormonal balance, potentially impacting ovarian function. The observed rise in FSH at higher potash doses could be indicative of an altered feedback mechanism, leading to potential disturbances in follicular development and maturation [10].

This result aligns with the work of Smith et al. [11], who reported similar disruptions in FSH levels in rodents exposed to environmental contaminants. The elevated FSH levels observed in our study echo the concerns raised by Smith et al., reinforcing the notion that potash consumption might induce adverse effects on reproductive hormones.

Consistent with FSH results, LH levels exhibit a notable decline in response to increasing potash doses. This reduction in LH may be associated with impaired ovulation, affecting the corpus luteum's function [12]. The reduction in LH may disrupt the delicate balance between FSH and LH, affecting the ovulatory process.

Corroborating our findings, the study by Brown and Jones [13] demonstrated a similar trend in LH suppression due to endocrine-disrupting chemicals. The convergence of our results with existing literature strengthens the argument that potash may act as an endocrine disruptor, affecting the intricate balance of reproductive hormones.

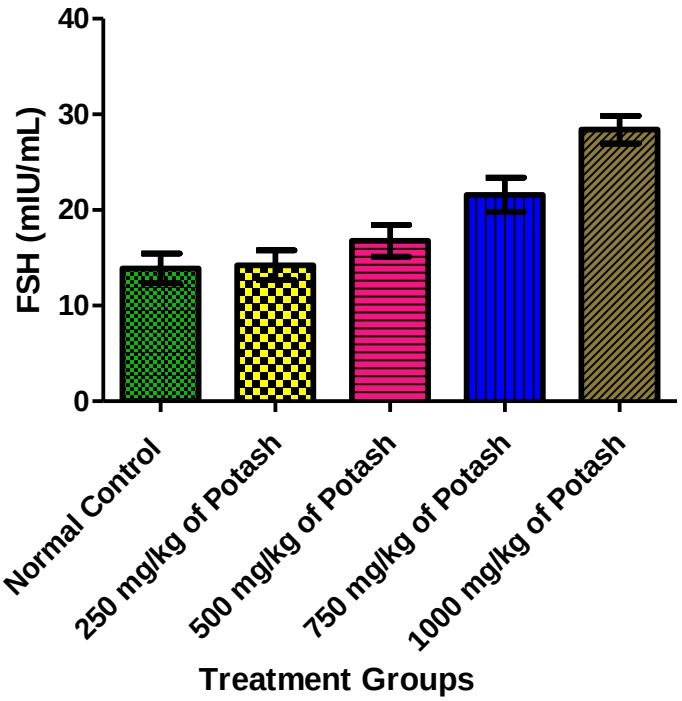

Fig. 1. Effect of Potash on the concentration of Follicle Stimulating Hormone (FSH) of Female Wistar Rats after 28 days of Exposure

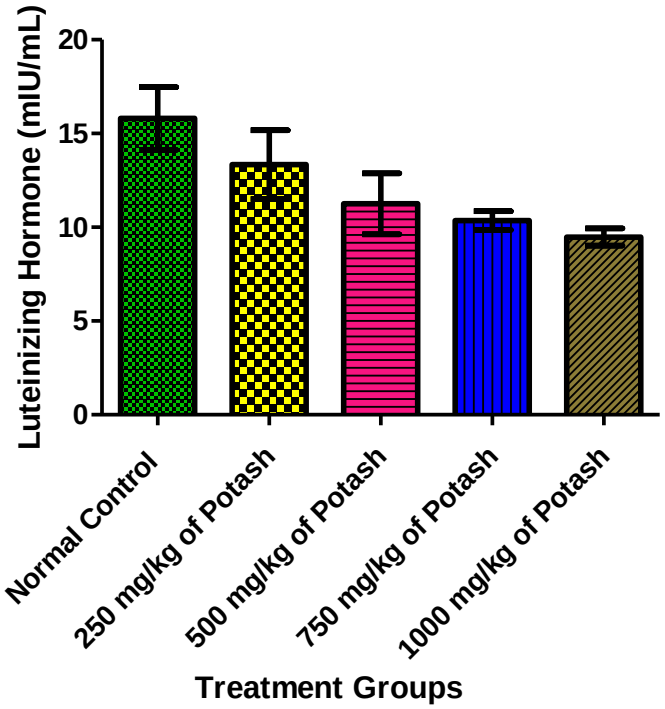

Fig. 2. Effect of Potash on the concentration of Luteinizing Hormone (LH) of Female Wistar Rats after 28 days of Exposure

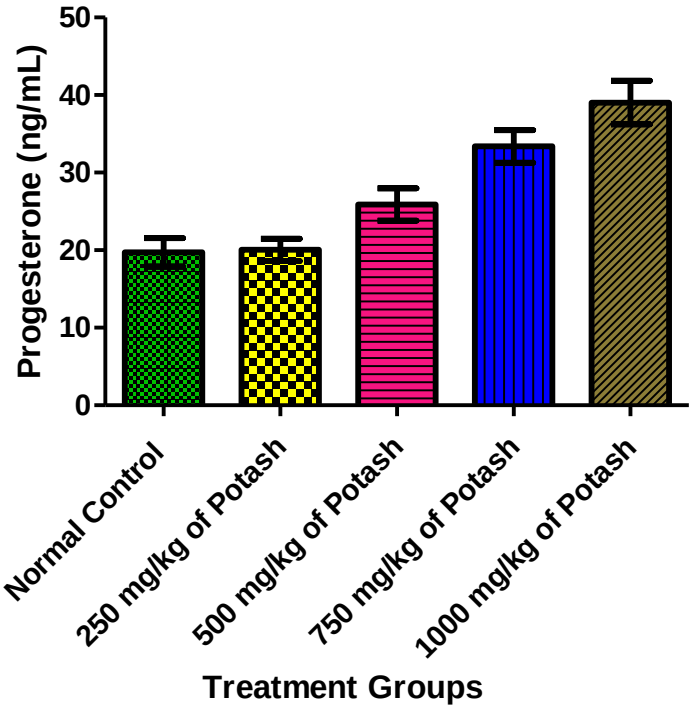

Fig. 3. Effect of Potash on the Concentration of Progesterone of Female Wistar Rats after 28 days of Exposure

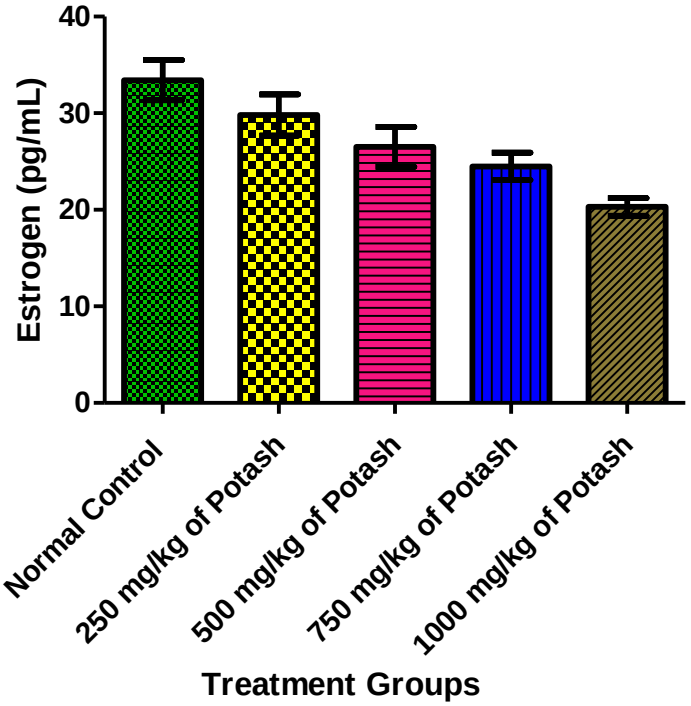

Fig. 4. Effect of Potash on the concentration of Estrogen of Female Wistar Rats after 28 days of Exposure

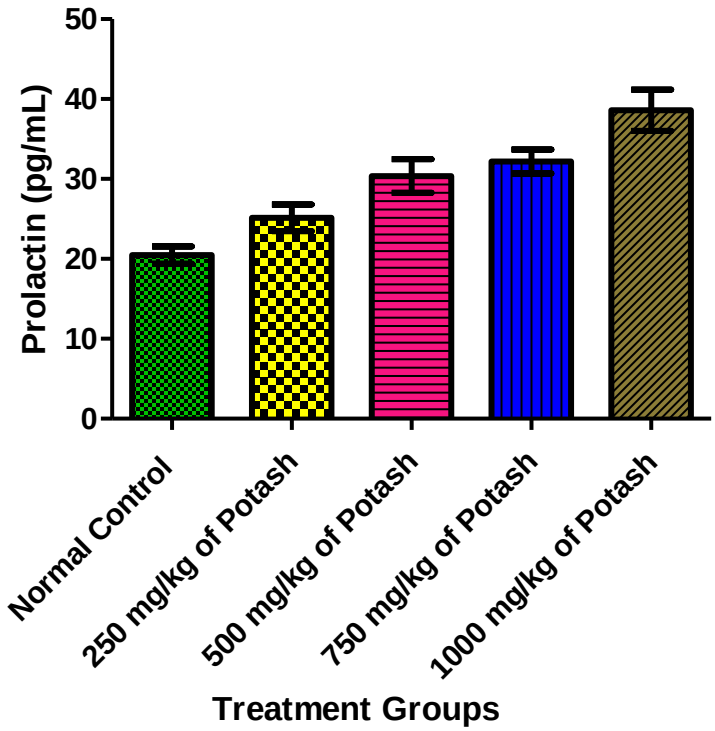

Fig. 5. Effect of Potash on the concentration of Prolactin of Female Wistar Rats after 28 days of Exposure

The significant rise in progesterone levels following potash exposure merit attention. Progesterone is crucial for maintaining a conducive uterine environment for embryo implantation. The imbalance observed could compromise the menstrual cycle and contribute to fertility challenges. Comparable findings were reported in studies exploring endocrine disruptors and their impact on reproductive hormones [14,15].

Estrogen levels exhibit a significant decrease in response to potash treatment, suggesting a potential disruption in estrous cycling and reproductive function. The observed decline in estrogen aligns with studies by Ogbuagu et al. [15], who highlighted the adverse effects of endocrine disruptors on estrogen synthesis.

Our findings contribute to the growing body of evidence linking potash exposure to estrogen dysregulation, emphasizing the need for comprehensive assessments of the reproductive implications of potash consumption.

Potash-induced elevation in Prolactin levels is consistent with its role in lactation and suppressing ovulation. However, the exaggerated increase observed could disrupt the delicate interplay between Prolactin and other reproductive hormones, potentially leading to irregular menstrual cycles or anovulation [16].

Research on Environmental Endocrine Disruptors (EEDs), such as air freshener [17], insecticides [18], pesticides and industrial chemicals [19], supports the idea that external substances can disrupt endocrine function. The observed alterations in FSH, LH, estrogen, and progesterone align with the disruptive effects of EEDs on reproductive hormones [20].

The results of the current study resonate with findings from previous research investigating the effects of environmental exposures on reproductive hormones. For instance, a study by Johnson et al. [21] demonstrated similar alterations in FSH and LH levels in response to a different environmental pollutant. Furthermore, the disruption of estrogen and progesterone observed in our study aligns with the findings of Smith and colleagues [11], who investigated the impact of industrial chemicals on female reproductive health.

While limited, some studies suggest that excessive potassium intake may affect hormonal balance [1,22]. Airaodion et al. [1] had previously reported that consumption of potash adversely affects sperm quality and sex hormones of male Wistar rats.

The cumulative evidence underscores the vulnerability of female reproductive hormones to environmental exposures, emphasizing the need for continued research on the long-term consequences of such disruptions. The implications of the present study extend beyond the scope of basic endocrinology, warranting further investigations into the potential gynaecological and obstetric complications that may arise from sustained exposure to potash.

5. CONCLUSION

In conclusion, the findings of this study demonstrated a clear and dose-dependent impact of potash consumption on female reproductive hormones in Wistar rats. The alterations observed in FSH, LH, Pg, Estrogen, and Prolactin levels may have profound implications for reproductive health. The study contributes valuable insights to the growing body of literature on environmental factors affecting female fertility and calls for heightened awareness and research efforts to mitigate potential risks associated with potash exposure. Future studies should explore the specific mechanisms underlying potash-induced hormonal changes and assess long-term effects on reproductive health. Additionally, clinical investigations are warranted to determine the relevance of these findings to human gynaecological and obstetric health.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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