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Effect of Banana, Apple, and Pineapple on Gonadotropic Hormones in Male Wistar Rats Treated with Monosodium Glutamate

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Abstract

Reproductive hormones are chemical substances that aid reproductive process by enhancing the growth and development of sex cells. When these hormones are not in order it affects reproductive process. Majority of male now depend on fruits consumption to enhance their hormonal status. Smoothies is a combination of different fruits and blend to give a desirable outcome. The aim of this study is to investigate the effects of smoothies (banana, apple, and pineapple) on reproductive hormones in male Wistar rats treated with monosodium glutamate. Infertility may occur due to male factors, female factors, combination of male and female factors or may be unexplained. In view of the importance attached to parenthood seen in Africa, it is not surprising that infertility is reported to be considered a major cause for divorce, abandonment, polygamy and marital instability. This has led to the use of alternate means to improve hormone levels as to boost fertility. This study involved 30 Male Wistar rats (weighing 130-180g) randomly selected in to five groups. Group 1 – Control, Group 2, 3 and 4 were administered with 1ml, 2mls and 3mls of smoothies respectively, Group 5 – Monosodium glutamate (400mg/ml), and Group 6 – Monosodium glutamate + High dose (400mg/ml

+3mls of smoothies). Results from this study showed that smoothies administration in rats induced dose-dependent reductions in follicle stimulating hormone and luteinizing hormone coupled.

Keywords

Effect, Banana, Apple, Pineapple, Reproductive Hormones,Monosodium Glutamate

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Introduction

Hormones are chemical substances that aid reproductive process and must be in normal proportion for fertility to take place. Hormones are important for both men and female reproductive process. Herbal medicine is been used across the globe to improve reproductive process (Gbaranor, et al., 2021a). Hormones are chemical substances that aid reproductive process and must be in normal proportion for fertility to take place. Hormones are important for both men and female reproductive process. Herbal medicine is been used across the globe to improve reproductive process. Both gonadotropic hormones (FSH, LH) and sex hormones (progesterone, oestrogen) are secreted by the anterior pituitary gland and ovary respectively. However, these hormones are control by the hypothalamo-pituitary-gonadal axis (HPA), (Gbaranor, et al., 2021a).LH motivates ovaries to create oestradiol thus their determination is crucial when investigating sterility (Fischbach, 9th ed. Philadelphi). Several plants have been used across the globe by traditionalists for the treatment of various diseases without proper documentation especially in Africa. Phytomedicine involves the use of various plant's parts such as leaves, stems, seeds, fruits, barks and roots to treat certain disease at home (Gbaranor, et al., 2021b).Monosodium Glutamate (MSG) is a known substance synthesized from L-glutamic acid and used as a flavour enhancer in foods. Monosodium Glutamate (MSG) is a substance commonly used as food additives and as a flavor enhancer (Husarovaand Ostatnikova, 2013). MSG causes increase in the serum estrogen and progesterone levels in adult female rats (Zia, et al., 2014). MSG suppresses the female reproductive function in rat possibly by impairing the functions of ovary and uterus (Mondal, et al., 2017). The MSG mechanism of action is to activate enzyme aromatase that catalyzes the conversion of testosterone to estradiol, thus increases estradiol synthesis (Eweka, et al., 2010). MSG has noted to cause oligozoospermia and increase abnormal sperm morphology in a dose dependent manner in male Wistar rats (Onakewhorand Oforofuo, 1998).Fruits are medicinal and also contain essential phytonutrients that gives the fruits potency that keeps the body healthy (Gbaranor, et al., 2024).In addition to natural herbaceous plants, some fruit and vegetable extracts with antioxidant properties display beneficial effects in animal reproduction system. Nevertheless, some plants, despite containing antioxidant substances, display detrimental effects and therefore cause defects and reproductive failure in male animals (Knight and Walter 2004). The dose-dependent manner may explain such dual functions (Na and Surh 2008; Moskaug et al., 2005).

Materials and Method

Collection, Identification and Preparation of fruits

The fruits were obtained fresh from mile 3 market in October, 2023. The fruits were identified by Dr M.G Ajuru from the department of Plant Science and Biotechnology, Faculty of Sciences, registered with the code number RSUHPb0153 for apple, RSUHPb0154 for pineapple and RSUHPb0155 for banana.
The fruits were washed and sliced into medium sizes. 25ml of water was added. The sliced fruits were turned into the blender which was connected to an electric source. The fruits were blended for five minutes. The fruits were allowed to become smooth and was disconnected from the electric source. The smoothies were poured into the beaker and administered to the rats.

Experimental Animals and Management

Young male wistar rats weighing 130-180g were obtained from the animal house, Faculty of Basic Medical Sciences, Rivers State University. The animals were housed in cages and maintained under natural environmental condition. These animals were fed with normal standard diets.

Study design

30 maleWistar rats were selected randomly into five rats per group. The groups include:
Group 1 – Control which was given only feed and 5mls of distilled water
Group 2 – 1ml of smoothies
Group 3 – 2mls of smoothies
Group 4 – 3mls of smoothies
Group 5 – Monosodium glutamate (400mg/ml)
Group 6 – Monosodium glutamate + High dose (400mg/ml +3mls of fruits)
Administration of fruits combinationdone for 14 days, and on the 15^{th} day, the animals were weighed and sacrificed after been anesthesized in chloroform soaked with cotton wool and samples were collected.

Blood Collection

Animals were anaesthetized with Chloroform soaked in cotton wool and placed in a desiccator and 5ml of blood samples collected through cardiac puncture with syringe and shared into the plane bottles. The blood was allowed for 900 seconds and then centrifuged for 900 seconds. Thereafter, the serum was collected and transferred into another bottle and stored in a freezer for hormonal analysis.

Analysis of Sample

Blood was used for hormonal analysis as described by Bolon et al. (1997).

Statistical Analysis

Data are presented as mean ± SEM and were analysed using a one-way Analysis of Variance (ANOVA). $P < 0.05$ was declared as significant statistically

Ethical Approval

Ethical approval was approved by the Research Ethics Committee of the Faculty of Basic Medical Science in Rivers State University, Nkpolu-Oroworukwo

Results

Effects Of Fruits Combination On Follicle Stimulating Hormone (FSH) In Male Wistar Rats

Administration of escalating doses of smoothies led to step-wise reductions in mean FSH from the control value of 1.98±0.02 mIU/ml to 1.68±0.05 mIU/ml, 1.65±0.02 mIU/ml and maximally 1.28±0.02 mIU/ml ($p<0.05$) at the highest 3mls/kg dose in a dose-dependent manner (Table 4.1 and figure 4.1). Co-treatment with monosodium glutamate (MSG) decreased FSH significantly to 0.89±0.02 mIU/ml over control, while the combination regimen showed an intermediate value of 1.16±0.01 mIU/ml. In summary, smoothies dose-dependently lowered FSH, an effect reversed by MSG (Figure 1.)

Effects Of Fruits Combination On Leutinizing Hormone (LH) In Male Wistar Rats

Similar to FSH, LH also decreased progressively from 1.50±0.02 mIU/ml in the control group to 1.68±0.05 mIU/ml, 1.25±0.02 mIU/ml ($p<0.05$) and maximally 1.04±0.01 mIU/ml ($p<0.05$) with escalating doses demonstrating a dose-dependent decline (Table 4.2 and figure 4.2). However, administration of MSG alone reduced mean LH levels to 0.69±0.02 mIU/ml over control, although co-treatment with high-dose smoothies increased LH moderately to 0.93±0.03 mIU/ml. Unlike the control, smoothies reduced LH dose independently, and MSG partially mitigated the effect (Figure 2).

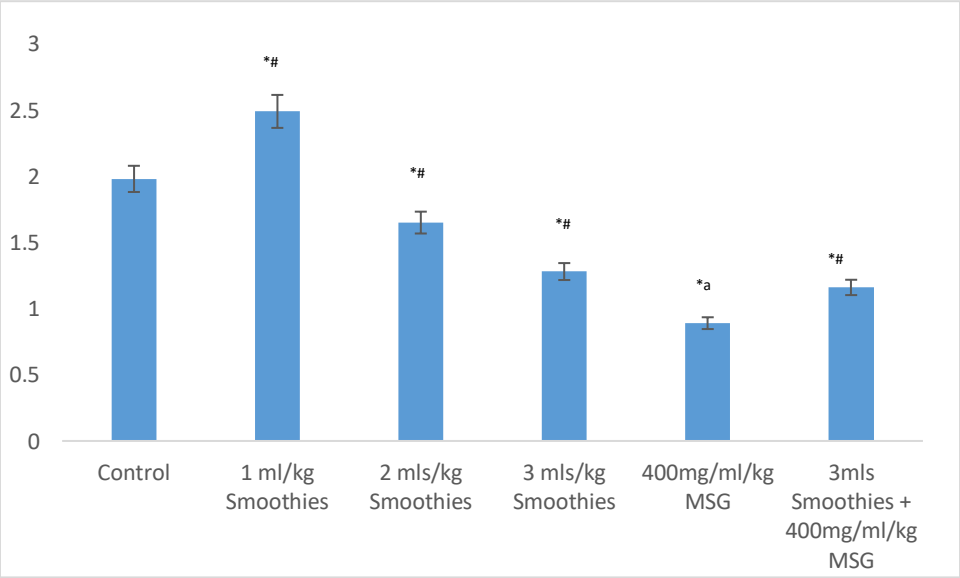

Fig. 1: The effects of smoothies on follicle-stimulating hormone in male Wistar rats

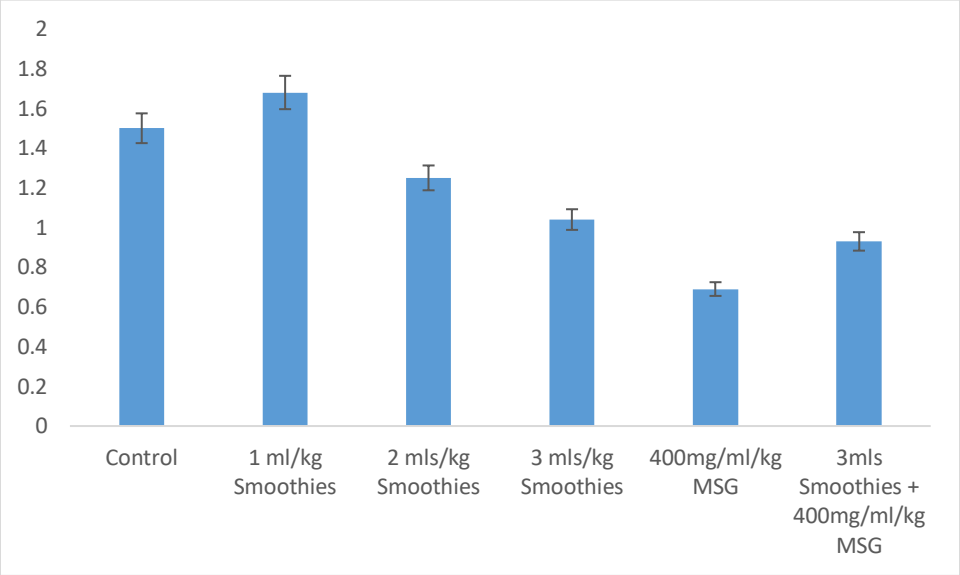

Fig 2: The effects of smoothies on Leutinizing Hormone in male Wistar rats

Discussion

The administration of increasing doses of smoothies to rats led to stepwise reductions in mean follicle-stimulating hormone (FSH) levels, with a maximal reduction of 35% compared to control animals (1.28 ± 0.02 vs 1.98 ± 0.02 mIU/ml) at the highest dose of 3ml/kg (Table 4.1 and Figure 4.1). This dose-dependent decrease in FSH was statistically significant at all doses tested ($p<0.05$) and is consistent with previous studies showing that phytoestrogens found in smoothies can modulate pituitary gonadotropin release (Jefferson *et al.*, 2002). Co-treatment with monosodium glutamate (MSG) significantly decreased FSH levels even further, to 0.89 ± 0.02 mIU/ml, compared to control ($p<0.05$). This agrees with a study that reported that MSG treatment had a statistical decrease in levels of FSH/LH (Haddad *et al.*, 2021). Additionally, MSG has been reported to cause neural degeneration in the hypothalamic-pituitary-gonadal axis, which can affect the cells producing LH and FSH in the anterior, eventually resulting in a decline in the serum levels of LH and FSH (Koohpeyma*et al.*, 2022). The combination regimen of smoothies plus MSG showed an intermediate FSH level of 1.16 ± 0.01 mIU/ml, suggesting some interacting or opposing effects on the hypothalamic-pituitary axis.

Similar to the effects on follicle stimulating hormone (FSH), the administration of escalating doses of smoothies to male rats led to a stepwise, dose-dependent reduction in mean luteinizing hormone (LH) levels (Table 4.2 and Figure 4.2).LH decreased progressively from 1.50 ± 0.02 mIU/ml in control animals to 1.68 ± 0.05, 1.25 ± 0.02 ($p<0.05$), and 1.04 ± 0.01 mIU/ml ($p<0.05$) at the maximal dose of 3 ml/kg smoothies. This result is consistent with previous studies showing that phytoestrogens found in smoothies can modulate pituitary gonadotropin release (Jefferson *et al.*, 2002). Monosodium glutamate (MSG) administration alone caused an even greater decrease in LH to 0.69 ± 0.02 mIU/ml ($p<0.05$ vs control) and this shows consistency with previous studies that has reported that MSG causes neural degeneration in the hypothalamic-pituitary-gonadal axis, which can affect the cells producing LH and FSH in the anterior, eventually resulting in a decline in the levels of LH and FSH (Koohpeyma*et al.*, 2022). This implies MSG may have additional central effects on the reproductive neuroendocrine axis beyond phytoestrogen actions. Co-treatment with high-dose

smoothies and MSG partially mitigated the LH reduction, increasing levels to 0.93 ± 0.03 mIU/ml. This suggests potential interacting mechanisms regulating LH release. In contrast to the effects on FSH, smoothies reduced LH independently of dose, while MSG partially reversed this decline. Further research on the hypothalamic-pituitary-gonadal effects of these nutritional factors is warranted.

CONCLUSION

Fruits combination administration in rats induced dose-dependent reductions in follicle stimulating hormone and luteinizing hormone.

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