

EFFECT OF INGESTION OF *GARCINIA KOLA* ON POST EXERCISE RESPIRATORY RATE ADJUSTMENT TIME DURING THE FOLLICULAR AND LUTEAL PHASES OF THE MENSTRUAL CYCLE

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ABSTRACT

Garcinia kola and the hormone progesterone have been studied to have a bronchodilatory effect which comes in handy during exercise. This study evaluates the possible effect of ingestion of *Garcinia kola* on the time it takes for respiratory rate to return to steady state values after exercise during the luteal and follicular phases of the menstrual cycle. Sixty-four healthy volunteers in equally divided proportions in the follicular and luteal phases of the menstrual cycle were studied. Their serum progesterone concentrations and base line respiratory rates were measured using standard procedures. Subjects in each of the two groups were further divided equally into four subgroups each with the first sub groups not given *Garcinia kola* seed and the remaining three groups given the seeds to chew at doses of 100mg/kg, 200mg/kg and 400mg/kg respectively. 90 minutes post ingestion; they were exposed to exercise for 35 minutes. The respiratory rates of subjects were recorded every minute until they returned to baseline values. Results were presented as mean \pm SD, $p < 0.05$ was considered to be statistically significant. Both phases of the menstrual cycle had an improved respiratory rate adjustment time with increasing doses of *Garcinia kola* ($p < 0.05$). In terms of time, the luteal phase (7.36 ± 0.74) had a better respiratory rate adjustment ($p < 0.05$) compared to the follicular phase (10.13 ± 0.35). Ingestion of *Garcinia kola* seeds was shown to have a favourable respiratory rate adjustment after exercise and this was improved further in the luteal phase of the menstrual cycle.

Key words: *Garcinia kola*, Menstrual cycle, Follicular, Luteal, Exercise, Respiratory rate

INTRODUCTION

Garcinia kola is a commonly used edible tropical plant with well documented medicinal properties. It belongs to the family of plants called *Guttiferae* and it is known with names such as bitter kola, false kola and male kola. Its therapeutic properties are traceable to its phytochemical constituents such as prenylated, benzophenone, xanthenes, bioflavonoids, alkaloids, phenols and tannin. *Garcinia kola*

also contains ascorbic acid which is responsible for its antioxidant properties (Okwu, 2005). Its use in the field of medical microbiology cuts across, antimicrobial, antiparasitic and antiviral effects (Ebana et al., 1991). Furthermore its effects on respiratory medicine include bronchodilatation (Orie and Ekon, 1993) and anti-influenza (Iwu, 1993). It has been shown to have smooth muscle relaxant effect (Braide, 1989). David et al., (2008)

showed that *Garcinia kola* extract, exhibits a dilatatory effect on the alveolar ducts, alveolar sacs, and alveoli thereby improving respiratory activities. Besides, other researchers have also documented its use in the treatment of cough, throat infections, bronchitis and hepatitis (Farombi et al., 2005).

Menstrual cycle is counted from the first day of menstruation of an index month to the first day of the next consecutive menstruation Progesterone which is one of the major hormones of the menstrual cycle has also been shown to have some positive respiratory effects. The menstrual cycle is made up of the estrogen dominated follicular phase and the progesterone dominated luteal phase. The interface between these two phases is ovulation. Previous studies on postmenopausal women with respiratory insufficiency or partial upper airway obstruction have confirmed the effectiveness of medroxyprogesterone in restoring the patency of their upper airway and respiratory control mechanism (Saaresranta et al., 1999, Saaresranta et al., 2001). From the foregoing, progesterone and *Garcinia kola* are important in improving respiratory function.

Exercise may be defined as any muscular activity that generates strength and interrupts homeostasis (Araujo, 2001). During exercise, there is cardiopulmonary response of the body to meet up with oxygen demand. However, the cardiopulmonary parameters e.g respiratory rate will have to return to normal base line values after the exercise. . It is generally accepted that people with higher levels of physical activity tend to have higher levels of fitness and that physical activity can improve cardio-respiratory fitness (Paranjape

et al.,2012; Burchfiel et al.,1997) Ingestion of *Garcinia kola* during the luteal phase of the phase of the menstrual cycle may have a synergistic cardiopulmonary advantage.

This study is therefore aimed at evaluating the possible synergistic effect of ingestion of *Garcinia kola* on the time it takes for respiratory rate to return to steady state values after exercise at the luteal and follicular phases of the menstrual cycle.

MATERIALS AND METHODS

Plant material

Garcinia kola seeds were purchased from Uselu market in Benin. They were subsequently authenticated in the department of Plant Biology and Biotechnology of the University of Benin, Nigeria,

Subjects

A total of 64 subjects who were students of a tertiary institution in Benin volunteered for the study. The 64 subjects were equally divided into two groups A and B. Group A were 32 subjects in the Follicular phase of the menstrual cycle, while group B were 32 subjects in the Luteal phase of the menstrual cycle. Group A subjects were subsequently divided into 4 subgroups with 8 subjects in each group, group A₀, A₁, A₂ and A₃. Similarly Group B subjects were divided into 4 subgroups with 8 subjects in each group, group B₀, B₁, B₂ and B₃.

Ethical clearance

Ethical approval was obtained from the Ethics and Research Committee of Saint Philomena's Catholic hospital. Informed consent was also obtained from the subjects.

Inclusion criteria: Regular menstrual cycle of 28 days

Exclusion criteria: History of peptic ulcer diseases, Palor, HbSS, Pregnancy, use of contraceptives, Asthma.

Phases of the menstrual cycle studied

The follicular phase of the menstrual cycle was defined as the 12th day of the cycle while the Luteal phase of the menstrual cycle was defined as the 24th day.

Menstrual profile

A questionnaire was used to extract menstrual profile of subjects for the study.

Progesterone assay

Progesterone was assayed by radioimmunoassay (Bayer) on the 12th day for those in the follicular phase and on the 24th day for those in the Luteal phase of the menstrual cycle.

Administration of *Garcinia kola*, Respiratory rate measurement and Exercise protocol

Prior to exercise, base line respiratory rate was measured using standard clinical method. Subsequently subjects were given appropriate doses of G.K; Subjects in

subgroup A₀ were not given *Garcinia Kola* and they served as control for the follicular phase, while subjects in groups A₁, A₂ and A₃ were given 100mg/kg, 200mg/kg and 400mg/kg respectively. Similarly, subjects in subgroup B₀ were not given *Garcinia kola* and they served as control for the luteal phase, while those in groups B₁, B₂ and B₃ were given 100mg/kg, 200mg/kg and 400mg/kg respectively.

Ninety minutes after the ingestion of *Garcinia kola* subjects were asked to warm up for 5 minutes and mount the thread mill with 2% inclination at 5mph for 30 minutes. The respiratory rates of subjects were measured every minute using standard clinical method until they returned to baseline values.

Statistical Analysis: Results were presented in tables and graphs as mean \pm S.E.M using Microsoft excel 2010. Statistical analyses were done using ANOVA and Students't-test; $p < 0.05$ was considered statistically significant.

RESULTS

Table 1: Menstrual profile of subjects

Parameters	Follicular phase (n=32)	Luteal phase (n=32)
Age (years)	19.21 \pm 2.96	18.21 \pm 3.02
Age at Menarche (years)	11-13	10-13
Duration of menstruation (Days)	3-6	3-5
Menstrual Cycle Length (Days)	28	28
Dysmenorrhea (%)	25 (75.00%)	23 (71.88%)
Parity	Nullipara	Nullipara

Table 2: The progesterone concentrations in Mean \pm SD of the groups in the Follicular phase of the menstrual cycle.

Parameter	A ₀ (n=8)	A ₁ (n=8)	A ₂ (n=6)	A ₃ (n=6)
Progesterone (ng/ml)	0.31 \pm 0.01	0.29 \pm 0.03	0.29 \pm 0.04	0.30 \pm 0.03

Table 3: The progesterone concentrations in Mean \pm SD of the groups in the Luteal phase of the menstrual cycle.

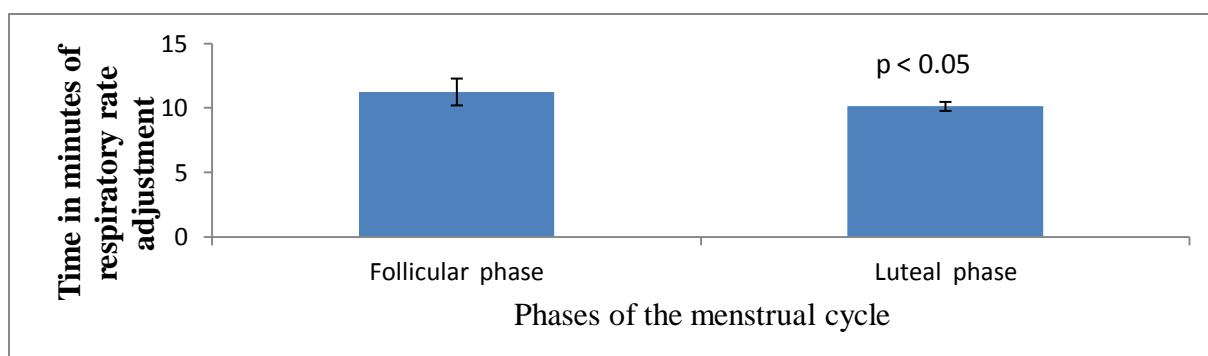
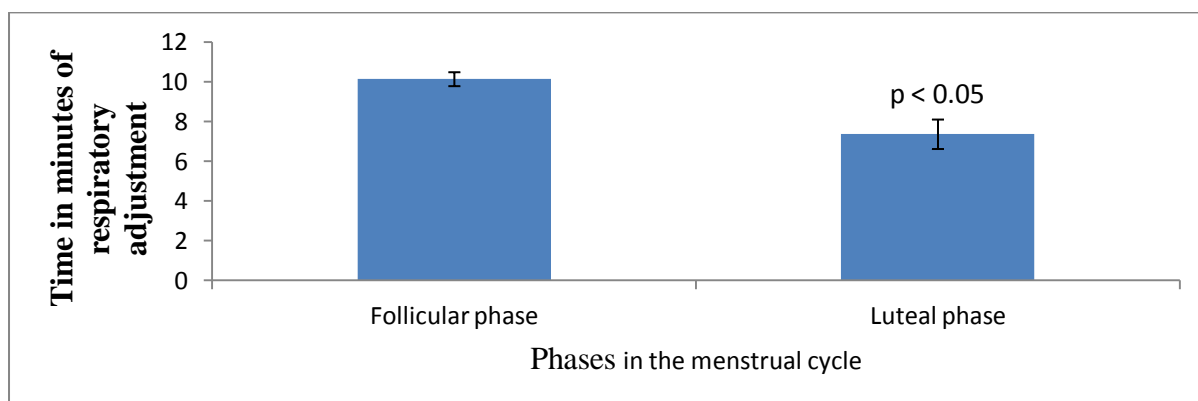
Parameter	B ₀ (n=8)	B ₁ (n=8)	B ₂ (n=7)	B ₃ (n=6)
Progesterone (ng/ml)	19.01 \pm 0.03	18.98 \pm 0.05	19.03 \pm .0.09	19.00 \pm 0.07

Table 4: Table showing the time in Mean \pm SD for respiratory rate adjustment in various groups in the follicular phase. * indicates a statistically significant difference

Parameter	A ₀ (n=8)	A ₁ (n=8)	A ₂ (n=6)	A ₃ (n=6)
Progesterone (ng/ml)	11.25 \pm 1.04	10.13 \pm 0.35*	10.17 \pm .0.17 *	8.67 \pm 0.52*

Table 5: Table showing the time in Mean \pm SD for Respiratory rate adjustment in various groups in the luteal phase. * indicates a statistically significant difference

Parameter	B ₀ (n=8)	B ₁ (n=8)	B ₂ (n=7)	B ₃ (n=6)
Progesterone (ng/ml)	10.13 \pm 0.35	7.63 \pm 0.74*	7.43 \pm .0.79 *	6.83 \pm 0.41*

Figure 1: Time in mean \pm SD for respiration to return to baseline values in subjects in the follicular and luteal phases who were not given *Garcinia kola*Figure 2: Figure 1: Time in mean \pm SD for respiration to return to baseline values in subjects in the follicular and luteal phases who were given 100mg/kg of *Garcinia kola*

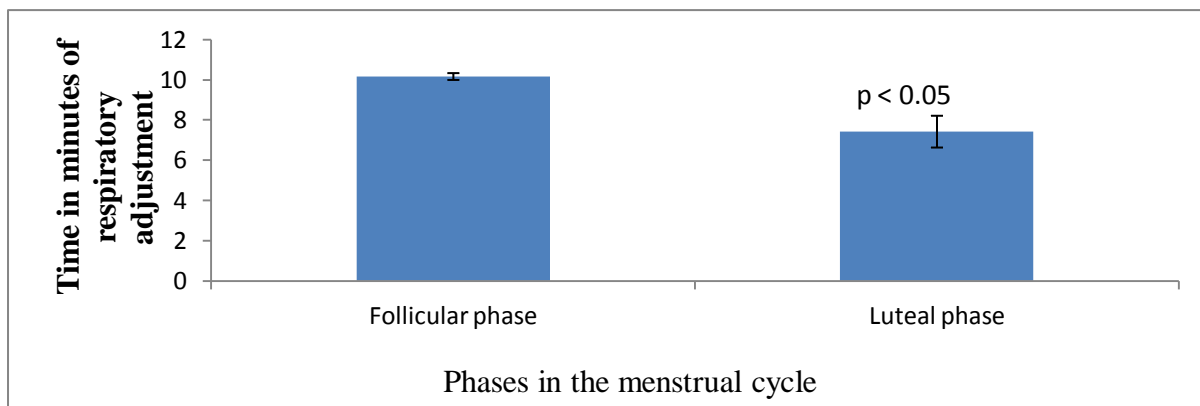


Figure 3: Time in mean±SD for respiration to return to baseline values in subjects in the follicular and luteal phases who were given 200mg/kg of *Garcinia kola*

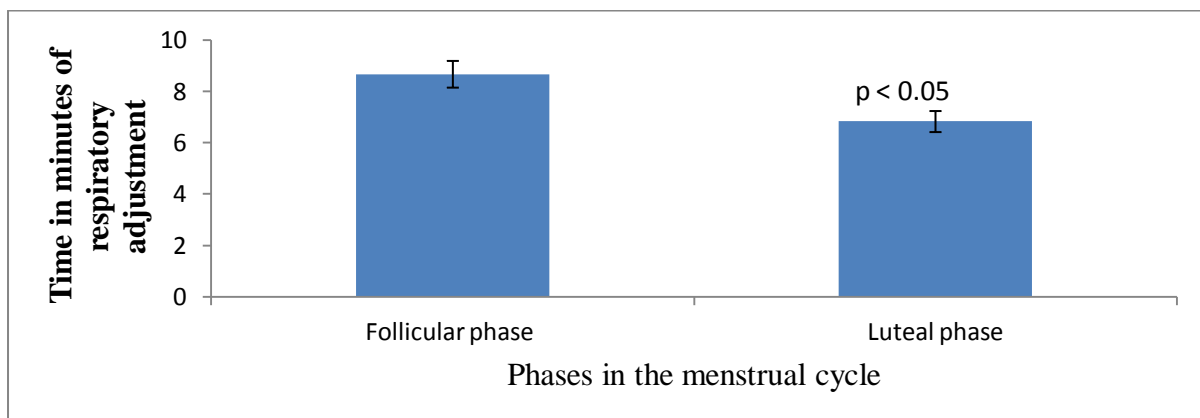


Figure 4: Time in mean±SD for respiration to return to baseline values in subjects in the follicular and luteal phases who were given 400mg/kg of *Garcinia kola*

DISCUSSION

Menstrual profile

The menstrual profile of the subjects used for the study is shown in table 1. These subjects were in their early reproductive years and they attained menarche (age at first menstruation) between 10 -13 years. The duration of menstruation ranged between 3-6 days and 3-5 days for subjects in the follicular phase and luteal phase of the menstrual cycle respectively. This duration of menstruation in both phases of the menstrual cycle were within the normal range of 2-7 days (Dutta, 1998). The subjects had regular menstrual cycles of 28 days, which is an indication that the subjects

have normal menstrual cycle with adequate hormonal interplay of the Hypothalamo-Pituitary-Ovarian axis. The ovarian hormones; progesterone and estrogen have effects on the endometrium for a possible fertilization and implantation. **Serum**

Progesterone concentrations

Of the sixty-four (64) subjects that filled the questionnaire seven (7) subjects (4 subjects from group A and 3 subjects from group B) declined as per further research protocol. Thus a total of fifty-seven (57) subjects completed the study.

The study shows that there was a remarkable increase in progesterone levels

during the luteal phase of the menstrual cycle compared to that of the follicular phase (Tables 2-3). The increase in progesterone levels is likely to improve pulmonary function during the luteal phase. Ventilation is significantly greater in the luteal phase of the ovulatory cycle than the estrogen dominated follicular phase. Consistent with the observation, Zimmerman and colleagues showed that the highest rates of emergency department visits for asthma occurred during the pre-ovulatory phase of the menstrual cycle. Progesterone exerts its influence by modifying the permeability of the chemoreceptor cells or by directly stimulating central respiratory or hypothalamic neurons in contact with blood (Novy et al., 1967). This improved ventilatory function brought about an earlier return of respiratory rate to baseline values in the luteal phase compared to the follicular phase.

Effect of *Garcinia kola* and Progesterone on the time of post exercise respiratory rate adjustment

The post exercise respiratory rate adjustment time in the follicular phase was influenced by various doses of *Garcinia kola* because despite the low serum levels of progesterone there was a progressive decrease in the time of return to base line values of respiratory rates as the doses of *Garcinia kola* seeds increased (table 4). This same pattern was also observed in the luteal phase of the menstrual cycle (table 5). The indication of this is that in terms of time, *Garcinia kola* has a positive respiratory adjustment value. Previous studies have shown a dose dependent effect on alveoli architecture because of its biflavonoids content which possess antioxidant properties. (Akpantah et al.,

2003). Consequently the antioxidant properties accounts for the mopping up of oxygen radicals produced during exercise (Cantuti-Castelvertric et al., 2000) with an overall decrease in the respiratory rate adjustment time. The complementary effect of progesterone in the luteal phase of the menstrual cycle further improved the time it took for subjects to return to the base line respiratory rates. Thus in comparing the respiratory rate adjustment time in the subjects in the luteal phase had a more decreased time of return to baseline respiratory rate than the subjects in the follicular phase (figures 2-4). This observation was despite the fact that both groups were treated with equal doses of *Garcinia kola*. Furthermore subjects in the luteal phase who were not given *Garcinia kola* had a better respiratory adjustment time (figure 1) than similar subjects in the follicular phase suggesting that progesterone alone has pro-pulmonary effect.

Overall the progesterone dominated luteal phase of the menstrual cycle has a better post exercise respiratory adjustment time than the estrogen dominated follicular phase of the menstrual cycle. This added advantage of subjects in the luteal phase was further potentiated by the consumption of *Garcinia kola*. This finding may be harnessed by sports girls who are involved in competition during the luteal phase of their menstrual cycle.

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