GENDER-BASED COMPARATIVE STUDY OF THE INFLUENCE OF *Cola nitida* ON THE SWEAT RATE OF HUMANS

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ABSTRACT
The study focused on how *Cola nitida* might affect the sweat rate of male subjects compared to their female counterparts. A total of sixty participants (30 males and 30 females), all inexperienced with consuming cola nuts, were involved, with ages ranging from 18 to 28 years. The participants were categorized into three groups: underweight (10), normal weight (10), and overweight (10). Individuals with hypertension, renal issues, or any cardio-pulmonary conditions were excluded. The study examined sweat rates under two chamber conditions: normal temperature (27°C, 70% RH) and elevated temperature (37°C, 90% RH). In both scenarios, participants remained seated quietly for 20 minutes. In a third scenario, they exercised on a bicycle ergometer at 750 J/min for 20 minutes in a normal temperature environment. All activities were performed prior to ingesting *Cola nitida*. Each subject was given 0.5g/kg of *Cola nitida*, chewed as a bolus, followed by 50 ml of deionized water, then rested for 90 minutes. Afterward, the participants were placed in a sweat chamber, where sweat was collected using the sweat capsule method to determine their sweat rate. The results showed a significant ($P<0.05$) reduction in sweat rates for female underweight (UW) and normal weight (NW) participants compared to males under both normal and elevated temperatures after consuming *Cola nitida*. However, no significant differences were observed between males and females during exercise conditions following ingestion.

Keywords: *Cola nitida*, Hypertensive, bicycle Ergometer, exercise condition

INTRODUCTION

Found in the blood and elsewhere, fluids and electrolytes, are crucial to the physiology of the body. (Krieger and Sherrad, 1991). Some factors like environmental and ill-health states might change their balance (Krieger and Sherrad, 1991). The fluids are ICF and ECF (Terrada 1966). Sodium ions are majorly found in the ECF whereas potassium ions are in the ICF (Terrada 1966)

Some investigators have observed that some factors such as temperature amongst others would determine heat production and the heat could be detrimental to the human body (Simon, 1993). However, through the process thermoregulation, the body is still able to adjust. Too much heat could negatively impact the body fluids, the heart and blood vessels and the renal system (Semenza *et al*., 1999).

Workers such as those working in the bakeries could easily be impacted by much heat with resultant effects on the renal functions (Laux *et al*., 2011). Knowing that body mass index has a direct bearing to sweating pattern, the underweight, normal weight and overweight could therefore be subjects of interest regarding such a study (Kenchaiah *et al*., 2002). To keep fit, the place of exercise cannot be overemphasized (Thune and Lund, 1996), (Coogan *et al*., 1997) (Blair and Church, 2004). This is quite advisable as most individuals are beginning to adopt more of a sedentary lifestyle (Eaton and Eaton, 2003). A major essence of sweating is to remove heat from the body, especially when the environment is overheated. (Cheuvront *et al*., 2010).

During an exercise, body fluid might be lost which should be replaced subsequently for the avoidance of abnormality. In order not to aggravate a rather worse scenario already existing, the replacement fluid should be caffeine or alcohol free. It is a common knowledge that caffeine is a diuretic. The primary active compound in Cola nitida is caffeine, along with other compon (McCarthy *et al*., 2008) (Umoren *et al*., 2009). It has been observed that a number of people are ignorantly abusing caffeine. Presently, the said substance is applicable in drink and drug production (Mednick *et al*., 2008).

Cola nitida is fondly consumed as a stimulant (Igwe *et al*., 2007) and prior to this time, a gender-based comparative study involving the human subjects using the said Cola nut and under the aforesaid experimental conditions has not been done. Therefore, how *Cola nitida* influenced the sweat rate in all the three body weight was considered in this present study.

MATERIALS AND METHODS

2.1 SUBJECTS

Sixty subjects (males=30 and females=30) (Pourhoseingholi *et al*., 2013); (Odili *et al*., 2014) and unaccustomed to Cola nut eating were involved (Chukwu *et al*., 2006). Their age range was between 18 and 28years. Three (3) sub-categories were involved: underweight=10, normal weight=10 and overweight=10. Hypertensive, renal and any subject with cardio-pulmonary-related conditions were exempted from the study. Prior to the start of the study, informed consent was obtained from all participants, and ethical approval was received from the university's ethics committee. Participants' health status was evaluated using questionnaires and physical examinations, following the protocols outlined by Ugwu and Oyebola (1996) and Ugwu (2007). While all participants were physically active, none were considered physically trained, as they had not followed a consistent exercise regimen in the six months prior to the study, according to the criteria outlined by Kokkinos *et al*. (1995).

2.2 THERMAL CHAMBER

The study was carried out in Professor (Sir) A.C. Ugwu's Sweat Chamber at the University of Benin, which is a room measuring 4 meters by 3 meters (Ugwu, 1978); (Ugwu and Oyebola, 1992).

2.3INCLUSION/EXCLUSION CRITERIA

Participants with hypertension as well as those with kidney or heart conditions, were excluded from the study. The body mass index (BMI) categories used .

2.4 SWEAT OUTPUT

Under both standard and elevated temperature settings, the participant stayed seated calmly for 20 minutes.

2.5 SWEAT COLLECTION

Sweat was gotten from the foreheads using the sweat capsule technique developed by Ugwu and Oyebola (1996).

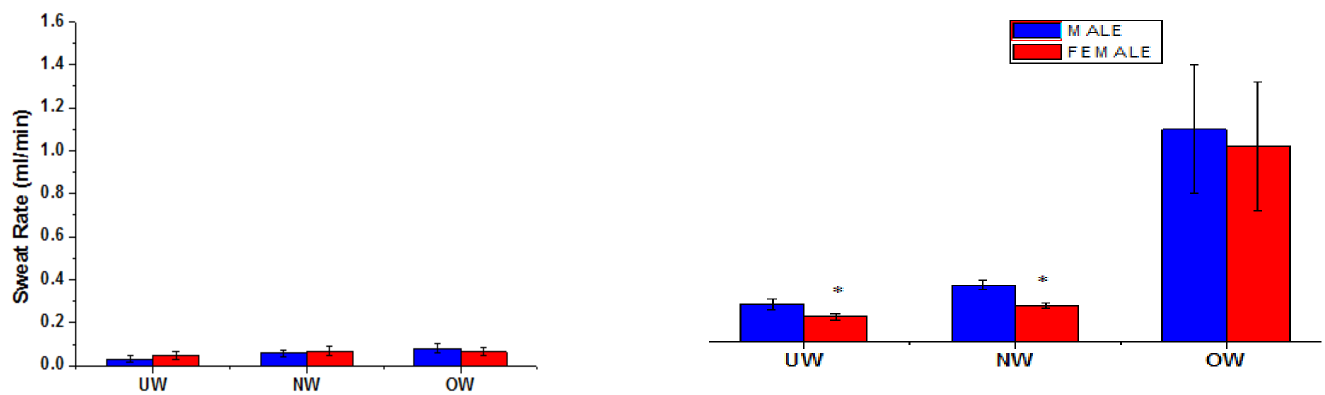
2.6 SWEAT ELECTROLYTES MEASUREMENT

Na and K were measured using flame spectrophotometry. Calcium ion levels were determined using the "Randox" Calcium reagent kit and the colorimetric method for quantitative in-vitro analysis of calcium in sweat. Magnesium ion concentrations were analyzed with the "Teco Diagnostics" Magnesium reagent kit for qualitative detection. Chloride ions were quantified using the "Teco Diagnostics" Chloride reagent kit and the colorimetric method.

2.8 DATA ANALYSIS

The results were presented in tables and graphs with Microcal Origin version 8.0 software, and a probability level of 0.05 (P<0.05) was considered statistically significant.

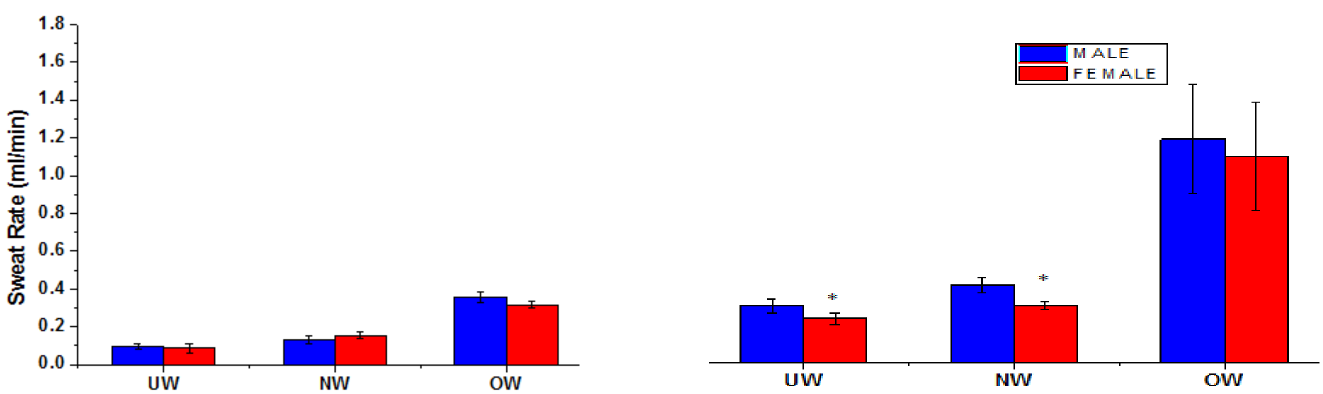
RESULTS



BEFORE **AFTER**

NORMAL CHAMBER TEMPERATURE (RT= 27^{0}C, RH= 70%) **NORMAL CHAMBER TEMPERATURE(RT= 27^{0}C, RH= 70%)**

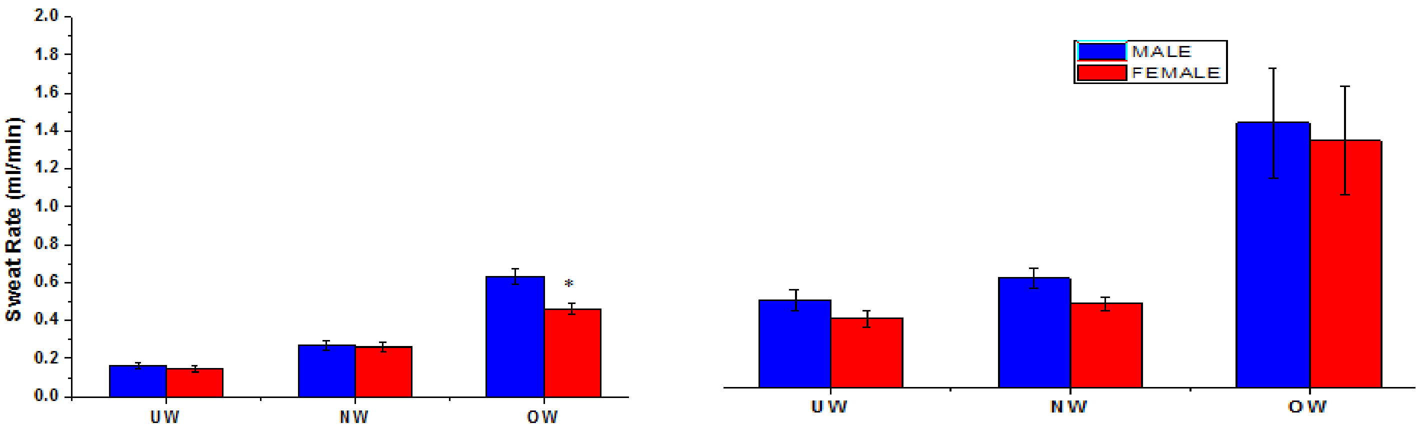
FIG.I: DISPLAYING THE SWEAT RATE IN INDIVIDUALS OF VARYING BODY WEIGHTS



BEFORE **AFTER**

RAISED CHAMBER TEMPERATURE(RT= 37^{0}C, RH= 90%) **RAISED CHAMBER TEMPERATURE (RT= 37^{0}C, RH= 90%)**

FIG.II: SHOWING THE SWEAT RATE IN INDIVIDUALS OF DIFFERENT BODY WEIGHT



BEFORE | **AFTER**

NORMAL CHAMBER TEMPERATURE WITH EXERCISE | **NORMAL CHAMBER TEMPERATUREWITH EXERCISE**

(RT= 27^{0}C, RH= 70%) | **(RT= 27^{0}C, RH= 70%)**

FIG.III: SHOWING THE SWEAT RATE IN INDIVIDUALS OF DIFFERENT BODY WEIGHT

DISCUSSION

There were significant decreases in the female UW and NW subjects sweat rate compared to the males after ingesting *Cola nitida* compared to before under normal (Figure I) and raised temperature (Figure II) conditions. This could be because caffeine (in *Cola nitida*) increased baseline metabolic rate, oxygen uptake, and heat generation (Poehlman *et al.,* 1985); (Cureton *et al.*, 2007). These effects might have been more pronounced in the males than the females. However, no significant change was observed in a comparison between the males and females after the ingestion of *Cola nitida* under exercise condition (Figure III). Some studies have identified differences in sweat rates between males and females, though Dill et al. (1977) found no such variation. However, the current study revealed that males have a higher sweat rate than females, consistent with Ugwu's findings. Notably, increased sweat rates are influenced by the number of active sweat glands and/or the output per gland. While females have more active sweat glands than males, their overall sweat rate is lower, particularly under elevated temperature conditions, as observed by Morimoto et al. (1967). This aligns with the current study, which may explain why males exhibit higher sweat rates. According to Inoue et al. (2005), the lower sweat rate in females is likely due to reduced sweat output per gland, rather than a smaller number of activated sweat glands. Additionally, Ugwu (1985) and Dill et al. (1983) reported that males have a lower threshold temperature for sweating compared to females, a finding that is also supported by this study.

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