THE EFFECTS OF *COLA NITIDA* ON THIRST PERCEPTION IN INDIVIDUALS UNDER DIFFERENT CONDITIONS

Abstract

This study looked at the influence of Cola nitida on thirst perception in male and female human participants. The participants in the research ranged in age from 18 to 28 years old and were non-obese (30 males and 30 females) and non-habitual Cola nut chewers. They were divided into three (3) categories for each gender: underweight (n=10), normal weight (n=10), and overweight (n=10). The researchers ruled out hypertension, renal illness, and cardiac disease from the study. The standard chamber temperature, with a room temperature (RT) of 270°C and a relative humidity (RH) of 70%, and the elevated chamber temperature, with an RT of 370°C and a RH of 90%, were used. The individuals sat silently in the sweat chamber for 20 minutes under the aforementioned settings. The third condition was normal chamber temperature with exercise, in which the patients pedaled a bicycle ergometer at a moderate exertion of 750J/minute for 20 minutes while maintaining RT and RH at 270C and 70%, respectively. Before ingesting Cola nitida, the three prerequisites were met. The visual analogue scale was used to rate thirst sensations immediately after 20 minutes in the sweat chamber. Under each of the three experimental circumstances, each participant was given 0.5g/kg body weight of Cola nitida, which was chewed as a bolus. After ingestion, each volunteer was given 50ml of deionized water to flush the masticated Cola nitida down the intestines, and the individual was given 90 minutes to relax before entering the sweat chamber. Finally, Cola nitida had a considerable impact on fluid loss through the sweat glands. Cola nitida enhanced thirst perception as a compensatory mechanism to the fluid loss as a result of the loss of fluid and electrolytes in perspiration (particularly Na+ and Cl-). As a result, when human beings (even those who are already accustomed to consuming Cola nuts) consume Cola nitida, caution should be exercised, especially when the temperature and exertion levels are high.

Key word: Exercise Conditions, Thirst Perception, Cola Nitida, sweat gland

INTRODUCTION

Caffeine is the main active element in cola nitida, however it also contains a variety of other ingredients (Umoren et al., 2009). Caffeine, theophylline, and theobromine (all found in Cola nitida) are methylxanthines, which are naturally occurring plant alkaloids. Smooth muscle relaxation, stimulation of the central nervous system (CNS), and diuresis are all properties of methylxanthines (Umoren et al., 2009).

The capacity to perceive and control body temperature is critical for human existence, as a difference of 3.50 degrees Celsius from the resting temperature of

37 degrees Celsius can cause physiological deficits and death (Moran and Mendal, 2002).

Thermoregulation is a brain system that links information about the external environment with the appropriate human response to maintain the internal environment more or less constant in response to external change (Nakamura and Morrison, 2008). It entails sensing external circumstances and the individual's internal temperature state, transmitting this information to the brain via afferent neural pathways, and efferent signals from the brain initiating the reaction (Nakamura and Morrison, 2008).

The thermoregulatory system interacts with the cardiovascular and body fluid regulatory systems (Takamata et al., 2001). Maintaining body fluid status during exertion in a hot climate avoids increasing hyperthermia (Sawka and Montain, 2000).

Sweating is the creation of a fluid that is expelled via the sweat glands in animals' skin (Ugwu, 2010). After heat exposure, it is a thermoregulatory physiological response linked to sweat gland activity. Sweating frequency and sensitivity increase as the ambient temperature rises (Armstrong and Maresh, 1991; Libert et al., 1988). Sweating, especially in humans, has excretory and thermoregulatory functions (Ugwu,2007; Blood et al., 2007).

Sweating is primarily controlled by the sympathetic nervous system (Stocking and Gubili, 2004). Sweat composition is mostly determined by the secretive and absorptive processes in sweat glands, which can alter solute concentrations (Ugwu, 1996; Shona et al., 2010).

When the temperature rises, the autonomic nervous system activates the eccrine glands, which leak fluid onto the skin's surface (Ugwu, 2007; Wyart et al., 2007). The thermoregulatory center in the hypothalamus regulates eccrine sweat secretion and blood supply to the skin to regulate body temperature (Holzle, 2002). Through the limbic system, it reacts to variations in core body temperature, hormones, endogenous pyrogens, physical exercise, and emotions (Holzle, 2002). Caffeine causes perspiration in humans as well.

Cells rely on dilute solutions of electrolyte minerals in both intracellular and extracellular fluid to execute a variety of tasks.

Caffeine increases sodium (along with other electrolytes) and water excretion in the kidneys. This is induced by a combination of slightly boosting the glomerular filteration rate and reducing salt and water tubular reabsorption (Milon et al., 1988; Rieg et al., 2004). Caffeine's diuretic properties have led some authorities to advise sportsmen and airline passengers to avoid it in order to decrease the danger of dehydration caused by increased urine production (Maughan et al., 2003). The goal of the study was to see how Cola nitida affected thirst perception.

MATERIALS AND METHODS

SUBJECTS

The study included sixty (60) non-obese individuals (30 males and 30 females) and non-habitual Cola nut chewers (Chukwu et al., 2006). The University of Benin provided the personnel. Questionnaires and a physical examination were used to measure their health (Ugwu, 2007; Ugwu and Oyebola, 1996). All of the participants were physically active, but none of them were athletically trained, as characterized by the lack of a regular physical activity program in the six months before to the experiment (Kokkinos et. al., 1995). Underweight (n=10), normal weight (n=10), and overweight (n=10) were the three (3) subgroups.

Three environmental conditions were involved:

- With a room temperature (RT) of 270°C and a relative humidity (RH) of 70%, the chamber temperature is typical.
- With an RT of 370°C and a RH of 90%, the temperature in the chamber was increased.
- When the RT and RH were maintained at 270°C and 70%, respectively, the normal chamber temperature was achieved (Ugwu, 1985; Ugwu, 1996).

The Sweat Chamber

The study took place in Professor (Sir) A.C. Ugwu's Sweat Chamber (at the University of Benin). It's a room that's 4m x 3m in size (Ugwu, 1978; Ugwu and Oyebola, 1992). The room temperature was raised with a heater and measured with a thermometer. An air conditioner was employed to keep the relative humidity at the appropriate level, while a hygrometer was utilized to measure it (Ugwu and Oyebola, 1992). The subjects' age (years), weight (kilogram), height (metre), blood pressure (mmHg), and pulse rate (beats/minute) were all measured before to the investigations.

Inclusion/Exclusion Criteria

Hypertension (Artfield, 1985), renal, and heart-related diseases (Reiling, 1999; Chukwu et al., 2006) were all ruled out of the experiment. Knowing that the commonly accepted body mass indices (BMI) are underweight (under 18.5 kg/m2), normal weight (between 18.5-25.0 kg/m2), overweight (between 25.0-30.0 kg/m2), and obese (over 30.0 kg/m2) (Omorede et al., 2016), only the subjects who were underweight, normal weight, and overweight but not obese were included in the study. The trial was ended when the volunteers met one of two criteria: 20 minutes of continuous activity or voluntary discontinuation (Troy et al., 2008).

Each subject was studied on a different day, and classes did not begin until after breakfast (Marriot, 1993). The visual analogue scale (VAS) was used to rate thirst sensations immediately after 20 minutes in the sweat chamber (Takamata et al., 1995; Amabebe et al., 2013).

Each subject had a separate piece of paper with a 10cm marker and the words "extremely thirsty" and "not thirsty" written on the ends. The subjects were initially given instructions on how to complete the VAS. They then assigned a point to each scale to indicate how thirsty they were.

0.5g/Kg body weight of Cola nitida (refers to a preliminary study in which the dose of Cola nitida used in the research was determined by letting the volunteers to drink as much as they wanted till they were pleased. The intake ranged between 0.39g/kg and 0.57g/kg body weight (Obika et al., 1995) and was given to each individual as a bolus to chew (Igwe et al., 2007). After consumption, each participant was given 50ml of deionized water to flush the masticated Cola nitida through the intestines (Igwe et al., 2007). The individual was given 90 minutes to rest (preliminary research revealed that the nuts' effects may be seen in bodily tissues 90 minutes after intake) (Igwe et al., 2007). After that, the individual was allowed to enter the sweat chamber.

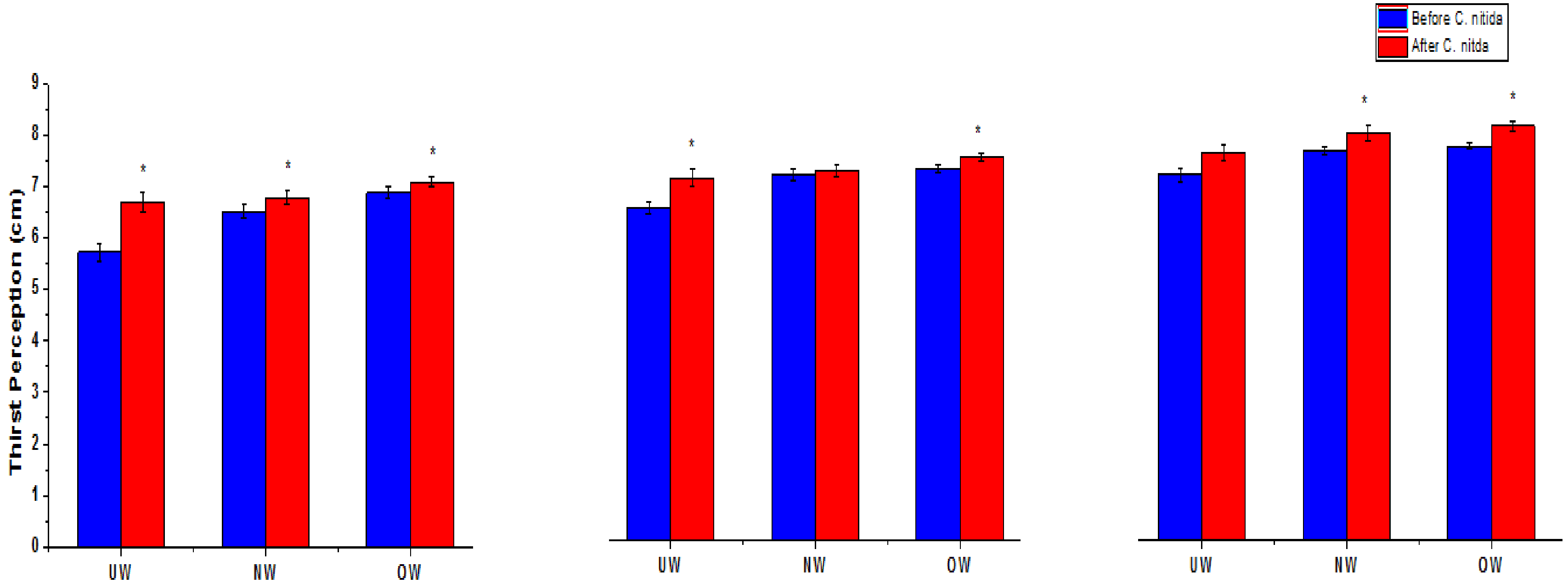
Sweat Output

The participant sat silently in the sweat chamber for 20 minutes under both normal and elevated chamber temperature settings (Ugwu, 1986; Ugwu and Oyebola, 1996). The patients pedaled a bicycle ergometer at a modest effort of 750J/minute for 20 minutes while in the usual chamber temperature with exercise condition (Ugwu and Oyebola, 1992).

Data Analysis

The Mean SEM was used to express all of the data in appropriate tables and graphs. Microcal Origin version 8.0 statistical software was used for the statistical analysis, and the 0.05 level of probability (P0.05) was considered significant.

RESULTS



NORMAL CHAMBER TEMPERATURE

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

RAISED TEMPERATURE

(RT= 37^{0}C, RH= 90%)

NORMAL TEMPERATURE WITH EXERCISE

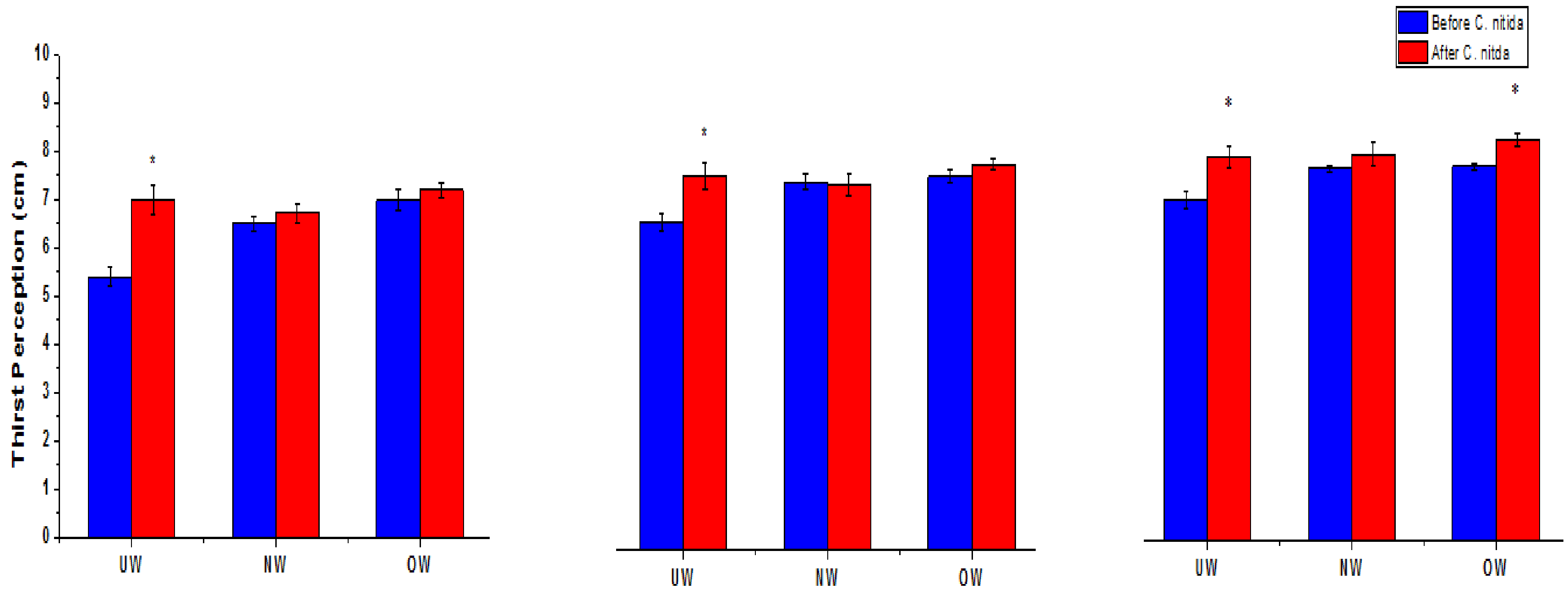
(RT= 27^{0}C, RH= 70%)

FIG. 1: SHOWING THE ***THIRST PERCEPTION*** IN INDIVIDUALS OF DIFFERENT BODY WEIGHT BEFORE AND AFTER INGESTING OF *COLA NITIDA* AT DIFFERENT CONDITIONS.

*P<0.05 indicates significant difference when before ingesting is compared with after ingesting of *Cola nitida*.

$^{\alpha}$P<0.05 indicates significant difference when underweight is compared with normal and overweight.

$^{\#}$P<0.05 indicates significant difference when normal weight is compared with overweight.



NORMAL CHAMBER TEMPERATURE

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

RAISED TEMPERATURE

(RT= 37^{0}C, RH= 90%)

NORMAL TEMPERATURE WITH EXERCISE

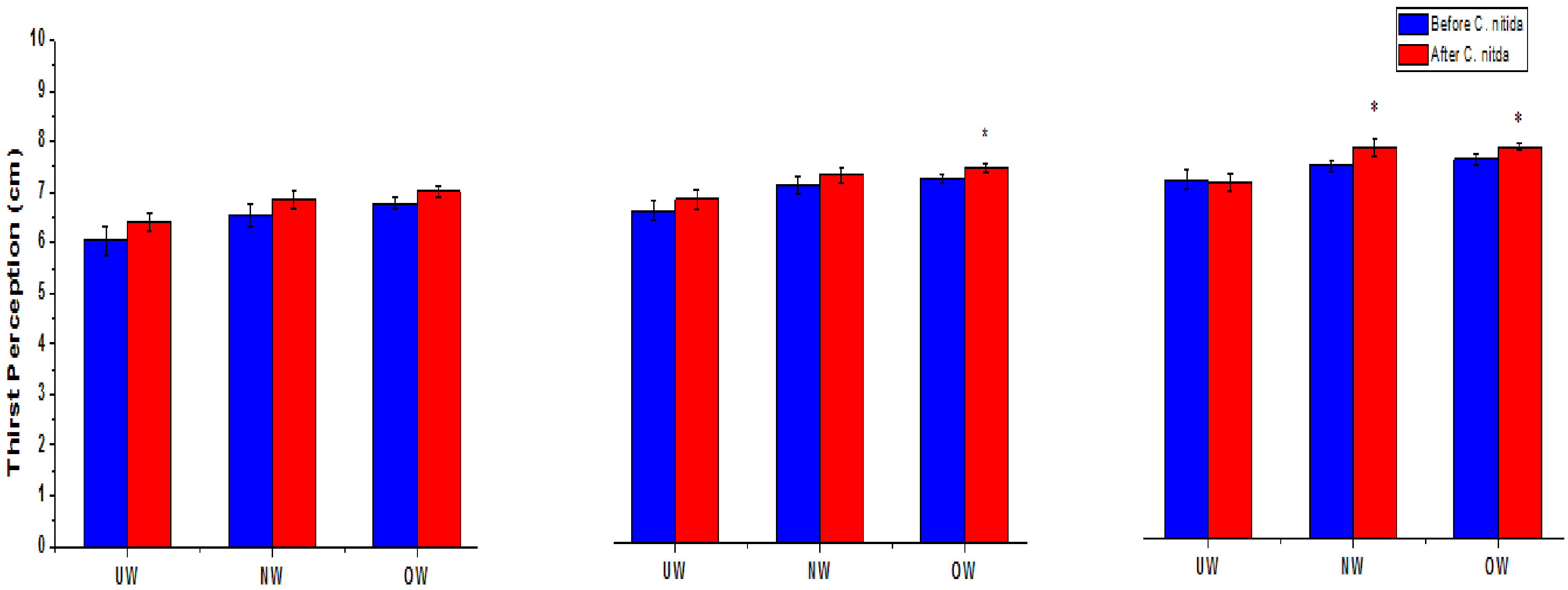
(RT= 27^{0}C, RH= 70%)

FIG. 2: SHOWING THE ***THIRST PERCEPTION*** IN MALE INDIVIDUALS OF DIFFERENT BODY WEIGHT BEFORE AND AFTER INGESTING OF *COLA NITIDA* AT DIFFERENT CONDITIONS.

*P<0.05 indicates significant difference when before ingesting is compared with after ingesting of *Cola nitida*.

$^{\alpha}$P<0.05 indicates significant difference when underweight is compared with normal and overweight.

$^{\#}$P<0.05 indicates significant difference when normal weight is compared with overweight.



NORMAL CHAMBER TEMPERATURE

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

RAISED TEMPERATURE

(RT= 37^{0}C, RH= 90%)

NORMAL TEMPERATURE WITH EXERCISE

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

FIG. 3: SHOWING THE ***THIRST PERCEPTION*** IN FEMALE INDIVIDUALS OF DIFFERENT BODY WEIGHT BEFORE AND AFTER INGESTING OF *COLA NITIDA* AT DIFFERENT CONDITIONS.

*P<0.05 indicates significant difference when before ingesting is compared with after ingesting of *Cola nitida*.

$^{\alpha}$P<0.05 indicates significant difference when underweight is compared with normal and overweight.

$^{\#}$P<0.05 indicates significant difference when normal weight is compared with overweight.

DISCUSSION

When compared to previously, all individuals (under normal conditions), UW and OW (under elevated temperature conditions), and NW and OW (under exercise conditions) demonstrated substantial increases in thirst perception after drinking Cola nitida (Fig. 1, 2 and 3). This might be attributed to hypovolemia produced by dehydration caused by the loss of Na+ and Cl- through perspiration, resulting in an increase in the extracellular fluid's osmolality and tonicity. The increased plasma osmolality is predominantly caused by Na+ and Cl- (Kubica et al., 1983). Na+ and Cl- transport fluid from the intracellular to extracellular fluid, allowing hypohydrated people to maintain their plasma volume.

Thirst symptoms, such as a dry mouth and throat, worsen with dehydration and improve with drinking (Phillips and Rolls, 2000). Dehydration causes physiological thirst through two main homeostatic mechanisms: I increased cellular tonicity (cellular dehydration), which is detected by osmoreceptors in the CNS, and ii) decreased extracellular fluid volume (ECF, extracellular dehydration), which is detected by baroreceptors in the large blood vessels (Kenney and Chiu, 2001). Central and peripheral osmoreceptors detect dehydration/hypertonicity and provide a signal to the hypothalamus, which triggers a variety of thirst-related homeostatic processes.

Plasma levels of hormones involved in hydromineral metabolism, including as angiotensin II (A-II), arginine vasopressin (AVP), oxytocin, atrial natriuretic peptide (ANP), relaxin, and aldosterone, impact drinking behaviors (Antunes-Rodrigues et al., 2004; Amabebe et al., 2017; Begg, 2017). When NaCl (the ECF's primary solute) and water are lost at the same time, the ECF is depleted proportionally more than when water is lost alone. Several adaptive regulatory mechanisms are used when the ICF or ECF capacity is depleted. These adaptive responses, which include RAS activation, AVP release, sympathetic activity, and enhanced renal sodium and water reabsorption, have the adaptive tendency of limiting changes in body fluid volume and composition (Amabebe et al. 2017; Begg, 2017; McKinley and Johnson, 2004; Stachenfeld, 2014).

This might have resulted in the activation of osmoreceptors in the organum vasculosum of the lamina terminalis, with increased thirst and antidiuretic hormone release as a result of the subsequent cascade of events (Ciura et al., 2011; Mckinley et al., 2004). This is consistent with Obika et al. (2009) findings, which found that dehydrated participants exhibit a stronger thirst perception than their euhydrate counterparts. Cola nitida, according to Obika et al. (1996), accelerates drinking and heightens thirst awareness. Thirst perception rose when the subject's BMI increased due to increased fluid and electrolyte loss during exercise (Osayande et al., 2016). A more complicated process is involved in hypovolemic thirst (double feedback loop). It consists of both vascular volume detectors (baroreceptors) that are engaged when blood volume falls and renal mechanisms that stimulate the renin-angiotensin-aldosterone system (RAAS) in response to decreased renal perfusion and NaCl concentration at the macula densa. Only when severe dehydration occurs does hypovolemia become a critical thirst trigger (Fitzsimons, 1991; Fitzsimons, 1998; Rolls and Phillips, 1990). When central osmoreceptors are stimulated, signals are sent to the cerebral cortex, causing thirst and water-seeking behavior (Palevsky, 1998).

CONCLUSION

Cola nitida raised thirst perception substantially. It was more noticeable in overweight patients and in the exercise experimental condition. Cola nitida consumption should be avoided or reduced in any of these settings to avoid probable overstretching of the thirst system.

Ethical Approval:

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

Consent

As per international standard or university standard, Participants' written consent has been collected and preserved by the author(s).

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