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TO STUDY THE RELATION BETWEEN BODY MASS INDEX AND MENSTRUAL PROBLEMS AND THEIR EFFECT ON AUDIOVISUAL REACTION TIME IN YOUNG FEMALES.

Physiology

Dr. Manu Saini Assistant Professor, Department of Physiology, Mahatma Gandhi medical college, Jaipur.

Dr. Mamta* Associate Professor, Department of Physiology, Mahatma Gandhi medical college, Jaipur. *Corresponding Author

Dr. Ruchi Agrawal Assistant Professor, Department of Physiology, Mahatma Gandhi medical college, Jaipur.

Dr Sweta Soni Senior Demonstrator, Department of Physiology, Mahatma Gandhi medical college, Jaipur.

ABSTRACT

Background: Menstruation is an important part of female reproductive cycle. Menstrual problems can affect the normal life of adolescent and young women. Many factors play a role in regulation of normal menstruation like genetic, hormonal factors and Body Mass Index. Reaction time is the time taken by an individual to react to a stimulus. It is an indirect index of processing capabilities of the Central Nervous System and is affected by various factors. **Aims & Objective:** The present study was undertaken to see the relation between Body Mass Index and menstrual abnormalities and effect on Auditory and Visual reaction time in healthy young females (16-19 yrs.) with the help of Audiovisual reaction time apparatus. **Method:** 90 young female medical and paramedical students from Mahatma Gandhi Medical College, Jaipur, were selected for this study. A questionnaire was given to them regarding the menstrual status and any abnormalities in menstrual cycle. Students were divided into 3 groups according to their body mass index:- Group 1:- Normal(BMI 18.5 – 24.99 kg/m^2), Group 2:- Underweight (BMI < 18.5 kg/m^2), Group 3:- Overweight (BMI > 25 kg/m^2). The reaction times were then noted by audiovisual reaction timer. **Results:** It was observed that students with High or Low BMI were more likely to have an excessive amount of blood flow and long interval between menstrual cycle as compared to normal BMI group . Auditory Reaction Time (ART) and Visual Reaction Time (VRT) were assessed by using one – way ANOVA with post – hoc Tukey's HSD test. Both Auditory Reaction Time and Visual Reaction Time were prolonged and highly significant ($p<0.0001$) in underweight and overweight female groups in comparison to the normal BMI group. **Conclusion:** Thus Body Mass Index affects the normal menstrual cycle and the Audio-visual reaction time. Adolescent girls should have a healthy and balanced lifestyle to maintain normal BMI and menstrual cycle.

KEYWORDS

Menstruation, Auditory Reaction Time, Visual Reaction Time, Body Mass Index

INTRODUCTION

Menstruation is a regular, rhythmic normal physiological phenomenon of female reproduction from menarche to menopause. It is regulated by cyclical changes in female sex hormones. Factors that play a role in regularity and flow of a female's menstrual cycle include hormonal changes, genetics, medical disorders and Body Mass Index. In young females, most challenging problems are related to menstruation. Menstrual problems include irregularity in cycle, hyper or hypomenorrhoea, oligomenorrhoea, dysmenorrhoea, menorrhagia and premenstrual syndrome. These problems affect the quality of life of young women. A high proportion of women report suffering from oligomennorhea or amenorrhoea which has been associated with BMI and other complications like polycystic ovarian disease, hirsutism etc. Audiovisual reaction time is the speed, with which a person can respond to an auditory stimulus and visual stimulus respectively[1]. It provides an indirect index of the processing capability of the central nervous system and also a simple means of determining sensory – motor performance[2]. It determines the alertness of a person because how quickly a person responds to a stimulus depends on his reaction time. Reaction time has physiological significance and is a simple and non invasive test for peripheral as well as central neural structures. Reaction time can be a crucial value in activities like driving and is an important quality of a sportsperson. Reaction time measurement includes the latency in sensory neural code traversing peripheral and central pathways, perceptive and cognitive processing, a motor signal traversing both central and peripheral neuronal structures and finally the latency in the end effector activation (i.e. muscle activation). So any change in reaction time indicates presence of a peripheral and/or central disturbance. Reaction time is affected by various factors such as Age, Gender, Exercise, Left v/s Right Hand, Fatigue etc. Studies have shown that Body Mass Index (BMI) calculated as Weight (Kg) divided by square of Height (m^2) influences cognitive functions, attention and memory[3,4,5]. Therefore present study was designed to find out whether BMI affects menstrual cycle and auditory and visual reaction time.

MATERIAL AND METHODS

The present study was conducted in the Upgraded Department of Physiology, mahatma Gandhi Medical College, Jaipur after getting approval from institutional human ethical committee. For the study, 90 healthy young females (17 – 20 yrs) were taken and categorized into 3 groups according to their Body Mass Index (BMI). 30 subjects were taken in each group. Each group was given an detailed self administered, structured, anonymous questionnaire regarding their menstrual history , age of menarche, regular or irregular cycle in interval and duration , amount of blood loss(number of pads used) , pain during menstruation including degree and location of pain, activity during menstruation, symptoms of pre menstrual syndrome. BMI is calculated by Weight (Kg) / Height (m^2). Height was measured with subject standing without shoes, feet together, eyes looking straight ahead and back in contact with measuring bar of stadiometer. Body weight recorded by a digital weight scale without shoes and with light clothes. Then the subjects were divided into 3 groups according to WHO criteria of BMI: Group 1:- Normal (BMI 18.5 – 24.99 kg/m^2), Group 2:- Underweight (BMI < 18.5 kg/m^2), Group 3:- Overweight (BMI > 25 kg/m^2)

Inclusion Criteria:

Age: 17-20 years, Healthy females.

Exclusion Criteria:

- Any acute and chronic illness.
- Any untreated visual or auditory problems.
- Any neuromuscular disorders.
- Taking any drugs which affect reaction time.
- Sleep disorders.
- Excessive Fatigue/Fasting.
- Smoking/Alcohol.

Reaction time recorded with the help of Audiovisual Reaction Time Apparatus, supplied by Medisystem, Yamunanagar, Haryana. It had a display accuracy of 100%. The apparatus has two modes of providing stimulus – Auditory and Visual. Auditory reaction time was recorded for low frequency sound stimuli and Visual reaction time recorded for Red light. Subjects were asked to have adequate 8hrs sleep at night, to avoid any kind of medication during study period and to come in the department between 8 AM to 10 AM after having light breakfast. Subjects were asked to respond the stimuli by pressing the response key with the index finger of their dominant hand. The display indicated the reaction time. After familiarizing the subjects with the instrument and after repeated practices, three readings for each stimulus were taken. The results expressed as mean ± standard deviation. Data was

analyzed using one way ANOVA with post –hoc Tukey's HSD test. $p < 0.05$ was taken as cut off for the measure of significance.

RESULTS

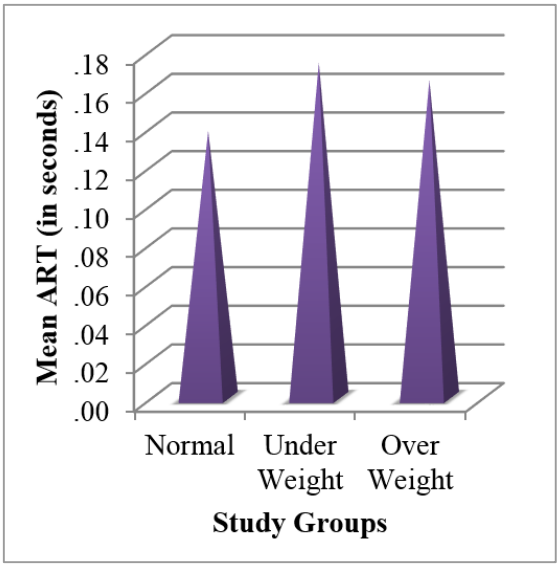
In the present study, BMI was significantly ($p < 0.0001$) different among the three study groups (Table-1). Students who were overweight had excessive amount of blood flow and long interval between cycles compared to those who had normal BMI. Meanwhile, students who were underweight had short interval between cycles. There was no statistically significant difference between pre menstrual syndrome and its symptoms and body mass index in all the 3 groups. There was prolongation of ART and VRT in underweight as well as overweight groups when compared to normal group. Results were significant ($p < 0.0001$) for both ART and VRT.

Table-1: Anthropometric parameters, Auditory Reaction Time and Visual Reaction Time of study subjects.

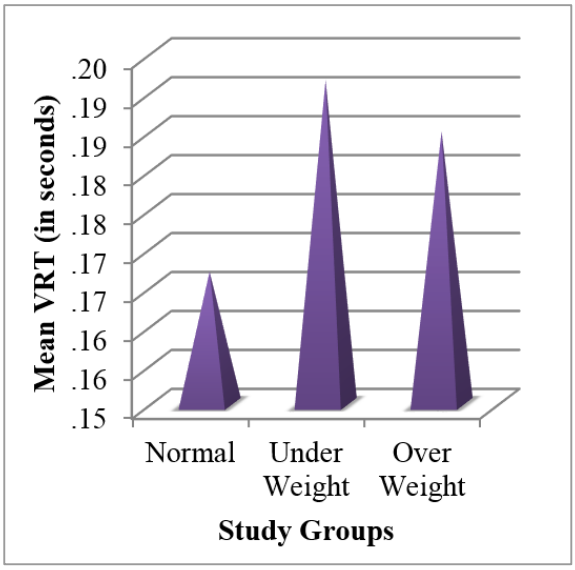
PARAMETER	GROUP 1 Normal (n=40)	GROUP 2 Underweight (n=40)	GROUP 3 Overweight (n=40)	p -value
HEIGHT (m)	1.73 ± 0.070	1.66 ± 0.049	1.74 ± 0.055	< 0.0001*
WEIGHT (Kg)	64.76 ± 8.21	45.72 ± 3.13	83.59 ± 10.25	< 0.0001*
BMI (Kg/m^2)	21.41 ± 1.71	16.59 ± 0.84	27.68 ± 2.52	< 0.0001*
ART (Seconds)	0.138 ± 0.01	0.173 ± 0.02	0.164 ± 0.02	< 0.0001*
VRT (Seconds)	0.167 ± 0.01	0.191 ± 0.02	0.185 ± 0.03	< 0.0001*

*Highly Significant

VRT: Visual Reaction Time; ART: Auditory Reaction Time.



Graph 1- Mean Auditory Reaction Time



Graph 2- Mean Visual Reaction Time

DISCUSSION

Reaction Time is the interval between the onset of a stimulus and the commencement of a movement response [6]. Reaction time can be further broken down into three parts. The first part is perception time – the time for the application and perception of the stimulus and giving the essential reaction to it. The second part is decision time, which signifies the time for giving a suitable response to the stimulus. The third part is motor time, which is the time for compliance to the order received [7]. Singer et al [8] defined reaction time as being composed of four stages, namely: the start of eye movements, eye movement time, decision time and muscle contraction time. In the present study, the reaction times were longer for the responses to the visual stimuli than for the responses the auditory stimuli. The cause of the visual reaction time being greater than auditory reaction time was not very clear, although almost all of the researches which were done on reaction time had reached the same conclusion[9,10]. Most likely it was due to the fact that the visual reaction time involved chemical changes in its occurrence. Also, the visual pathway involved many collateral pathways to various association areas and hence, a greater delay in the comprehension of the visual stimulus, as it was interpreted in a more complex and an elaborate fashion. There could have some degree of difference in the type of receptor and the manner in which the receptor got stimulated i.e. the retina versus the organ of corti. In contrast, Shenvi et al[11]; found that the auditory reaction time was greater than visual reaction time and they rationalized that the auditory pathway must be more polysynaptic as compared to visual pathway. The reaction time is an important component of the motor movements. In the present study, both ART and VRT were increased and statistically significant in underweight and overweight individuals when they were compared to the normal BMI group. Overweight and obesity, indicated by Body Mass Index have been found to be associated with a host of medical conditions. Neurophysiological studies have shown brain regions involved in cognition, memory, vocabulary, speed processing and reasoning are influenced by BMI[2]. Gunstad J et al[2] showed the relationship between the elevated BMI values and the reduced cognitive performance. The vascular disease is likely to underlie the association between obesity and cognition, because obesity is a risk factor for the vascular disease, which in turn, is related to a higher risk of the cognitive impairment. Other hypotheses which have been made on the underlying mechanisms concern the secretions of the adipose tissue such as hormones, cytokines and growth factors that can cross the blood-brain barrier and affect the brain health. Similar study by Skurvydas A. et al[12] showed longer reaction time in overweight subjects. Different neurophysiological studies have shown influence of obesity and elevated body mass index on cognitive functions, memory deficits and executive dysfunction in young as well as middle aged individuals[13,14]. Gustafson[14] observed that in the elderly, the association between underweight and the cognitive functions was likely to be the result of a preclinical dementia. Our results on the cross sectional associations between underweight and cognition in the early midlife were consistent with this hypothesis. Underweight could be a result of poor health[15]; a further possibility is that the underweight persons experience a dysregulation in the hormone secretion which corresponds to that in anorexia, that results in cognitive disorders[15]. Some studies have shown that Psychiatric disorders such as Obsessive-Compulsive disorder, Schizoid Personality disorder and Asperger's disorder are associated with a low body mass index, which may be the result of neuroendocrine dysfunction and/or disturbed eating behaviors[16].

Further investigations of the mechanisms which underlie the cumulative effects of underweight on the cognition, would be an important topic for future research.

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