EFFECT OF BMI (BODY MASS INDEX) ON REACTION TIME IN BILIOUS AND PHLEGMATIC INDIVIDUALS

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ABSTRACT

Background and Objective: Every individual have a distinctive temperament and also possess distinctive characters as well. According to Unani Medicine, it is considered that BMI of phlegmatic individual is more than bilious individuals which depend upon their metabolic and various physiological differences. The objective of this study is to compare the Reaction Time of different BMI groups in both bilious and phlegmatic categories.

Methodology: This study was carried out in Ajmal Khan Tibbiya College, Aligarh Muslim University, Aligarh during the year 2015–2016. For this study, two hundred (200) healthy volunteers of both sex having bilious and phlegmatic temperaments were randomly selected from various faculties of Aligarh Muslim University. The BMI of the volunteers was calculated using Quetelet's index. After the assessment and categorization of temperament and BMI the volunteers were called for an assessment of simple reaction time.

Results: It was revealed after this study reaction Time is greater in phlegmatic than that of bilious temperament in BMI groups 17.0-19.9, 20.0-22.9, 23.0-25.9 and it was statistically insignificant in 17.0-19.9 group. While 20.0-22.9 and 23.0-25.9 have statistically significant results.

Conclusion: Through this study, we can say that the functions of the brain in bilious individuals having lower range of BMI are faster than phlegmatic ones with more BMI because of the prevailing heat and dryness in their temperaments.

Index terms: Temperament (Mizaj), bilious (Safrawi), phlegmatic (Balghami), reaction time and BMI.

I. INTRODUCTION

Reaction Time is the measurement of information processing and is used to judge the person's ability to concentrate and coordinate. It provides an indirect index of integrity and processing ability of central nervous system and is a simple non-invasive mean of determining sensorimotor coordination and performance of an individual (Nikam *et.al.*, 2012). Various factors such as nutrition, training (Sanders, 1998), age (Gorus *et. al*, 2008), gender (Bellis, 1933), exercise (Kashihara *et. al*, 2005), hand dominance (Dane *et.al*, 2003) ,fatigue (Brebner,1980) ,intelligence and personalities type (Nettelbeck, 1980) have been found to influence ones reaction time.

There are evidences that supports assertion that some anthropometric measures may also have an effect of reaction time. Previous study showed that young volunteers with greater body mass index (BMI) had longer RT in response to simple stimuli than those who had lower BMI (Cournot *et.al.*, 2006) (Jeong *et.al.* , 2004).

Body Mass Index (BMI), calculated as weight (in kg) divided by height square (m^2), influences cognitive function, memory, reasoning, processing speed and sensorimotor performance, has been shown in neurophysiological studies BMI of an individual affects the audio visual reaction time, which indirectly measures the sensory motor association (Ngo *et.al.* , 2015).

Temperament is responsible for myriads of functions and anthropometric variations of the body, a pre-requisite for normal health. Since concept of temperament is as applicable to organs as to the whole body, every organ possesses its own temperament and, thus works distinctively. Functionally organs of all human beings are similar yet their capacities are not identical. This functional variability results in physiological span of variations (Zaidi, 1999).

According to ***Ibn-e- Sina*** well muscular development denotes moist and hot temperament. Scanty muscular development denotes dryness. Fat always denotes cold temperament if the body is fleshy and the amount of fat is not much, the temperament is hot and moist (Sina, 1993) (Gruner, 1983).

Zaidi and Zulkifle hold the opinion that since functions of an organ reflect its functional and structural integrity, they indicate within physiological limit, equable temperament of the organ. Functions and actions when accelerate beyond physiological limits becomes indicative of hot temperament of the organ (Zaidi, 1999).

II. MATERIAL & METHODS

This study was carried out in Ajmal Khan Tibbiya College, Aligarh Muslim University, Aligarh from the year 2015–2016.

Selection of Volunteers

In this study, 218 healthy male and female volunteers, aged between 18 and 35 years were enrolled from various faculties of Aligarh Muslim University. Among them, 18 subjects dropped out for not fulfilling the inclusion criteria. The study was approved by Institutional Ethics Committee (IEC) of Ajmal Khan Tibbiya College, A.M.U, Aligarh, and was initiated with the written consent of the subjects. After health fitness examination, the participants were selected for the study. The participants who were normal, healthy with no background of heavy exercise and athletic activity were selected for study and those suffering from malnutrition, myopia, diabetes mellitus, hyperthyroidism, hypothyroidism, volunteers with musculoskeletal disability, any type of neuropathy, hearing problem and vision problem which have effect on reaction time were excluded from our study.

The 200 individuals were randomized and assessed to categorize for temperament groups. Among them, 112 volunteers have bilious temperament and 88 have phlegmatic temperament and after that they categorized according to their BMI.

Determination of Temperament

The assessment of temperament (*mizaj*) of the volunteers was made on the basis of *Ajnas-e-Ashra (*ten determinants*)*, mentioned in the classical Unani literature. It comprises questions related to physical characteristics, physiological habits and psychological make-up of an individual. Each *mizaj* namely *damwi* (sanguine) *safrawi* (bilious), *balghami* (phlegmatic) and *saudawi* (melancholic) carries four options. The responses were computed to obtain a final score. On the basis of responses given by a person in each column of respective *mizaj* followed by an interview and physical examination by the researcher, the dominance of specific *mizaj* was identified (Annexure-1).

Body mass index calculation

Anthropometric parameters; height (meters) and weight (kg) were noted for each subject. Height of the subject was measured using a measuring scale whose least count is 0.1 cm. Height of each subject was converted in unit of metres. Weight was measured using weighing machine whose least count was 0.5 kg. BMI of each subject calculated using Quetelet's index:

$$BMI = \text{Weight (kg)}/\text{Height}^2 \text{ (m)}$$

Reaction Time Assessment

A special reaction time device was built up, tailored to the specific needs of the experiments which consist of following components.

1. Display screen
2. Touch table
3. Oscilloscope

- ***Display Screen***

A 50cm computer screen was used to give a visual stimulus to the volunteer.

- ***Touch Table***

It consisted of different coloured buttons arranged in a circular pattern and was connected to the oscilloscope. In the centre of the table, there was a piezoelectric sensor. A piezoelectric sensor is a device that uses the piezoelectric effect, to measure changes in pressure, acceleration, temperature, strain, or force by converting them to an electrical charge.

- ***Oscilloscope***

It is a type of electronic test instrument that allows observation of constantly varying signal voltages. Oscilloscopes are used to observe the change of an electrical signal over time, such that voltage and time describe a shape which is continuously graphed against a calibrated scale. The observed waveform can be

analysed for such properties as amplitude, frequency, rise time, time interval, distortion and others. In this study, Rigol Digital Oscilloscope DS1102E was used.

The Recording of the Visual Reaction Time

Volunteers were asked to stand at a certain point in a static position and asked to place their index finger on the centre of the touch table. The visual stimulus was given to the volunteer that was a colour displayed on the display screen and the volunteer was asked to identify the colour and tap its index finger on the colour patch according to the given colour. As the volunteer tapped at the colour patch, the piezoelectric sensor generated a voltage that was recorded on the oscilloscope in the waveform. The difference between the waves was measured as reaction time in milliseconds. The procedure was repeated five times for the purpose of the study and the mean of these five readings was taken in the data to avoid the error.

The reaction time was recorded on the 500 msec and 500 mV which means one square (1 cm) of the graph is 500 msec on X-axis whereas Y-axis indicates the force of action in mV.

III. OBSERVATIONS AND RESULTS

Body mass index (BMI) of individuals was calculated. The number of volunteers having their BMI in the range of 17.0-19.9 were 35, out of which 02 were phlegmatic and 33 were bilious. Among the 108 volunteers having BMI in the range of 20.0-22.9, 69 were bilious and 39 were phlegmatic. The total number of volunteers whose BMI fall in the category of 23.0-25.9 was 57 out of which 10 were bilious and 47 were of phlegmatic temperament.

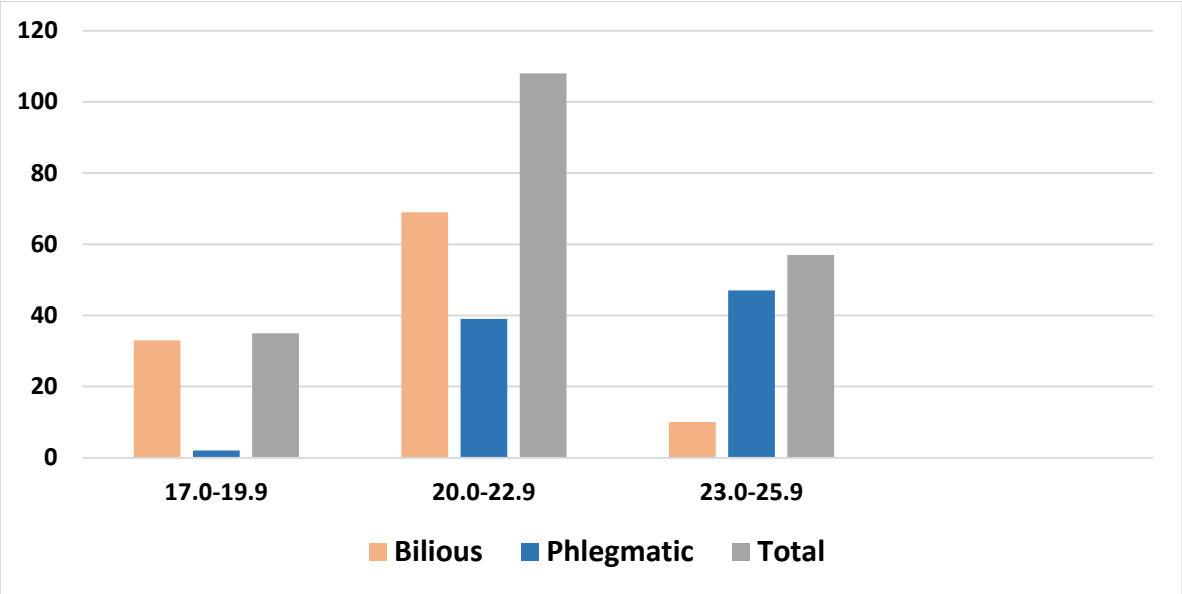
The maximum number of bilious volunteers (69) were belong to 20.0-22.9 BMI group whereas maximum number of phlegmatic volunteers(47) belong to 23.0-25.9 BMI group as shown in Table -01,Graph-01.

Table-01

Showing Distribution of Volunteers according to BMI

BMI	***Bilious temperament***	***Phlegmatic temperament***	***Total***
17.0-19.9	**33**	**02**	**35**
20.0-22.9	**69**	**39**	**108**
23.0-25.9	**10**	**47**	**57**
Total	**112**	**88**	**200**

Graph-01



STATISTICAL ANALYSIS

The raw data so obtained was arranged and statistically analysed. The mean and standard deviation of reaction time was calculated and unpaired t-test was applied to obtain the significance of results.

The study was statistically analysed with reference to mean value of Reaction Time in particular BMI group; it was observed the mean value of Reaction Time is greater in phlegmatic than that of bilious temperament in BMI groups 17.0-19.9, 20.0-22.9, 23.0-25.9 and it was statistically insignificant in 17.0-19.9 group. While 20.0-22.9 and 23.0-25.9 have statistically significant results. Table -02.

Table-02

Showing comparison of Reaction Time with BMI of volunteers

BMI	Bilious temperament	Phlegmatic temperament	Significance
17.0-19.9	205.45 ± 15.22	225 ± 21.1	No P>0.05
20.0-22.9	201.44 ± 15.46	227.17 ± 19.32	Yes P<0.05
23.0-25.9	204 ± .10.74	233.61 ± 29.29	Yes P<0.05

IV. DISCUSSION

This study has been taken to find out the difference of reaction time in two temperament groups according to their BMI categories. Bilious individuals are energetic, extrovert, intelligent and hyperactive than phlegmatic individuals. They have excellent metabolic activities, and hence they fall towards lower range of BMI groups.

So they have physiologically faster reaction time because of their temperamental differences (Shah, 1972). In previous studies, it is evident that people with higher intelligence (Schweitzer, 2001) and extrovert personality types (Brebner, 1980)(Welford, 1980) (Nettelbeck,1973), have faster reaction time. Since reaction time is related with *af'al-e-nafsaniyah* (mental functions) which are faster in bilious individuals, because of prevalent heat and dryness in their temperament. Although, the present study had small sample size, the obtained results are promising. Further studies are recommended on large sample size and future work may be conducted to explore the recognition and choice reaction time instead of simple reaction time.(Saleem *et.al*, 2018)

V. CONCLUSION

This study is done to build a relationship between BMI and Reaction Time in different temperament groups. The Reaction Time of people appears to be influenced by temperament and anthropometric variations and hence also influenced by BMI. Optimal BMI is required to balance between various physiological functions including neuromuscular co-ordination.

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REFERENCES

1. Bellis C. J. 1933. Reaction time and Chronological Age. Proceedings of the Society for Experimental Biology and Medicine; 30: 801.
2. Brebner, J. T. and Welford A.T.1980. Introduction: An Historical Background Sketch. In A. T. Welford (Ed.), Reaction Times. Academic Press, New York; pp. 1-23.
3. Cournot M, Marquie JC, Ansiau D.2006, Relation between body mass index and cognitive function in healthy middle agedmen and women. Neurology.67:1208–1214.
4. Dane, S. and Erzurumluoglu A.2003. Sex and Handedness Differences in Eye-hand Visual Reaction Times in Handball Players. International Journal of Neuroscience; 113(7): 923-929.
5. Gorus, E.,De Raedt R., Lambert M., Lemper J. , Mets T.2008. Reaction Times and Performance Variability in Normal Aging, Mild Cognitive Impairment, and Alzheimer's Disease. Journal of Geriatric Psychiatry and Neurology; 21(3): 204-219.
6. Gruner, O.C. 1983. The Four Temperament, Avicenna's tract on cardiac drugs and essays on Arab Cardio therapy, IHMMR, New Delhi; pp 119-123.

7. Jeong SK, Nam HS, Son MH, Son EJ, Cho KH.2004. Interactive Effect of Obesity Indexes on Cognition. Dement Geriatr Cogn Discord. 19:91-96.
8. Kashihara, K. and Nakahara Y.2005. Short-term Effect of Physical Exercise at Lactate Threshold on Choice Reaction Time. Perceptual and Motor Skills; 100(2): 275-281.
9. Nettelbeck T.1973. Individual Differences in Noise and Associated Perceptual Indices of Performance. Perception; 2(1): 11–21.
10. Nettelbeck, T.1980. Factors Affecting Reaction Time: Mental Retardation, Brain Damage, and other Psychopathologies. In AT. Welford (Ed.), Reaction Times. Academic Press, New York; pp. 355-401.
11. Ngo C.W. *et. al.* 2015, Influence of Body Mass Index on Visual Reaction Time: A Cross-sectional Analytical Study, British Journal of Medicine & Medical Research; 10(3): 1-8.
12. Nikam LH, Gadkari JV.2012. Effect of Age, Gender and Body Mass Index on Visual and Auditory Reaction Times in Indian Population. Indian Journal of Physiology and Pharmacology; 56:94–9.
13. Saleem S., Sherani FS. 2018. Comparative Study of Reaction Time in the Individuals of Bilious and Phlegmatic Temperament, Research & Reviews: A Journal of Unani, Siddha and Homeopathy ; 5(2) 1-8
14. Sanders, A. F. 1998. Elements of Human Performance: Reaction Processes and Attention in Human Skill. Lawrence Erlbaum Associates, Publishers, Mahwah, New Jersey; p21.
15. Schweitzer K. 2001.Pre-attentive Processing and Cognitive Ability. Intelligence; 29(2): 169.
16. Shah MH. 1972. Temperament, Explanation and Interpretation Philosophy of Medicine and Science Problems and Perspective. IHMMR New Delhi: Compiled by Department of Philosophy of Medicine and Science.
17. Sina I. 1993. Al Qanoon fil Tibb, Book-I, English translation of the critical Arabic Text. Jamia Hamdard. New Delhi; pp. 7-13 ,65, 190-197.
18. Welford AT. 1980. Choice Reaction Time: Basic Concept. In: Welford AT, editor. Reaction Times. New York. NY: Academic Press.73: 128.
19. Zaidi IH and Zulkifle M.1999. Temperamentology: A Scientific Appraisal of Human Temperament. 1st ed, Aligarh; Pp.6-13, 18-23, 34, 64-65.