



INFLUENCE OF TRYPTOPHAN ON REACTION TIME IN FIRST YEAR MEDICAL STUDENTS

Physiology

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ABSTRACT

The present study is aimed to study the effect of Tryptophan on reaction time i.e. information processing time and speed. Reaction time is one of the important physiological parameters, which gives information how fast and quickly person responds. Reaction is purposeful voluntary response to different stimuli as a visual reaction time and auditory reaction time stimuli. Visual reaction time (VRT) is the time required to response to visual stimuli and auditory reaction time (ART) is the time required to response auditory stimuli. Reaction time is reliable indicator to the speed of processing of sensory stimulus by central nervous system. In human Protein converted into amino acid tryptophan which is precursor for synthesis of serotonin. In this study our aim is to see the effect of protein as a supplement in healthy individual on reaction time.

KEYWORDS

Visual Reaction Time, Auditory Reaction Time, Serotonin

INTRODUCTION:

Human body responses to the number of external environmental stimuli of different modalities. Human body gives a desired and purposeful voluntary response to stimulus. Reaction time is defined as interval of time between presentation of stimulus and appearance of appropriate voluntary response in a subject. There is a certain time period between application of stimulus and appropriate motor response. There are various sensory modalities, human body responses to various stimuli with different speed and timing (1). This plays an important role in everyday life. Reaction time is one of the important physiological parameters, which gives information how fast and quickly person responds to various types of external stimuli of different modalities (2). Reaction time is purposeful voluntary response to different types of stimuli. Reaction time becomes an important component of information processing as it indexes speed of stimulus processing and response programming (3). Reaction time is having mainly two components (4).

1. Mental processing time: Which is the time required for responder to perceive stimulus, identifying and analyzing of stimulus and decide the proper motor response. (4)
2. Movement time: It is the time required to perform the movement after selection of response.

Serotonin was discovered in the late 1940s and was quickly related to the central nervous system. By the late 1950s, scientists started to unveil that serotonin impacted a multitude of different areas of the body, including the cardiovascular system, gastrointestinal tract and CNS, by attaching to receptors throughout the body. The serotonin system has the largest number of receptors and subtypes of any of the neurotransmitter systems (5). There are seven distinct families of 5 HT serotonin receptors, such as 5HT1, 5HT2, 5HT3, 5HT4, 5HT5, 5HT6 and 5HT7, divided in to 14 subtypes identified that affect various aspects of bodily functions. Serotonin acts through several receptor types and subtypes, widely distributed throughout the central nervous system (6). Approximately 90% of all serotonin is found in the gastrointestinal tract and remaining 8 to 10% in CNS (Berger, 355). Serotonin is synthesized from its precursor the amino acid tryptophan. Two enzymes are involved in the synthesis of serotonin are tryptophan hydroxylase and aromatic amino acid decarboxylase.

The neurotransmitter serotonin known chemically as 5-hydroxytryptamine or 5-HT. While excess production of serotonin or People experiencing elevated levels of serotonin have a variety of positive effects and it is not usually elevated to harmful levels unless an individual suffers diseases or takes anti-depressants (Young, 395). In humans, increasing tryptophan levels can increase serotonin synthesis and decreasing tryptophan availability can cause a substantial decline in serotonin synthesis and turnover in human, When tryptophan is given it is

increases the saturation of tryptophan hydroxylase and increases the rate of serotonin synthesis, it increases the serotonin level (7,8). Generally, the normal range for serotonin levels in normal adult human blood is 70–270 nanograms/milliliter (ng/ml). Changes in serotonin level causes various neurological effects in nervous system. That acts directly or indirectly on the nervous system causing morphological, chemical, or electrical changes in the nervous system. Serotonin neurotransmitter shows improvement in various functions in human central nervous system.

Three types of reaction time. 1. Simple reaction time: Here there is one stimulus and one response. 2. Recognition reaction time: Here there are some stimulus that should be responded to and other that should not get a response. 3. Choice reaction time: Here, there are multiple stimulus and multiple responses (5,6,9).

By the motor movements, muscular coordination and speed of movement can be improved which would improve movement time (9). Long lasting improvement in performing skilled motor movements can be achieved by training and retraining and repeated practicing (10,11). The present study is carried out to see the effect of protein supplement on serotonin level and effect of protein supplement on visual and auditory reaction time.

Methodology

The present study was a prospective study conducted at Department of Physiology, Dr. D.Y. Patil medical college, Hospital and Research center, Nerul, Navi Mumbai. In this study participants were first year medical students aged between 18 to 25 years. Institutional ethical clearance was obtained prior to starting the study. Total number of participants were 100, comprising of 51 male and 49 female participants without any pre morbidities and not on any medications. Daily 30 gms of protein power was given to participants in morning at the same time for 10 days. Serotonin level of blood was measured before and after completion of 10 days period by using a Serum Enzyme Immunoassay (EIA) method. The effect of serotonin on their Visual and auditory reaction time was assessed before and after study period, using standard portable reaction time apparatus designed has two components (A&B) connected to each other. (A) has a start button and it is handled by the examiner only. (B) has a stop button which was handled by the subject alone, it has a small blue light inbuilt which is used as a stimulus to measure visual reaction time (VRT). In the apparatus, an inbuilt timer is placed which provides reaction time in milliseconds. While recording of auditory reaction time a start (A) button is handled by the examiner only & (B) has a stop button which will be handled by the subject alone. When examiner starts the machine, the machine will produce beep sound immediately. The participant has to respond to beep sound immediately by pressing the stop button. The auditory reaction time the inbuilt timer is placed

which provides auditory reaction time in milliseconds. Pre and post VRT and ART measured at fixed interval. The data was analyzed pre and post administration in consultation with institutional statistician.

OBSERVATION

In present study 100 healthy male and female first year medical students participated in this study. Mean age for male and female was 18.47, all the subjects successfully completed the entire study trail within the stipulated study period. The mean serotonin levels were 107.64 ng/ml with a standard deviation of 32.696. before the study trial, and mean serotonin levels post administration was 114.33 ng/ml with a standard deviation of 34.663. No statistically significant difference were observed in the values among males and females in terms of mean serotonin levels. 5% participants were deficient of serotonin in pre supplementation. After post administration the significant increase seen in serotonin level in deficient and other also. Statistically significant P values were revealed in serotonin level.

ART mean in pre supplements was 140.59 milliseconds with standard deviation 29.559 and in post supplements 131.02 milliseconds with standard deviation 26.830. showing significant decrease of ART (P value < 0.0001). VRT mean in pre supplementation was 283.49 milliseconds with standard deviation 57.935 and in post supplements 271.24 milliseconds with standard deviation 54.547. showing significant decrease of ART (P value < 0.0001). (Table).

Table: Mean Serotonin, ART And VRT Before And After Supplements

	Mean	SD	SE	Corr elation	Sig.	Mean diff.	95% C.I.	t	p
Serotonin									
• Pre	107.64	32.696	3.270	0.978	<0.0001	-6.697	-8.15 to -5.24	-9.152	<0.0001
• Post	114.33	34.663	3.466						
ART									
• Pre	140.59	29.559	2.956	0.917	<0.0001	9.576	7.24 to 11.91	8.132	<0.0001
• Post	131.02	26.830	2.683						
VRT									
• Pre	283.49	57.935	5.794	0.991	<0.0001	12.248	10.59 to 13.91	14.644	<0.0001
• Post	271.24	54.547	5.455						

DISCUSSION:

The present study revealed a relationship between administration of protein and levels of serotonin on reaction time otherwise healthy subjects. There was no significant difference in serotonin levels based on gender among the selected study population. This is in concurrence with studies by Leibowitz, et al, study who did not find significant changes in serotonin levels based on gender. A variety of studies have mentioned that the direct participation of 5-HT is seen in enhanced brain serotonin activity by means of its precursor tryptophan (12) shows improved responses to various stimuli with different speed and timing (13). In present study the subjects shown a statistically significant difference in terms of changes in VRT and ART in post administration of protein among the selected study group. The auditory reaction time is found to be less than visual reaction time, which is similar to Thompson experiment who has documented that the mean reaction time to detect visual stimuli is approximately 180 to 200 milliseconds and visual stimulus takes 20-40ms to reach visual center in brain (13). Whereas for sound it is around 140-160 milliseconds and sound stimulus takes 8-10ms to reach in brain (13,14,20). Pain and Hibbs, in their research showed that simple auditory reaction time has the fastest reaction time for any given stimulus (14,15,16). This change is in concurrence with studies by Murphy and Markus (7,8), who reported that a protein rich diet increases cognitive function in individuals. The finding of our study revealed that the reaction time for auditory and visual stimuli was found to be delayed i.e. faster in protein rich diet. Joki E, et al 1974, study says reaction time helps to release tension and develops alertness and better contact of mind with body, which seems to be responsible for better performance of the individuals (17,18,19).

CONCLUSION

It can be concluded from our study that after giving protein as a supplement to healthy individual protein getting converted in to 5 hydroxytryptophane (5HT) which is used for synthesis of serotonin as neurotransmitter which improves the speed and processing time of sensory stimulus. Also alter the muscular motor response in central nervous system. VRT and ART were significantly reduced after the consumption of protein powder as supplement.

Future prospect of the study are more number of participants with different age group and molecular basis of mechanism of action at cellular level can be study.

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