Research Article

Ageing & Reaction time in Indian Population

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Abstract:

The effect of advancing age & gender on visual and auditory reaction time was evaluated in 320 normal Indian male & female volunteers in the age group of 21-60 years. The volunteers were divided in two groups according to age; Group A comprised of 200 volunteers (100 males & 100 females) in the age group of 21-45 years & Group B comprised of 120 volunteers (60 males & 60 females) in age group of 46 – 60 years. The auditory & visual reaction time was recorded using Techno Digital Response Time apparatus. Significant increase in visual reaction time and auditory reaction time was observed with the advancing age. In males, auditory reaction time increased by 22.6 msec & the visual reaction time for green & red light increased by 24.3 msec & 23.9 msec respectively from Group A to Group B. Similarly in females, the auditory reaction time lengthened by 24.4 msec while visual reaction time for green & red light increased by 28.6 msec & 27.1 msec respectively. The auditory reaction time was shorter in females in both the age groups, while visual reaction time was shorter in males in both the age groups. The results for change in auditory reaction time due to advancing age in males as well as females were significant ($p<0.05$). While the results for the effect of ageing on visual reaction time for red as well as the green light in males & females were significant($p<0.05$).

Key Words: Visual reaction time, Auditory reaction time, Age & Gender.

Introduction:

In the today's fast paced world of digital technology, the role of time has acquired an important significance not only for growth but also for the survival. Even in the routine activities of our everyday life, it can seen that today's man works invariably in a complex set ups where he is required to react to the variety of situations promptly & correctly. The time taken by an individual to react to unwarranted or unexpected challenges is called as reaction time (Sternberg, 1966; Ganong, 2005). The reaction time involves reception of the stimuli by the sense organ, conduction of the information through the nerve to the brain & from the brain to the muscle contraction & the movement of the muscle. The contribution of the central processes in the brain is usually far larger than all the others put together (Welford, 1977). Because the reaction time involves a sensory as well as motor alertness, the factors affecting sensory as well as motor system can affect the reaction time. The effect of age on the reaction time is thoroughly studied by Crossman & Szafran (1956). Proportionate increase in reaction time with age is shown by various worker (Griew, 1959; Suci & Davidoff, 1960).

Manifestations of changes in human motor function with advancing age are familiar events. Older people clearly exhibit and experience varying degrees of loss of abilities which require fine coordination and rapid initiation of movement (Norris et al, 1952).

Because reaction time involves speed & accuracy, it has provided a way to evaluate commonly used psychological tests for attention, concentration and cognitive skills with well proven diagnostic and predictive validity (Welford, 1980).

Diseases like epilepsy (King, 1962), parkinsonism (Hicks & Barren, 1970), diabetes, schizophrenia, depression and neurological impairment are a few pathological factors which affect reaction time (Welford, 1980).

The aim of the present study was to find out: Whether the age affects the reaction time equally in male & female and at what age does reaction time starts getting affected?

Materials & Methods:

Volunteers were screened for auditory and visual impairment, major illness such as diabetes, hypertension, renal disorders, tuberculosis, neuropathies and psychiatric disorders. Individuals having any of the above problems were excluded from the study. All

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subjects on steroids, psychotropic drugs, anti diabetics, antibiotics, antihypertensives, anti-inflammatory agents and anti-histaminics were also excluded from the study. After screening test, 320 volunteers, 160 males and 160 females between 21-60 years were evaluated to assess the effect of advancing age on visual & auditory reaction time. The subjects were divided in two age groups i.e. 21-45 (group A) and 46 – 60 (group B). All the females of group B were post menopausal. Volunteers both the group, were equal in number and gender. Group A comprised of 200 volunteers & group B consisted of 120 volunteers. An informed consent was taken from the subjects. Test was recorded (between 9-11am) at room temperature of 25-27^0 C. Instructions were given about nature & aim of the test. Several work trials were carried out before the actual test, to acquaint the subject with the procedure & the apparatus.

The study was carried out in the department of Physiology, Dr Ulhas Patil Medical College & Hospital, Jalgaon with the help of Techno Digital Response Time apparatus. In it, two visual stimuli of Red & Green lights & two auditory stimuli of different tones with independent operation are provided. The chronoscope is a four figure, seven-segment LED display with the least count of 00.01 second & maximum display of 99.99 second. It has sloping operating panels on both sides, with a middle partition which effectively shields the operations on either side.

In present study, three stimuli were used; two for visual reaction time (red & green light) & one for auditory reaction time (high pitch sound).

First the auditory mode was selected and the auditory stimulus box was connected to the stimulus socket. The display was set to zero. The apparatus was enabled which gave stimulus in the form of beep sound and the volunteer would disable the apparatus thereby locking the reaction time in display. The reading was noted, and counter was reset for the next trial. Similarly, the visual reaction time was recorded for the green & the red lights. For both auditory and visual stimuli, three readings were taken & the mean of them was taken as the final value.

The results were analysed statistically using students unpaired 't' test.

Results & Discussion:

There were 200 volunteers in Group A (age group 21-45 years) out of which 100 were male & 100 were females. The Group B (age group 46-60 years) had 120 volunteers out of which 60 were males & 60

Table I: Showing age & gender distribution in study population.

Age Group	No of subjects		Average age	
	Males	Females	Male	Female
21-45 (Years)	100	100	32.99	33.34
46-60 (Years)	60	60	53.76	54.01

Table IIa: Showing effect of ageing on auditory reaction time in male & female

Auditory reaction time in msec	Male (mean±SD)		p-value	Female (mean±SD)		p-value
	Group A	Group B		Group A	Group B	
	341.96±2.7	364.63±3	<0.05*	337.99±4.7	362.39±1.5	<0.05*

*p<0.05- significant

Table IIb: Effect of gender on auditory reaction time.

Auditory reaction time in msec	Group A (21-45 years) (mean±SD)		p-value	Group B (46-60 years) (mean±SD)		p-value
	M	F		M	F	
	341.96±2.7	337.99±4.7	<0.05	364.63±3	362.39±1.5	<0.05*

*p<0.05- significant

Table IIIa: Effect of ageing on visual reaction time in males & females.

Visual reaction time in msec	Male (mean±SD)		p-value	Female (mean±SD)		p-value
	Group A	Group B		Group A	Group B	
For green light	365.29±2.3	389.63±4.1	<0.05*	371.1±2.8	399.75±5.0	<0.05*
For red light	364±5.2	387.9±4.4	<0.05*	365.5±4.1	392.65±3.9	<0.05*

*p<0.05- significant

Table IIIb: Effect of gender on visual reaction time in Indian population.

Visual reaction time in msec	Group A (21-45 years) (mean±SD)		p-value	Group B (46-60 years) (mean±SD)		p-value
	M	F		M	F	
For green light	365.29±23	371.1±2.8	<0.05*	389.63±4.1	399.75±5.0	<0.05*
For red light	364±5.2	365.5±4.1	<0.05*	387.9±4.4	392.65±3.9	<0.05*

*p<0.05 - significant

were females (Table I). Table also shows the average age of male & female in each age group.

In the present study, the mean auditory reaction time in male changed from 341.96±2.7 msec in Group A to 364.63±3 msec in Group B, the increase of 22.6 msec, while female volunteers showed an increase of 24.4 msec from 337.99±4.7 msec in Group A to 362.395±1.5 msec in Group B (Table IIa).

The mean visual reaction time for green light in males changed from 365.29 ± 2.3 msec in Group A to 389.63±4.1 msec in Group B, the lengthening of 24.34 msec while for red light there was an increase of 23.9 msec, from Group A to Group B (Table III). In females, mean visual reaction time increased by 28.65 msec & 27.15 msec for green & red light respectively from Group A to Group B (Table IIIa).

It is evident from Table IIa & IIIa, that as the person (male/female) ages, his/her reaction to auditory as well as visual stimuli slows down.

We observed that the ageing affects reaction time (auditory as well as visual) in females more than the males. The change in auditory reaction time as well as visual reaction time for red and green light were significant in both males & females ($p < 0.05$).

It is also obvious from Table IIa and IIIa, that ageing slows down visual reaction time more than the auditory reaction time. Reaction time for green light is affected more than for the red light.

Result of the present study on effect of ageing is in conformity with the study by Obrist (1953) which had shown that there is shortening of the reaction time till 19th year of life after which it remains constant till the 26th year & then there is a steady increase in the reaction time as person ages. Miles (1931) and Bellis (1933), showed that reaction time of adults increased with age but the rate of this increase is apparently much greater during senescence than in middle ages of life. According to Welford (1980), the reason for slowing of reaction time with advancing age is not simple mechanical factor like the speed of nerve conduction but also because older people tends to be more careful and monitor their responses more thoroughly. This effect of ageing affect females more than males and could be due to hormonal changes females have under gone after attaining menopause.

Various research studies have yielded controversial results as regards to the effect of gender on reaction time. Study by Miles (1931) and Bellis (1933) showed that males are faster than females in reacting to auditory and visual stimulus. However, Noble et al (1964) observed that males had a shorter reaction time than females in every age group except 10-14 years and the oldest group where there was no difference in reaction time. Welford (1980), Noble et al (1964) and Bellis (1933) reported that the mean time to press key in responses to light & sound stimulus, was longer in females than in males. A study by Prinzel et al (1995), observed that males are faster than females in both reaction and movement .

Gender difference was also observed by Shenvi & Balasubramanium (1994), who showed that the auditory as well as visual reaction time, were significantly higher in males as compared to females in age groups of 17-18 years.

Results of Noble et al (1964) were in conformity with the present study as far as the auditory reaction time is concerned, but for visual reaction time for green & red light of the present study were contradictory to the findings of Noble et al (1964) who found that older women had shorter reaction time as compared to males of the same age group. This was explained by them on the basis of the fact that women tend to live longer than males and hence constitutionally they are more fit especially towards the end their lives. Miller (1966) observed that around 30 years of age, there is an increase in synaptic delay and a 5-10% decrease in the speed of nerve conduction causing nervous reflexes to slow down. The speed of the nerves decline to 92% by age 50, but does not seem to change much after that.

Botwinick & Storandt (1974) and Botwinick & Thompson (1966) hypothesised that this could be due to the effect that older people are less aroused than those who are younger and that older people tend to look more at what they are doing and are more cautious in reacting to stimuli. Females are more inclined

towards perfection and tend to sacrifice speed for accuracy.

Bibliography:

1. Bellis CJ: Reaction time & chronological age. Experimental Biology & Medicine, 1933; 30(6):801-803.
2. Botwinick J, Storandt M: Cardiovascular status, depressive effect, & other factors in reaction time. The Journal of Gerontology, 1974; 29:543-548.
3. Botwinick J, Thompson LW: Components of reaction time in relation to age & sex. Journal of Genetic Psychology, 1966; 108(2):175-183.
4. Crossman ER, Szafran J: Changes with age in speed of information intake & discrimination. Experimentia, 1956; (Suppl.4):128-134.
5. Griew S: Complexity of response & time of initiating responses in relation to age. American Jr. Of psychology. 1959; 72(1):83-88.
6. Ganong WF: Functions of the nervous system-reflexes. In: Review of medical physiology. A Lange Medical book publication,California; 22nd Edn; 2005;pp.131.
7. Hicks L H, Barren J E: Aging, brain damage & psychomotor slowing. Psychological bulletin, 1970;74(6):377-396.
8. King H E: Psychomotor indications of behaviour disorder arising from neurologic trauma & disease. Psychiatric Communications, 1962; 5:31-35.
10. Miles WR: Correlation of reaction time and coordination of speed with age in adults. American Journal Psychology, 1931; 43(3): 377-391.
11. Miller RG: The Effects of Aging Upon Nerve and Muscle Function and their Importance for Neurorehabilitation. *Neurorehabilitation and Neural Repair*, 1966; 9(3):175-181.
11. Noble CE, Baker BL, Jones TA: Age & sex parameters in psychomotor learning. Perceptual & Motor skills, 1964; 19:935-945.
12. Norris AH, Shock NW, Wagman IH: Age changes in maximum conduction velocity of motor fibers of human ulnar nerves. Journal of Applied Physiology, 1952; 5(10):589-593.
13. Obrist WD: Simple auditory reaction time in aged adults. Journal of Psychology, 1953; 35(2): 429-432.
14. Prinzel LJ III, Freeman F G: Sex differences in visuo-spatial ability: task difficulty, speed accuracy trade-off, & other performance factors. Canadian Journal of Experimental Psychology, 1995; 49(4):530-539.
15. Suci G A, Davidoff MD, Surwillo WW: Reaction time as a function of stimulus information & age. Journal of Experimental Psychology, 1960; 60(4):242-244.
16. Shenvi D, Balasubramanian P: Comparative study of visual & auditory reaction times in males & females. Indian Journal of Physiology & Pharmacology, 1994; 38(3):229-231.
17. Stephen Hawking: A big bang to black hole In: A brief history of time. Oxford University Publication, United Kingdom;1988 pp. 173.
18. Sternberg S: High speed scanning in human memory. *Science*, 1966; 153:652-654.
19. Welford A T: Some possible reasons for slowing with age. In: A Historical Background Sketch in Reaction Time. Academic Press, New York; 1980; pp.1-17.
20. Welford A T: Reaction time & choice. In: International encyclopedia of psychiatry, psychology, psychoanalysis & neurology. Benjamin Wolman(Eds); Van Nostrand Reinhold Co.; New York; 1977; pp. 376-380.

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