Original Research Article **Anatomy**

International Journal of Pharma and Bio Sciences

ISSN 0975-6299

INTERRELATION OF FUNCTIONAL PREFERENCES OF LATERALITY IN A SELECTED INDIAN POPULATION

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ABSTRACT

Handedness is the most obvious type of cognitive and behavioural asymmetry reported in human beings. It refers to the preference to perform several tasks with one hand rather than the other. Handedness is a manifestation of the extent of anatomical-functional asymmetry in human brain organization. Also, the brain mechanism underlying handedness is such that handedness is contra laterally related to the two hemispheres, left hand to the right hemisphere and right hand to the left hemisphere. There is evidence that left and right handers differ when compared on a variety of behavioural measures. The present study examined the correlation between hand, foot, eye and ear performances in left and right-handers, which showed high significance as these correlations are indicative of the effects of cerebral dominance.

KEYWORDS: Handedness, Footedness, Earedness, Eyedness, Cerebral dominance.

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Received on : 30-09-2016
Revised and Accepted on : 03-11-2016
DOI: http://dx.doi.org/10.22376/ijpbs.2017.8.1.b49-52

INTRODUCTION

Nowadays among school children, there is a great increase of the occurrence of left-handedness and sinistrality. They clearly show a large number of left-sided sensory and motor precedence which are considered as external hallmark of functional hemispheric asymmetry of the brain. Actually, laterality refers that the two hemispheres of brain are roughly symmetrical in appearance, though not in structure and functions. It implicit that certain functions are differentially entitled in the two sides of the brain . The structure and function of paired organs or of two similarly organized areas of non-paired organs, dispersed on the left and right sides can be referred as Laterality[1]. Laterality is structural as well as functional. Structurally, the cortex is divided anatomically into two hemispheres, the right and the left. The two cerebral hemispheres are roughly symmetrical in appearance, but not in structure and functions[2]. In a main part of the human population, observational proof suggests that, for language functions the left hemisphere is superior to the right hemisphere, whereas for visuo-spatial functions the right hemisphere is superior to the left hemisphere[3]. Information processing that is predominantly analytical, serial, linear and temporal is distinct in left hemisphere, the information processing that is synthetic, configurational, simultaneous, and holistic in nature is distinct in right hemisphere[4]. The peripheral measure of hemispheric asymmetry, which is hand preference has been found to be a powerful phenomenon. Former research has shown that cerebral asymmetries act in unlike manner for left- and right-handers[5]. In normal left and right handed persons, the constitution of language centres is often somewhat different. In right handers speech centre is located in the left hemisphere in 95% of cases and in the right hemisphere for remaining 5%, and in left-handers speech centre is located in the left hemisphere for 60% of cases, and right hemisphere for 20%, and remaining 20% in both hemispheres[6]. Individual variation in hemispheric asymmetry is due to the configurational difference of speech centre[7]. In right handers, the hand used to write is contralateral to the hemisphere effectuating language functions and the neural systems that accord to these behaviours in right-handers are lateralized primarily to the left hemisphere. In contrast, in majority of left handers language is ipsilateral to the preferred hand. In addition, left handers are more probably to be segregated on measures of hand preference, strength and skill than right-handers[8]. In many society inclusive of Indian culture, they do prefer right hand and the avoid left hand and strict hygiene about its use are witnessed. Past research has mentioned that the prevalence of right handedness is higher in many non-western cultures than in the Western cultures[9]. Foot tapping was included for consideration because feet-related activities are less complex and less vulnerable to environmental factors. Therefore, footedness is anticipated to be less subject to social pressures than handedness and therefore it may render intuition into the nature of hemisphericspecialization[10]. Ocular dominance, sometimes called eyedness or eye preference, is the inclination to prefer visual input from one eye to the other. It is somewhat comparable to the laterality of right or left handedness. However, the side of the dominant hand and the dominant eye do not match always. For verbal stimuli studies show a right visual field advantage and for non-verbal stimuli a left visual field advantage[11]. In healthy individuals functional asymmetries are often concluded from the performance asymmetries on central or direct and peripheral or indirect measures. Further, at motor and perceptual levels these measures differ in the degree of participation of responses. The peripheral measures of asymmetry involve the preference and performance measures of handedness and footedness in the motor domain and preference measures of eyedness and earedness in the perceptual domain. Hand preference has been very discernible out of all the measures of hemispheric asymmetry and has received a abundant awareness by researchers as well as common people. The present study also examined the correlation between hand, foot, eye and ear performances in left and right handers, as these correlations are indicative of the effects of cerebral dominance. There have been studies using one or more measures but in research literature using a wide range of the measures is sparse. This study examined how the different measures of functional laterality are associated to each other.

MATERIALS AND METHODS

A sample of 210 student volunteers were selected from various schools in Kanyakumari District for the study. They were selected in such a way that the sample for our study consisted of equal number of right handed and left handed volunteers. Systematic random sampling method was adopted to select the sample.

Inclusion criteria

1. Consenting individuals both male and female between 11- 17 years.
2. Individuals resident of Kanyakumari District, Tamilnadu.
3. Consenting right handers matching to left handers were rolled in.

Exclusion criteria

1. Individuals having any gross deformity were excluded
2. Individuals who cannot give consent to participate in the study.

The parents of these volunteers were informed about the intended study, its procedures and consent was also obtained from the parents of each volunteer before inclusion in this protocol, which received the approval of the Institutional Human Ethics Committee. The lateral Preference Inventory (LPI) by Porac & Coren, 1981[12] for measurement of handedness, footedness, eyedness and earedness was used as the tool. This inventory involved only 16 items i.e. 4 items per subscale and took only 2 to 3 minutes to complete. The 16 items that made LPI were sufficiently brief and self-explanatory which allowed a quick assessment of all four dimensions of laterality.

Statistical analysis

The confirmation and contributions of associations were confirmed Binary logistic regression. The above statistical analysis and interpretations were performed

by the statistical package namely IBM statistics-20. The P-Values less than or equal to 0.05 (P≤0.05) were considered as statistically significant.

RESULTS AND DISCUSSION

Table 1
Comparison of handedness between the left and right handers

Handedness	n	Mean	SD	Difference	t	df	Significance
Left	105	93.1	16.1	5.1	2.424	208	P=0.016
Right	105	88.0	14.6				

The handedness of left and right handers was compared in the table-1. The mean handedness of left handers was 93.1±16.1 and the right handers were 88.0±14.6. The difference of handedness between them was statistically significant (P<0.05).

Table 2
Handedness and footedness relationship between the left and right handers

Footedness	Handedness						Results	Odds ratio (OR)
	Left	%	Right	%	Total	%		
Left	76	72.4	7	6.7	83	39.5	χ^2=94.850	
Right	29	27.6	98	93.3	127	60.5	df=1	36.690
Total	105	100.0	105	100.0	210	100.0	P<0.001	

Table 3
Handedness and Eye preference relationship between the left and right handers

Eye preference	Handedness						Results	Odds ratio
	Left	%	Right	%	Total	%		
Left	68	64.8	40	38.1	108	51.4	χ^2= 14.946	
Right	37	35.2	65	61.9	102	48.6	df=1	2.986
Total	105	100.0	105	100.0	210	100.0	P<0.001	

The eye preferences between the left and right handers were showed in the above table -3. The same side eye preferences were 64.8% and 61.9%. The opposite side eye preferences were 35.2% and 38.1%. The preferences were statistically very highly significant (P<0.001). The same side preference was 2.986 (OR) times more than that of opposite side preferences.

Table 4
Handedness and Ear preference relationship between the left and right handers

Ear preference	Handedness						Results	Odds ratio
	Left	%	Right	%	Total	%		
Left	96	91.4	25	23.8	121	57.6	χ^2 = 98.302	
Right	9	8.6	80	76.2	89	42.4	df=1	34.133
Total	105	100.0	105	100.0	210	100.0	P<0.001	

The ear preferences between the left and right handers were showed in the above table -4. The same side ear preferences were 91.4% and 76.2%. The opposite side ear preferences were 8.6% and 23.8%. The preferences were statistically very highly significant (P<0.001). The same side preference was 34.133 (OR) times more than that of opposite side preferences. There is a strong relationship between which side of the brain is dominant and which ear is used to listen. Few tudies have revealed that consistent hand preference is related with efficient motor performance[13]. Researchers suggest that more lateralized people would display more pronounced functional asymmetries because hemispheric specialization is less variable than the inconsistent persons. Coordinated movement patterns indicating fine motor control is due to consistent lateral preference. In this issue the evidence based on observation is more. Remarkable right and left hand difference has been described on tasks like tapping [14]and pegboard [15]. Few researchers have found using monozygotic twins, that right handers are more dynamically lateralized than their left-hander sisters[16]. Also, the preference-performance score associations are appreciably positive. Hand preference is appreciably related to performance in young adults[17].It has been noticed that with their right hand and their right foot right-handers perform better. Left handers normally present well with their left hand but for their left foot the pattern is mixed[18]. In right-handers few researchers have noted a right foot performance advantage, and little but remarkable right-foot advantage for left handers also[19]. No left foot preference with an unsteady right foot preference is found in the left-handers. On performance measures another research has shown high associations between hands and between feet. For recognizing verbal material a right ear advantage is found and for non-verbal material a left ear advantage is found. Subject is offered with two different stimuli at the same time, one arriving at each ear in dichotic listening task. Through contralateral connections the stimulus coming to the right ear reaches the left hemisphere and the stimulus to the left ear reaches the right hemisphere[20].It has been described that between visual and auditory language processing asymmetries the left handers unveil notably intense association than the right handers[21]. The disorder also may cause sensitivity to the

senses of sight, hearing, touch, smell, and taste. Occupational therapy can provide intervention that helps children to develop appropriate social, play, and learning skills[22]. Even though left and right handers differ on performance measures, few studies have announced that the dissimilarity be likely to be slight in left than in right handers[23].

CONCLUSION

In humans, there are four paramount of lateral preferences, among which handedness and footedness are concerned with motor functions of limbs and earedness and eyedness with sensory functions. To execute major part of our interactions with the physical environment, we depend upon the limbs the prime effector organs. On the other hand, comparative to the external conditions, the sense organs perform an input function by collecting information from the environment and harmonizing the movements of the limbs. Efforts have been made to reveal the peripheral preference measures including endorsement of the use of long limbs like hand and foot, and sensory receptors like eye and ear. Casing sensory and motor domains on the same group of subjects through a multiplicity of cognitive and behavioural tasks, the actual tenability of several probable criterion of association among laterality measures may be analysed.

CONFLICT OF INTEREST

Conflict of interest declared none.

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