ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Interrelation between handedness and postural lateral preferences in a selected Indian population.

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ABSTRACT

Handedness is one of the example of many forms of behavioural lateralization seen in humans. Left handedness has existed in a small subset of the human population, approximately 8%, since the origin of man. The prevalence of left handedness is usually reported to be consistent among human populations. Sinistrality is more common in males than in females. Hand clasping , arm folding and foot overlapping are bilateral limb postures which are subject to lateral preferences. Arm folding refers to the preferential tendency for individuals to fold one forearm over the other, whereas hand clasping refers to the preferential tendency for individuals to clasp the hands together and foot overlapping refers to the preferential tendency for individuals to fold one leg over the other. Applying chi-square test we analyzed the relationship between handedness the marker of laterality with hand clasping, arm folding and foot overlapping in left and right handers.

Keywords: Handedness, hand clasping, arm folding, foot overlapping.

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ISSN: 0975-8585

INTRODUCTION

Among the many authentic and innovative considerations of the famous Russian neuropsychologist Alexander Romanowitch Luria, one from patients with aphasia still awaits replication1. He was thrashed by the strong side precedence with which we fold arms (arm folding, AF) and clasp fingers (hand clasping, HC) providing another index of lateral preference. Analysing the favoured posture in AF and HC in 55 right handed patients with aphasia due to left hemispheric lesions, Luria identified that patients with familial left handedness, a left top position in AF, or a left top position in HC had a similarly good prognostication to recuperate from aphasia as that of left handed and ambidextrous patients [1,2]. Side priority for AF and HC is exceptionally substantial, as there appears to be small environmental prejudice to effect which arm or thumb is spontaneously placed on top of its corresponding counterpart [3]. Whether these lateral preferences are innate or learned is still untold, but individuals inclination in AF and HC appear as stable as hand preference for motor actions [4]. Some laterality studies, not only in Luria's period but still today, have determined handedness by self-report , or the writing hand, or do not even describe how handedness was assessed, methodology that are known to be unseemly [5]. Laterality studies testing adult populations rather use standardised handedness questionnaires, which have in common that the preferred hand is assessed for several hand actions of day to day life such as goal directed movements and tool use [6]. These current studies still relate handedness with cerebral dominance for language processing [7]. Right handedness, for example, is often related with more steady left hemisphere language dominance than is either left-handedness or ambidexterity [8]. Some studies have also correlated attenuated right handedness to better recuperation from aphasia [1, 9] .Earlier studies instantly testing the association between AF, HC, and handedness are debatable. Some research described no specific relationship between handedness and AF or HC respectively [10], while some others reported a positive relationship between right handedness and right thumb top preferences [4, 11, 12] but no such relationship for AF [4, 12] We therefore tested the association between handedness and postural preferences in Arm Folding, Hand Clasping and Foot overlapping in a healthy adolescent population.

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. 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.

Handedness was assessed by Edinburgh Handedness Inventory [6] .The subjects were demonstrated about the exercises i.e. arm folding, hand clasping and foot overlapping and they were asked to mimic the exercise. The arm, digit or foot which was on top, was considered as the dominant one.

STATISTICAL ANALYSIS

The statistical analysis and interpretations were performed by the statistical package namely IBM statistics-20. The P-Values less than or equal to 0.05 ($P \leq 0.05$) were considered as statistically significant.

ISSN: 0975-8585

RESULTS AND DISCUSSION

In 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 between them was statistically significant (P<0.05). Table -2, shows the association between handedness and arm folding which is statistically significant (P<0.01). Table-3 shows the interrelation between handedness and hand clasping with a statistically significant difference (P<0.001). Table-4 shows the association between handedness and foot overlapping which was also statistically significant (P<0.001).

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: Association between Handedness and Arm folding in Left and Right handers with Gender

Handedness	Gender	Arm folding			χ^2	df	Sig
		L	R	Total			
Left	Male	42	24	66	0.226	1	P>0.05
	Female	23	16	39			
	Total	65	40	105			
Right	Male	23	43	66	1.316	1	P>0.05
	Female	18	21	39			
	Total	41	64	105			
Merged	Left	65	40	105	10.972	1	P<0.01
	Right	41	64	105			
	Total	106	104	210			

Table-3: Association between Handedness and Digital inter locking in Left and Right handers with Gender

Handedness	Gender	Digital inter locking			χ^2	df	Sig
		L	R	Total			
Left	Male	50	16	66	0.193	1	P>0.05
	Female	31	8	39			
	Total	81	24	105			
Right	Male	18	48	66	1.226	1	P>0.05
	Female	9	30	39			
	Total	27	78	105			
Merged	Left	81	24	105	55.588	1	P<0.001
	Right	27	78	105			
	Total	108	102	210			

Table-4: Association between Handedness and Foot overlapping in Left and Right handers with Gender

Handedness	Gender	Footed Overlapping			χ^2	df	Sig
		L	R	Total			
Left	Male	50	16	66	0.026	1	P>0.05

	Female	29	10	39			
	Total	79	26	105			
Right	Male	22	44	66	0.074	1	P>0.05
	Female	12	27	39			
	Total	34	71	105			
Merged	Left	79	26	105	94.850	1	P<0.001
	Right	34	71	105			
	Total	113	97	210			

When current considerations in European populations are considered, both for arm positioning and thumb positioning it reveals that left top positions are the established position for right-handers [13, 14] This left top preference in right handers would suggest an opposite relationship to that proposed by Luria, i.e., that right top positions in European populations are related with attenuated right handedness, and by conclusion diminished hemispheric asymmetry [1]. Depending on an intact trunk of the corpus callosum ,AF and HC are bilateral limb postures necessitating bimanual coordination, [15]. Since distal (HC) and proximal (AF) limb movements might be innervated and controlled differently, the role of the corpus callosum may differ between AF and HC, [16, 17]. Proximal movements of the arms are controlled with more bilateral involvement whereas distal movements (forearm, wrist, and hand) are primarily controlled contralaterally. In other words, distal movements are mainly under contralateral control whereas proximal movements are under an additional ipsilateral control. Associations between psychopathology and non-congruent or ambiguous laterality patterns have been described for neurological [18] , intellectual [19] and psychiatric abnormalities with specific pertinence to handedness [20]: Callosal morphology is an anatomical correlate for generally diminished functional hemispheric asymmetries [21] with a larger corpus callosum, in particular of the anterior half, found in left handers than right handers [22], and in patients with schizophrenia [23]. The latter observation appears particular to male patients [23]. In this context it is noteworthy that congruent (AF and HC same side) and non-congruent (AF and HC different sides) bilateral postures might be a sensitive behavioural marker of interhemispheric transfer. This proposal is reinforced by current studies showing an uplifted occurrence of non-congruent combinations of AF and HC in patients with schizophrenia and healthy individuals with a thinking style suggestive of that known from schizophrenia [13]. Given the adequate experimental and clinical evidence that in right handers the left hemisphere is more important in controlling motor functions than the right hemisphere the higher prevalence of left-top postural preferences appears to be a culmination of this regular motor predominance of the left hemisphere [24] AF and HC are bilateral limb postures, which require bimanual coordination and thus the involvement of the corpus callosum [15] Weakened functional hemispheric asymmetries have been associated to callosal morphology [21] Interhemispheric cross talk differs for distal and proximal limb postures with distal movements (forearm, wrist, and hand), more pertinent to HC, being primarily controlled by the contralateral hemisphere, and proximal movements of the arms, more pertinent to AF, being under more bi-hemispheric control. Therefore, in the case of an absence of a clear right hand preference for common hand actions, the more contralaterally innervated distal limb posture (HC) deviated from the common left-top position [16, 17]. Interestingly, commissural fibres are practically absent connecting homotopic motor areas for hands [25]. It is also these unilateral versus bilateral innervations of distal and proximal muscles, respectively, that appears to account for a stronger risk of distal muscles to cortical lesions than proximal ones [26]. In fact, some few studies would suggest that postural preferences seem more firm for HC as compared to AF [27]; This distinctive range of bilateral control over HC and AF, respectively, might also describe why positive schizotypal features were found to be related to the non-congruent postural combination RL, in which the AF position deviated from the common left-top position [28] .

CONCLUSION

An understanding of handedness may provide valuables clues as to how the brain becomes organized the way it is. These presumptions require future studies to assess the stability of postural combinations, as well as their association to hemispheric specialisation as judged from the stability of hand preferences across different items and from an individual's expression of behavioural markers. The present study examined the correlation between handedness, arm folding, hand clasping and foot overlapping

in left and right-handers, which showed high significance as these correlations are indicative of the effects of cerebral dominance.

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