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Comparison of Handedness Questionairre with Brain Hemisity Questionairre for Determining Brain Dominance in Young Adults

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Brain dominance and handedness have been of great interest to physicians and neurologists from time immemorial. While handedness deals with motor dominance and cerebral hemisphere producing language , brain hemisity deals with learning characteristics and behavioural styles. A Edinburgh handedness inventory (EHI) published in 1971 [(1)] measures hand dominance in daily activities.

After nearly 35 years of use of EHI a revision [(2)] was made in EHI by discarding activities like opening box, broom and drawing and incorporating a new one , that is use of a computer mouse. Likert scale format was added.

While this satisfied neurologists, evidence has accumulated that individuals with right and left brain behavioural orientations do exist .Of late the term hemisity has been used for this, hemisity characters are rarely used in medical practice but extensively used in higher education and career choice. [(3)] Hemisity has been assessed and confirmed by biophysical methods , questionnaires and MRI studies.[(4)]

Morton (2012) adopted 30 validated questions using MRI findings and developed a new hemisity questionnaire which included assessment of logical orientation , type of consciousness , fear level and sensitivity , social professional orientation. [(5)]

Since there is confusion between handedness , brain dominance and brain hemisity , we conducted this study to see the correlation between self reported handedness , Edinburgh handedness Inventory , Revised Edinburgh handedness Inventory and hemisity . The study will also validate Edinburgh handedness questionnaire and hemisity questionnaire in our population.

I. Materials And Methods

Setting: Fr Muller Medical College and St Aloysius College which is an art and science college in the city of Mangalore, South India. The study was approved by Institutional Ethics Committee and appropriate permissions were obtained by the Institution head for the study

Study Duration : 3 months
Study Design : cross sectional survey
Sampling Method : convenient sampling

Inclusion Criteria

1. Healthy volunteers aged 18 – 40 years
2. Minimum education , > 12 years of education
3. Informed consent

Exclusion Criteria

1. Physically or mentally challenged individuals
2. Any systemic illness

Methods: After obtaining informed consent, 50 self reported left handed individuals and 50 right handed individuals were selected for the study. They were asked to answer Edinburgh Handedness Inventory , revised Edinburgh Handedness Inventory and Hemisity questionnaire. Whichever question was not applicable , the subjects were asked to mark not applicable. The subjects were classified as left handed or right handed based on EHI and revised EHI . Subjects were classified as left or right brain dominant based on the hemisity questionnaire.

II. Statistical Analysis

Handedness assessed by EHI and revised EHI were compared with self reported handedness using chi square test. Correlation coefficient was calculated using Phi test, sensitivity and specificity of EHI and revised EHI were calculated. Hemisity dominance was compared with self reported handedness , EHI and revised EHI by chi square test and correlation coefficient was calculated using Phi test.

Validation of EHI and revised EHI was done using sensitivity and specificity test. Hemisity questionnaire was validated by calculating the response rate of each question .any question with > 80 %

response rate was considered as acceptable for Indian setting. Handedness was also compared with opposite brain hemisity by chi square test and Phi test was used to get the correlation coefficient.

III. Results

Table 1 shows demographic data of the subjects selected for the study .Right handed persons were significantly older and more males were included in the group whereas more left handed females were recruited .Table 2 Shows relationship between self reported handedness, EHI, revised EHI and brain hemisity As is seen in the table ,there was 100 % agreement between self reported right handedness and EHI and revised EHI .However Brain hemisity did not have any relationship with handedness .Table 3 shows correlation between self reported handedness and EHI and revised EHI and brain hemisity questionnaire .Both EHI and revised EHI correlated well with self reported handedness but Brain hemisity did not correlate with handedness at all .Table 4 shows that EHI and revised EHI had 100% sensitivity and specificity for self reported right handedness .While revised EHI had high sensitivity(95.17%) and specificity (100%) for self reported left handedness when compared to EHI with 82% sensitivity although 100% specific .Brain hemisity questionnaire had low sensitivity and specificity .Hemisity questionnaire could be answered easily by our study population although questions on spousal relationship and mate (Question 1,2,5) were not answered by unmarried people .Also question No12 on parenting was not answered by unmarried people .The question on self medication with depressant such as alcohol or cannabis or stimulant like cocaine or amphetamine is not relevant to our population.

Table 1 : showing demographic details of the subjects

PARAMETERS	LEFT HANDED (self reported) n = 50	RIGHT HANDED (self reported) n = 50	p value
AGE (mean ± SD)	22.38 ± 3.36	25.46 ± 5.92	0.002
MALE	15 (30%)	29 (58%)	0.005
FEMALE	35 (70%)	21 (42%)	

Table 2 :Self reported handedness , EHI and revised EHI and Brain Hemisity Relationship

HANDEDNESS ASSESSMENT METHOD	HANDEDNESS	LEFT HANDED (self reported) n = 50	RIGHT HANDED (self reported) n = 50
EDINBURGH	LEFT	39	0
	RIGHT	9	50
	NEUTRAL	2	0
REVISED EDINBURGH	LEFT	41	0
	RIGHT	9	50
HEMISITY	LEFT BRAIN	30 (60%)	22 (44%)
	RIGHT BRAIN	20 (40%)	28 (56%)

Table 3 Showing Correlation between Self reported handedness, EHI ,Revised EHI and Brain Hemisity

COMPARING PARAMETERS	Phi value	p value
1. SELF REPORTED HANDEDNESS vs EHI	0.636	< 0.001
2. SELF REPORTED HANDEDNESS vs REVISED EHI	0.863	0
3. EHI vs HEMISITY	0.206	0.348
4. SELF REPORTED HANDEDNESS vs HEMESITY	0.101	0.477

Table 4 : showing sensitivity and specificity of EHI , revised EHI and hemisity questionnaire in comparison with revised EHI which is the gold standard.

HANDEDNESS ASSESSMENT METHOD	Self reported HANDEDNESS	SENSITIVITY	SPECIFICITY
EHI	LEFT	82	100
	RIGHT	100	100
Revised EHI	LEFT	95.17	100
	RIGHT	100	100
HEMISITY	LEFT BRAIN	69.40%	46.11%
	RIGHT BRAIN	73.90%	51.12%

IV. Discussion;

The results of our study show that Self reported handedness has a very high sensitivity and specificity for right handedness and hence if any person reports as right handed there is no need to administer handedness questionnaire to confirm However for left handedness although it is 100 % specific , its sensitivity is slightly less and hence self reported left handers need confirmation by preferably revised EHI which is more sensitive than EHI .Since revised EHI is more sensitive retaining 100 % specificity for handedness ,this is the Inventory of choice.

However hemisity questionnaire is not a sensitive or specific questionnaire for detection of handedness . It may be good for detection of brain dominance. Since it is known that even in left handed individuals 95 % of them can still have left brain dominance , hemisity questionnaire needs to be used for determining brain dominance. This study shows that motor brain dominance may not have any connection with hemisity characters. Hence handedness cannot determine ones learning , type of consciousness , behaviour , orientation and spousal relationship. which are detected by hemisity questionnaire .The study also shows that Morton`s questionnaire can easily administered to our youth although questions on spousal relationship and relationship with mate need to be replaced by relationship with the best friend for unmarried people .The question on preference for self medication , stimulants such as cocaine or amphetamine can be replaced with coffee , tea or coke and preference for depressants such as alcohol or cannabis can be replaced with non stimulant drinks such as milk or fruit juices.

This is the first ever study comparing handedness and hemisity and the study clearly shows that handedness shows motor dominance while hemisity characters are non motor . However our study is limited by small sample size and unequal gender distribution .and not being able to use 5 out of 21 questions of Hemisity questionnaire Future studies must include larger sample size with equal number of males and females with right handedness and left handedness and use modified Hemisity questionnaire based on this study

Hemisity questionnaire was validated through this study although questions on spousal relationship for unmarried group can be changed to relationship with the best friend and self medication preference with stimulants or depressants also need to be changed.

V. Conclusion

Self reported handedness correlates well with EHI and revised EHI, However Handedness and Hemisity questionnaire do not correlate well .Handedness determines motor dominance while hemisity determines ones behaviour and learning style .There is need to modify Hemisity questionnaire to suit Indian culture to know its value in determining brain dominance

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