

Prevalence of the Three Categories of Handedness Among Malawian School Children

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ABSTRACT

A cross sectional study of prevalence of left, right and mixed handedness was made on 512 Malawian school children (240 boys and 272 girls) aged 6–17 years. Handedness was assessed using questionnaire incorporating questions on hand preferred for eight unimanual activities. Interviews with guardians, pupils and teachers were conducted to assess the pressure experienced by children to use right hand for unimanual activities. The overall prevalence of left-, right- and mixed-handers was 3.9%, 90.4% and 5.7%, respectively. Association between handedness and age or gender of children was nonsignificant. 96.2% of guardians and 92.7% of teachers were insistent upon use of right hand for unimanual tasks. Most of non-right handed children indicated that they had experienced pressure to use right hand for unimanual activities but they were still using left hand for one or more manual tasks. 28 pupils indicated that they stopped using left hand under the pressure from guardians and teachers.

Key words: handedness, children, Africa

Introduction

Handedness refers to the preference for using right or left hand for various unimanual activities. It can be assessed on the basis of personal impression, questionnaires, or manual dexterity motor tasks^{1,2}. The proportion of left-, mixed- and right-handers varies significantly from study to study and this might be attributed to different incidence of the

three categories of handedness, cultural differences in acceptance of left hand preference in different populations, heterogeneity of handedness phenomena as well as by discrepancy of methods used for assessment of handedness^{3–7}. As far as we know, only a few studies of handedness have been conducted in Africa^{4,8}.

Various questionnaires have been developed for assessment of hand preference in children. It has been demonstrated^{4,5,9} that questions on hand preference for writing, drawing, eating and games adequately assess handedness in children. For adults additional items on hand preferred for various professional activities usually are included.

Study of hand prevalence has both theoretical and practical importance. Handedness is considered⁶ an indirect indicator of cerebral lateralization of functions, particularly those related to language capacities. To some extent it affects development of cognitive functions in children¹⁰. Some intrauterine and neonatal factors such as hypoxia, extreme prematurity, low birth weights were found to be associated with increased prevalence of left handedness¹¹. At the same time these factors themselves cause other disorders and diseases to manifest in lefthanders. It has been demonstrated^{12–20} that non-right handed children have increased risk of upper limb injuries, sportrelated injuries, thoracic hyperkyphosis, migraine, depression, schizophrenia, immune disorders, bronchial asthma and common cold. Therefore non-right handed children should be identified and receive additional attention in order to minimize risk of development of these disorders. The aim of the present study was to assess hand preference in children in urban Malawi, as these data are not available in the literature.

Methods

The study has been conducted at Mbayani primary school randomly selected from the list of primary schools in urban Blantyre, the biggest city in Malawi. The school is located in densely populated part of the city and enrolls pupils from low-income families with causal business being the main source of income in over half of the households. To some extent it is typical for urban and semi-urban areas in the country. The total enrolment in the school was above 5,000 children at the time of the study. Approximately 53% of pupils were girls. Each tenth child was selected from the list of pupils in each standard (of eight standards). In total, 512 children aged between 6 and 17 years were recruited. None of the volunteers exhibited obvious physical deformities of the arms that could affect hand preference. Children and guardians were informed about the project and told that responses would be kept confidential. All pupils and their parents gave informed consent to participate in the survey. Ages of children were obtained from the school registers and reported to the nearest whole year. Children were grouped according to gender and age (Table 1).

Handedness was assessed using questionnaire containing eight questions on hand preference for writing, drawing, cutting with scissors, threading a needle (for girls) or hammering (for boys), striking a match, brushing teeth, eating and playing games with a ball, bat or racket.

TABLE 1
DISTRIBUTION OF SAMPLE OF MALAWIAN CHILDREN BY AGE AND SEX

Gender	Age (N)												Total
	6	7	8	9	10	11	12	13	14	15	16	17	
Boys	12	21	19	17	18	13	22	34	27	22	21	14	240
Girls	19	27	15	22	18	29	27	22	22	32	25	14	272

It was clarified for the volunteers that they should indicate current hand preference. Subjects were classified as left- or right-handers if they preferred left or right hand respectively for all activities and as mixed-handers if hand preference was inconsistent. Interviews were conducted with 302 guardians and 28 school teachers on whether they discourage children from using left hand for habitual activities listed in the questionnaire for assessment of handedness. All children were also interviewed on use of left hand for unimanual activities in the past and asked to indicate any pressure from guardians and teachers to stop using left hand.

Statistical analysis was performed using Epi Info 2000 and Excel software. The Chi squared test was used to compare

proportions. The level of statistical significance was fixed at $p < 0.05$.

Results

The hand preference in the sample of Malawian school children according to gender is shown in Table 2. In total, 89.5% of boys and 91.2% of girls preferred right hand for all activities listed in the questionnaire. 3.8% of boys and 4.0% of girls were not using right hand for all habitual activities and were classified as left-handers. 6.7% of boys and 4.8% of girls reported that they were using right hand for 1 or more manual tasks. They were classified as mixed-handers. Table 3 shows hand preference in different age group of children. Association between

TABLE 2
NUMBER OF CHILDREN ACCORDING TO THE NUMBER OF TASKS PERFORMED BY THE RIGHT HAND (8 IS THE TOTAL NUMBER OF TASKS LISTED IN THE QUESTIONNAIRE) AND GENDER

	Number of tasks N (%)								
	8	7	6	5	4	3	2	1	0
Boys	215 (89.5)	1 (0.4)	3 (1.3)	4 (1.7)	3 (1.3)	1 (0.4)	2 (0.8)	2 (0.8)	9 (3.8)
Girls	248 (91.2)	2 (0.7)	3 (1.1)	1 (0.4)	2 (0.7)	1 (0.4)	3 (1.1)	1 (0.4)	11 (4.0)
Total	463 (90.3)	3 (0.6)	6 (1.2)	5 (1.0)	5 (1.0)	2 (0.4)	5 (1.0)	3 (0.6)	20 (3.9)

TABLE 3
NUMBER OF CHILDREN ACCORDING TO THE NUMBER OF TASKS PERFORMED BY THE RIGHT HAND (8 IS THE TOTAL NUMBER OF TASKS LISTED IN THE QUESTIONNAIRE) AND AGE GROUP

Number of tasks	Age groups N (%)					
	6–7	8–9	10–11	12–13	14–15	16–17
8	70 (88.5)	66 (90.4)	73 (93.5)	94 (89.4)	93 (90.1)	67 (90.3)
7	1 (1.3)	0 (0.0)	0 (0.0)	1 (1.0)	1 (1.0)	0 (0.0)
6	1 (1.3)	2 (2.7)	1 (1.3)	0 (0.0)	1 (1.0)	1 (1.4)
5	1 (1.3)	1 (1.4)	0 (0.0)	1 (1.0)	1 (1.0)	1 (1.4)
4	2 (2.5)	0 (0.0)	0 (0.0)	2 (1.9)	0 (0.0)	1 (1.4)
3	0 (0.0)	0 (0.0)	1 (1.3)	0 (0.0)	1 (1.0)	0 (0.0)
2	1 (1.3)	1 (1.4)	0 (0.0)	2 (1.9)	1 (1.0)	0 (0.0)
1	0 (0.0)	0 (0.0)	1 (1.3)	1 (1.0)	0 (0.0)	1 (1.4)
0	3 (3.8)	3 (4.1)	2 (2.6)	4 (3.8)	5 (4.9)	3 (4.1)
Total	79 (100)	73 (100)	78 (100)	105 (100)	103 (100)	74 (100)

handedness and gender or age of children was not statistically significant ($df = 7$, $\chi^2 = 3.55$, $p > 0.9$ and $df = 40$, $\chi^2 = 22.01$, $p > 0.9$, respectively).

96.2% of guardians and 92.7% of teachers were insistent upon use of right hand for majority of unimanual tasks listed in our questionnaire. All mixed-handed children and 90% of left-handers indicated that they had experienced pressure to use right hand for unimanual activities but they were still using left hand for one or more manual tasks. 6% of right-handers (28 pupils) indicated that they were using left hand in the past for one or more unimanual activities but they were forced to change the hand by guardians and/or teaches. At the time of survey these pupils were using right hand for all activities listed in the questionnaire. Therefore they were classified as right-handers.

Discussion

The assessment of hand preference by questionnaire and the length of questionnaire itself are open to criticism but more adequate methods have yet to be developed. Our questionnaire included questions on the limited number of the main habitual activities of the children in Malawi. This was due to restriction of time in this survey. Previous studies^{3,5} have indicated that similar instrument adequately assesses hand preference in children. Therefore it is reasonable to suggest that incorporation of additional questions should not affect our data significantly. Measurement of hand preference using manual motor tasks is unlikely to produce more correct results as performance of motor tasks depends on manual skills, cognitive abilities and emotional lability of subjects^{2,5}. These factors can affect measurements particularly when different age groups are involved in the study.

It is generally accepted^{1–3,21} that 8–10% of the population in western countries is

left-handed. However reported figures vary widely due to differences in handedness classification criteria and subject characteristics. Data for African populations are very limited. Agostini et al. have found the prevalence of left-handedness of 15% among 12–15 age group of school children in Abidjan, Ivory Cost⁴. In 18–22 age group the prevalence was 1%. In Khartum, Sudan, the prevalence of left-handedness among undergraduate students was 5%⁴. The prevalence of inconsistent hand use (mixed handedness) was not reported. The overall prevalence of left-handedness in our survey was 3.9%, which was much lower than in Western countries^{1,5} or in Ivory Cost⁴ but it was similar to the prevalence of left-handedness among Indian school children (4.2%)⁷. Proportion of mixed-handers in this study was 5.7%, which was similar to the survey conducted by Calnan and Richardson⁵ but lower than in other studies conducted in Western countries^{1,3}. The overall proportion of both consistent and inconsistent left hand users in the present study was 9.6%, which is still lower than the proportion of left-handers among school children in Ivory Cost⁴.

Several theories attempted to explain the origin and underlying mechanisms of hand preference. According to Annett^{1,7} dextrality depends on a single gene, which facilitates left hemisphere specialization for speech. Witelson and Nowakowski²² have proposed that naturally occurring loss of axons of the corpus callosum might be responsible for embryological development of hand preference. They suggested that loss of callosal axons might have a genetic component. Some researches have offered an environmental mechanism responsible for »pathological left handedness« in children who have been genetically predisposed to be right-handed but switch to the left hand²³. Damage of the left hemisphere due to birth complications and birth stress can result in right

hemisphere control for manual dexterity and left-handedness. Our survey was focused on the current hand preference of children. Therefore it was difficult to assess the prevalence of »pathological left handedness« in our study group but we do believe that the screening picked up such children. Our study group participated in a larger survey aimed to assess growth of children. All pupils were examined by a medical practitioner and none of them had obvious signs of perinatal trauma. However we cannot exclude the minor brain damage due to birth difficulties.

Several studies^{4,8,24,25} have demonstrated that handedness development and expression have strong environmental and cultural components. For example, it has been reported that monozygotic twins may have different hand preference²¹. Study in Ivory Coast⁴ has showed that cultural and environmental factors are able to change hand preference for one activity or overall preferred hand or reduce degree of hand preference. Studies conducted in India and Korea^{7,24}, where left hand use in public is severely restricted, also indicated low prevalence of left-handedness, similar to our data. The present study showed strong cultural pressure against left-handedness in urban Malawi as most of interviewed adults discouraged children from using the left hand for unimanual activities. This concurred with reports from left- and mixed-handed children who indicated that guardians and teachers were pressing them to chan-

ge the hand but they were still using left hand for unilateral tasks as they found it more convenient. The most interesting finding in the present study is that 28 right-handed pupils reported that they had been using left hand in the past for one or more habitual activities but they were forced to use right hand and at the time of survey they were using right hand only and therefore they were classified as righthanders. This decreased the number of non-right-handers by 28 children (5.5% of the study population). Therefore our study indicated that cultural factors affect expression of handedness of children in urban Malawi.

There was no correlation between handedness and gender or age of Malawian children. This is different from reported data⁵, which demonstrated that prevalence of left-handedness is 2 to 3% higher among boys than girls. We suggest that with respect of handedness both boys and girls might conform to the cultural pressure equally. We can only speculate that prevalence of non-right handedness might be higher in pre-school children as they do not experience pressure from school teachers to use right hand for writing and other social activities but this needs further investigation.

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ZASTUPLJENOST TRI KATEGORIJE DOMINANTNE RUKE MEĐU ŠKOLSKOM DJECOM U MALAWIJU

S A Ž E T A K

U radu su prikazani rezultati presječne studije zastupljenosti ljevaka, dešnjaka i ambivalentne školske djece u Malawiju (240 dječaka i 272 djevojčice), starosti od 6–17 godina. Procjena je vršena korištenjem upitnika u kojem su kombinirana pitanja o 8 radnji koje zahtijevaju korištenje jedne ruke. Vršeni su razgovori sa starateljima, učenicima i nastavnicima, za procjenu pritiska koji djeca doživljavaju zbog zahtjeva za obavljanje unimanualnih radnji desnom rukom. Prevalencija ljevaka, dešnjaka i ambivalentnih bila je 3,9%, 90,4% i 5,7%, po redosljedu. Veza između dominantne ruke i dobi ili spola bila je statistički neznačajna. 96,2% staratelja i 92,7% nastavnika su bili uporni u nametanju upotrebe desne ruke u izvođenju unimanualnih zadataka. Većina ne-dešnjaka su bili pod pritiskom za korištenje desne ruke u unimanualnim zadacima, ali su još uvijek koristili lijevu ruku za jedan ili više zadataka. 28 učenika je prestalo koristiti lijevu ruku pod pritiskom staratelja i nastavnika.