ANTHROPOLOGICAL NOTEBOOKS

Vol. 30, Issue 3, pp. 65-89, ISSN 2232-3716.
DOI: https://doi.org/10.5281/zenodo.14563393
Research article

The relationship between handedness, footedness, eyedness and chewing side preference in adults

Katarína Harnádková, Charles University, ORCID 0000-0003-3472-3680

Alexander Morávek, Charles University, ORCID 0000-0003-2252-6719

Lenka Kožejová Jaklová, Charles University, ORCID 0000-0001-5308-4998

Jana Velemínská, Charles University, ORCID 0000-0002-5213-951X

Abstract

Lateralization manifests as a sensory or muscular preference. These preferences are often crucial for (1) handedness calculation (determined by the Edinburgh Handedness Inventory – EHI) and determination of self-reported handedness, (2) description of the relationship between handedness and different side preferences, specifically footedness, eyedness and chewing side preference. Our sample consisted of 133 laterality and EHI questionnaires filled in by healthy adults (self-reported 72 right-handed, 2 ambidextrous and 59 left-handed). Results showed that self-reported and calculated handedness were in a 100 % agreement for right-handers. There was an approximately 80 % agreement for left-handers, as only 8 individuals were classified as ambidextrous, and 2 individuals were classified as right-handers. There was a strong correlation between EHI activities and handedness. Footedness and chewing side preference showed a moderate correlation with handedness. Eyedness showed only a weak correlation. No significant sex differences were found. In conclusion, a significant relationship between self-reported and calculated handedness was found. Accuracy in categorizing handedness was 100 % for right-handers and 80 % for left-handers. Writing and drawing showed the strongest correlation with handedness, while eye preference had the weakest correlation. A crossed laterality was found more in left-handed individuals.

KEYWORDS: handedness, laterality, side preference, human

Introduction

Handedness (hand preference) is a widely studied area in anthropology because of its biological and sociocultural impact on humans throughout their whole lives. Other fields, such as evolutionary biology (McManus, 2022; Ocklenburg & Güntürkün, 2018b), neuroscience (Klöppel, Mangin, Vongerichten, Frackowiak, & Siebner, 2010), psychiatry and psychology (Dane et al., 2009; Ocklenburg & Güntürkün, 2018a; Van der Haegen, Westerhausen, Hugdahl, & Brysbaert, 2013), use the informative value of handedness in the context of their research or clinical practice.

Motor lateralization is the subject of much research and has been studied from many perspectives (Dane et al., 2009; Papadatou-Pastou & Martin, 2017; Potdevin et al., 2023). The preference for one or both hands (ambidexterity) is considered one of the manifestations of brain lateralization (Ocklenburg & Güntürkün, 2018c). The majority of the population prefer to use the right hand for motor tasks and only a small percentage is left-handed. The prevalence of left-handed individuals in the population varies from 9.3 to 18.1 %, with the average percentage of left-handers being 10.4 % (Papadatou-Pastou et al., 2020). In terms of sex differences, left-handed individuals are more likely to be male than female. This trend has been reported in many studies, but the percentage difference between the sexes varies from 2 to 4 % (Oldfield, 1971; Papadatou-Pastou et al., 2020; Porac & Coren, 1981).

Hand preference is controlled by the contralateral hemisphere of the brain. This means that the left hemisphere is used to control the right hand and vice versa (McManus, 2022). However, the final hand preference could be influenced by many factors, including genetics – a polygenic trait, molecular mechanisms (Brandler et al., 2013), epigenetics (Schmitz, Metz, Güntürkün, & Ocklenburg, 2017), external factors such as culture (Faurie et al., 2008; Teng, Lee, Yang, & Chang, 1976; Westmoreland, 2023) and/or a combination of these. There is a degree of genetic contribution to final handedness, with heredity estimated at 24 to 25 % (Medland et al., 2009; Somers et al., 2015). There are 41 loci associated with left-handedness and 7 with ambidexterity. Other associations relate to the central nervous system and cellular pathways involved in the regulation of brain morphology and microtubules (Cuellar-Partida et al., 2020).

Across populations and geographical areas, there are the same evolutionary mechanisms for maintaining a ratio between right-handers and left-handers at 10:1 (Papadatou-Pastou et al., 2020). However, there are still cultural factors that may impact this ratio by lowering the number of left-handed individuals (Fagard & Dahmen, 2004; Papadatou-Pastou et al., 2020). Activities in which individuals were forced to use the right

hand usually included writing (Rubene, Daniela, & Medne, 2019; Vuoksimaa, Koskenvuo, Rose, & Kaprio, 2009) and eating (Fagard & Dahmen, 2004). Consequently, the percentage of left-handers may vary between different regions, and this percentage also differs from the average 10 % of left-handers especially in cultures with a high level of conformity. For example, studies have found that fewer than 6 % of Koreans (Jung & Jung, 2009), 3.98 % of Kharagpur Indians (Suar, Mandal, Misra, & Suman, 2013) and 3.5 % of Chinese children (Teng et al., 1976) are left-handed.

Another activity controlled by one brain hemisphere is the preference for or one lower limb/leg/foot (they represent the term—footedness), which is sometimes regarded as a better predictor of hemispheric dominance than handedness (Elias & Bryden, 1998). This may be due to less cultural pressure than in the case of handedness. A preference for the right leg has been described in 79.9 % of cases (Muraleedharan, Ragavan, & Devi, 2019) or in 90.2 % in another study (Çetkin et al. 2020), but compared to hand preference, there were still fewer left-handed than left-legged individuals.

Several studies have shown that there is a significant correlation between hemispheric laterality and chewing side preference, allowing chewing to be used to determine hemispheric laterality (Khamnei et al., 2019; Serel Arslan, İnal, Demir, Ölmez, & Karaduman, 2017). In 60 to 70 % of the population, the dominant side for chewing matches the dominant side for handedness. The laterality for chewing hard types of food, such as nuts, corresponds strongly with the preference for the side of the dominant hand (Khamnei et al., 2019).

Another type of lateralization is sensory, which is expressed as a preference for using one eye or ear. In humans, most visual information from one eye is processed in the contralateral brain hemisphere (Jensen, Hougaard, Amin, Larsson, & Ashina, 2015; Toosy et al., 2001). Right-eyed individuals show a larger left lateral occipital complex, and left-eyed individuals have a larger right lateral occipital complex (Jensen et al., 2015). In the average population with a right-/left-handed ratio of 10:1, the prevalence of individuals with left eye dominance is 34.44 % for right-handers and 57.17 % for left-handers (Bourassa, 1996).

In the context of biological anthropology, handedness can be associated with brain, skull and facial morphology. However, this association does not depend on a simple relationship between handedness and morphology alone. Other dominances related to the function of the relevant region usually contribute to the final result. This study focuses on the questions of how variables included in the Edinburgh Handedness Inventory (EHI) contribute to the calculated hand preference and what relationship there is between cal-

culated and self-reported handedness. We expected that calculated handedness would be more accurate, but self-reported handedness has the potential to be very reliable. Finally, we aim to describe the prevalence and relationships of the other dominances (chewing side preference, eye preference, leg dominance) in left- and right-handed individuals.

Materials and methods

Our study was based on responses to the EHI along with an additional questionnaire collected from 133 healthy adults from the Czech Republic and Slovakia, including 64 men and 69 women. The age range of the sample was from 18 to 63 years. Subjects in this study were healthy, without any trauma, congenital diseases or malformations of the hands and head. Individuals using specific medication, drugs and alcohol were also excluded. No individual included in this study had switched from their natural dominant hand to the other hand.

All subjects participated voluntarily, and all signed a written informed consent for the study, including an agreement to long-term research. This study was approved by the Institutional Review Board of Charles University, Faculty of Science, Prague, Czech Republic (No. 2022/17).

The questionnaire developed for this study (see Appendix) consisted of three sets of questions. The first set included ten questions concerning the individual's health status and one-sided physical load. These questions provided information about operations, injuries or congenital malformations involving the studied area. The second set comprised eight questions concerning the individual's current and regular use of medication or other substances. The last set of questions focused on side preferences for various activities, where the subjects were offered the option to select both the dominant side and the intensity of use. In this section, the first ten questions were based on the Edinburgh Handedness Inventory (EHI) (Oldfield, 1971). The following three questions focused on leg, eye and chewing side preferences and, in terms of methodology, were based on previous studies (Çetkin et al., 2020; Peters & Durding, 1979). The penultimate question addressed self-reported handedness and the last question dealt with any experience of switching from the dominant hand to the other one during life (usually forced switch from the dominant left hand to the right hand).

Determination of handedness – EHI

Hand preference was assessed using the Edinburgh Handedness Inventory (EHI) (Oldfield, 1971). This questionnaire covers ten motor skills with respect to the intensity of use of a particular hand and the answers are scored as follows: 'strictly right' = '2', 'more right' = '1', 'without preference' = '0', 'more left' = '−1' or 'strictly left' = '−2' (Table 1). The scored responses (−2 to 2) were used to calculate the laterality quotient (LQ), which represents the individual's laterality. The LQ can vary from 100 to −100, while individuals with an LQ between 100 and 40 are defined as right-handed and individuals with an LQ between −40 and −100 are defined as left-handed. Between these LQs there are ambidextrous individuals.

Table 1

Scoring system for responses to the EHI, Spearman correlation coefficient values and their interpretation (strength of correlation).

EHI: scoring system for items	EHI: intensity of use	Spearman correlation coefficient value	Strength of correlation
2	strictly right	1.00–0.80	very strong
1	more right	0.79–0.60	strong
0	without preference	0.59–0.40	moderate
−1	more left	0.39–0.20	weak
−2	strictly left	0.199–0.01	very weak
		0	no correlation

Determination of handedness – self-reported

Self-reported handedness was assessed with a question at the end of the questionnaire. Individuals could choose to answer "right-handed", "left-handed", "ambidextrous" or "other". Respondents were also asked about their family history of left-handedness. If they reported a family member as left-handed (meaning self-reported), we asked who this person was.

Determination of footedness

Preference for one lower limb/leg/foot was assessed with one question included in the questionnaire. Individuals were asked about their preference for kicking a football into a goal. If the respondents were unsure of their preference, they were asked to perform the

action. The classification was “strictly right”, “more right”, “without preference”, “more left” or “strictly left”.

Determination of eyedness

A part of the laterality questionnaire was also one question concerning eye preference (preferred eye for looking into a small aperture or microscope), with individuals choosing from the options “right eye”, “both eyes” or “left eye”. Individuals who were unsure of their preference were asked to look into a small aperture.

Statistical analysis

Descriptive statistical methods were used to evaluate the sample under study and the results were collected in contingency tables. As the data did not meet the criterion of normal distribution, Spearman correlation coefficients (Table 1) were calculated to describe the statistical strengths between handedness and activities according to the EHI. The same method was used to calculate the statistical relationship between self-reported handedness and handedness based on the EHI. These correlation coefficients were then processed using the paired samples Wilcoxon test to show the presence or absence of sexual dimorphism in the relationship between handedness and the individual activities. We calculated the Wilcoxon test for both self-reported and EHI-based handedness. All statistical tests were calculated at $\alpha = 0.05$. All statistical analyses were performed using R software (R Core Team, 2019).

Results

Descriptive statistics showed that the group with self-reported laterality (Table 2) included 72 right-handed, 59 left-handed and 2 ambidextrous individuals.

Table 2

Descriptive statistics for self-reported and calculated laterality (laterality quotient) separately. L = left-handed, R = right-handed, A = ambidextrous.

Self-reported: N = 133, male = 64, female = 69								
R	N	%	**L**	N	%	**A**	N	%
	72			59			2	
Male	39	61.00%	**Male**	25	39.10%	**Male**	0	0.00%
Female	33	47.80%	**Female**	34	49.30%	**Female**	2	2.90%
Calculated laterality (laterality quotient): N = 133, male = 64, female = 69								
R	N	%	**L**	N	%	**A**	N	%
	76			49			8	
Male	40	62.50%	**Male**	22	34.37%	**Male**	2	3.13%
Female	36	52.17%	**Female**	27	39.13%	**Female**	6	8.70%

Across the whole data set (Table 3), 100 % of right-handed individuals were classified as right-handed. In contrast, 83 % of left-handers were correctly classified as left-handed, while 3.4 % of left-handers were incorrectly classified as right-handed. Finally, 100 % of the ambidexters were classified as right-handed.

Table 3

A contingency table showing the numbers of self-reported handedness versus calculated handedness for the whole dataset (without division into males and females). L = left-handed, R = right-handed, A = ambidextrous. The sum of each row represents the total number of self-reported laterality of individuals. The sum of each column represents the total number of calculated laterality of individuals.

Whole dataset: N = 133			
	Calculated laterality		
Self-reported	**L**	**A**	**R**
L	49	8	2
A	0	0	2
R	0	0	72

A contingency table for males (Table 4) shows that out of 25 self-reported left-handers, the EHI classified 22 (88 %) individuals as left-handed, 2 (8 %) as ambidextrous and 1 (4

%) as right-handed. Among males, there were no self-reported ambidexters, and there was a 100 % correspondence between self-reported and EHI-classified right-handers. The correlation between self-reported and calculated handedness for males was 0.96 (p-value e-16), which is a very strong correlation. For females, the contingency table (Table 4) shows that out of 34 self-reported left-handers, the EHI determined 27 (79.4 %) individuals as left-handed, 6 (17.35 %) as ambidextrous and 1 (2.94 %) as right-handed. Based on the EHI, 2 (100 %) ambidextrous females were classified as right-handed and 33 (100 %) right-handed females were classified as right-handed. For females, a very strong correlation of 0.93 (p-value e-16) was found between self-reported and calculated handedness.

In both sexes, the original self-reported individuals were divided after laterality calculation into left-handers, ambidexters and right-handers. Left-handers showed the greatest variability in laterality determination: the majority of individuals (approximately 80 %) in this group were classified as left-handed, then as ambidextrous (there were fewer calculated ambidextrous males (8 %) than females – 17.65 %) and 1 person of each sex was calculated as right-handed. Furthermore, 2 ambidextrous females were classified as right-handed (100 %), while the most accurate classification was for right-handers, out of whom 100 % were classified as right-handed. Overall, in both sexes combined, there was a very strong correlation of 0.94 (p-value e-16) between self-reported and calculated handedness.

Table 4

A contingency table showing the numbers of self-reported handedness versus calculated handedness for males and females separately. L = left-handed, R = right-handed, A = ambidextrous. The sum of each row represents the total number of self-reported laterality of individuals. The sum of each column represents the total number of calculated laterality of individuals.

MALES				**FEMALES**			
Laterality:	Calculated			**Laterality:**	Calculated		
Self-reported	**L**	**A**	**R**	Self-reported	**L**	**A**	**R**
L	22 (88%)	2 (8%)	1 (4%)	**L**	27 (79.4%)	6 (17.65%)	1 (2.94%)
A	0	0	0	**A**	0	0	2 (100%)
R	0	0	39 (100%)	**R**	0	0	33 (100%)

Correlations between self-reported and calculated laterality with activities from the EHI, lower limb, eye and chewing side preference for males and females separately are shown in Table 5. A difference between the levels of correlation was found in throwing – for females, there was only a strong correlation. Overall, there was a moderate correlation for lower limb preference, but in males there was a weak correlation with calculated laterality for this activity. The correlation between calculated laterality and chewing side preference was also weak in females. Eye preference was significantly correlated only in females, with a moderate level of correlation.

There were no significant differences between the sexes in the correlation between activity and laterality: self-reported laterality (p-value 0.93) and calculated laterality (p-value 0.65). This means that there was no difference between the sexes in the relationship between activity and laterality.

Table 5

Correlations, divided by sex, between self-reported versus calculated laterality and activities from the EHI along with additional activities – preference for lower limb, eye and chewing side. SR = self-reported handedness, LQ = laterality, CL = calculated laterality, pM = p-value for males, pF = p-value for females, M = males, F = females.

Activity	Correlation with SR: M and F		pM and pF		Correlation with CL: M and F		pM and pF	
Writing	0.99	0.99	e-16	e-16	0.96	0.93	e-16	e-16
Drawing	0.99	0.97	e-16	e-16	0.96	0.94	e-16	e-16
Throwing	0.82	0.69	e-16	e-11	0.86	0.78	e-16	e-15
Scissors	0.73	0.77	e-11	e-14	0.78	0.79	e-14	e-16
Toothbrush	0.81	0.86	e-16	e-16	0.86	0.93	e-16	e-16
Knife (without fork)	0.91	0.82	e-16	e-16	0.97	0.91	e-16	e-16
Spoon	0.93	0.91	e-16	e-16	0.97	0.86	e-16	e-16
Broom (upper hand)	0.76	0.61	e-13	e-8	0.73	0.63	e-12	e-9
Striking a match	0.87	0.88	e-16	e-16	0.92	0.95	e-16	e-16
Box opening	0.66	0.64	e-9	e-9	0.72	0.70	e-11	e-11
Lower limb	0.50	0.57	e-5	e-7	0.30	0.58	e-6	e-7
Eye	0.20	0.47	0.12	e-5	0.23	0.50	0.06	e-5
Chewing side	0.47	0.49	e-4	e-4	0.44	0.39	e-4	0.001

Figure 1 illustrates data for the preferred side used for different activities in males. In males there were no ambidextrous preferences for the writing and drawing activities. The most variable activities in terms of side preference were chewing, box opening and use of the upper hand for holding a broom. Almost 30 % of males reported using both sides for chewing and a further 40 % reported using the right side. The second most variable activity was box opening, with almost 25 % of males using both hands and 45 % using the right hand. The preferred side for the upper hand to hold a broom was the right hand in more than 40 % of cases and both hands in 20 % of cases. For other activities, there was a preference for both hands in up to 20 % of cases, with the right side being most often preferred in each activity.

In females (Figure 1), there were no ambidextrous preferences for drawing. The most variable activities with respect to side preference were chewing, lower limb preference and the use of the upper hand to hold a broom. The activity with the highest percentage for both sides was chewing. Approximately 50 % of females used both sides without preference for chewing, while almost 30 % of females preferred the right side. The second most variable preference was the lower limb preference, with approximately 20 % of females using both legs and more than 50 % of females preferring the right leg. The preferred upper hand to hold a broom was the right hand in approximately 35 % of cases, while in 20 % of cases there was a preference for both hands. For other activities, preferences for both hands reached up to 20 % (usually about 10 %).

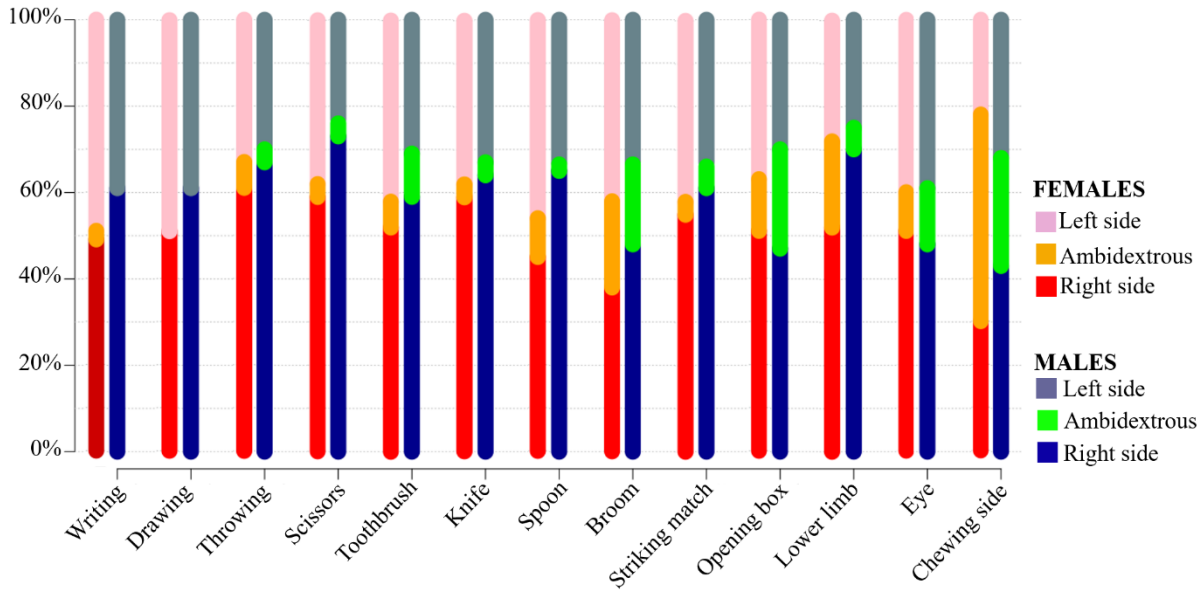

Figure 1 *Percentage of males and females (self-reported preference for one hand or both hands) for each activity from the EHI, along with lower limb, eye and chewing side preference/dominance.*

Finally, we focused on crossed laterality (Table 6) between handedness and chewing side, as well as foot side preference and eye side preference. The results showed that the preferred side for chewing corresponded best to the dominant side for both calculated and self-reported handedness in both sexes. However, there were a large number of individuals who preferred both sides for chewing: in left-handed females it was even more (about 50 %) than preference for left-sided chewing (up to 40 %). Crossed preference for handedness and chewing side was the greatest in left-handed males (20.0 %), but in other groups, crossed laterality was present in less than in 20 % of cases.

For footedness, there was a preference for the same foot as for the hand in the majority of the sample. However, there was a difference between left-handers and right-handers. In left-handed individuals, the agreement between the preferred foot and the preferred hand was between 50 and 60 %. A crossed hand/foot laterality (right hand and left foot and vice versa) in males made up about 5 % in right-handed and about 40 % in left-handed, but in females there was a prominent percentage of females with a preference for both feet (approximately 20 % from each group of right and left-handers) and the crossed laterality was therefore lower. Generally, for right-handers, there was an even greater agreement with right-footedness (75–90 %). Crossed laterality for right-handers was very low, with a maximum value of 5.1 %. Right-handed females were more likely than males to prefer both feet.

Data on eyedness and handedness showed that the majority of left-handed individuals had the same side preference for the eye and for the hand (52.0–66.7 %). A crossed eye/hand laterality reached up to 36.2 % in males. A preference for both eyes was reported by only approximately 10 % of individuals (maximum 13.7 %). Right-handed individuals manifested a greater overlap with right-eyed individuals than left-handed individuals (56.4–72.7 %). Similarly, right-handed individuals showed a greater overlap with right-side-chewing individuals and right-footed individuals. The preference for both eyes in right-handers was similar as in left-handers (maximum 12.8 %).

Table 6

Numbers and percentages of preferred sides for chewing, preferred foot and preferred eye in left-handed, right-handed and ambidextrous individuals. A crossed laterality for the relevant activities is also shown. N = number of individuals; % = percentage of individuals; M = males; F = females; L = left-handed; A = ambidextrous; R = right-handed; Side (L = left, B = both, R = right) = preferred side for chewing, leg use and eye use.

			Calculated handedness				Self-reported handedness			
			MALES		FEMALES		MALES		FEMALES	
		Side	N	%	N	%	N	%	N	%
Chewing	**L**	**L**	9	40.9	10	37.0	10	40.0	11	32.4
		B	9	40.9	13	48.2	10	40.0	19	55.9
		R	4	18.2	4	14.8	5	20.0	4	11.7
	A	**L**	0	0.0	4	16.6	0	0.0	0	0.0
		B	1	50.0	5	83.3	0	0.0	2	100.0
		R	1	50.0	0	0.0	0	0.0	0	0.0
	R	**L**	5	12.5	4	11.1	4	10.3	4	12.1
		B	6	15.0	15	41.7	6	15.4	12	36.4
		R	29	72.5	17	47.2	29	74.3	17	51.5
Footedness	**L**	**L**	13	59.1	15	55.6	14	56.0	18	52.9
		B	1	4.5	6	22.2	1	4.0	6	17.7
		R	8	36.4	6	22.2	10	40.0	10	29.4
	A	**L**	1	50.0	3	50.0	0	0.0	1	50.0
		B	0	0.0	0	0.0	0	0.0	1	50.0
		R	1	50.0	3	50.0	0	0.0	0	0.0
	R	**L**	2	5.0	1	2.8	2	5.1	0	0.0
		B	2	5.0	8	22.2	2	5.1	7	21.2
		R	36	90.0	27	75.0	35	89.8	26	78.8
Eyedness	**L**	**L**	12	54.5	18	66.7	13	52.0	21	61.8
		B	3	13.7	3	11.1	3	12.0	3	8.8
		R	7	31.8	6	22.2	9	36.0	10	29.4
	A	**L**	1	50.0	2	33.3	0	0.0	0	0.0
		R								

	R	0	0.0	0	0.0	0	0.0	0	0.0
		1	50.0	4	66.3	0	0.0	2	100.0
R	**L**	12	30.0	7	19.5	12	30.8	6	18.2
	B								
	R	6	12.5	3	8.3	5	12.8	6	9.1
		23	57.5	26	72.2	22	56.4	24	72.7

Discussion

Handedness and other body lateralities are widely studied in different research areas due to their association with mental disorders, language, or morphology (Çetkin et al., 2020; Dane et al., 2009; Ocklenburg & Güntürkün, 2018d). There are many types of inventories for assessing handedness, such as the EHI (Oldfield, 1971), the Annett Hand Preference Questionnaire (Annett, 1970) or the Waterloo Handedness Questionnaire (Elias, Bryden, & Bulman-Fleming, 2019).

The EHI was developed for very quick, informative, and inexpensive screening of the population. This method enables determination of the dominant hand, and it should be more accurate than self-reported hand preference (Oldfield, 1971). These are the main reasons why Oldfield's (1971) original EHI was used in this study. There is a Czech version of this inventory (Komarc & Harbichová, 2012), which suggests using only six variables from the original EHI (the activities of writing, using a knife, holding a broom and box opening can be excluded without compromising the quality of the results). However, our results showed a very strong correlation of handedness with writing and knife holding. As mentioned by Annett (1970) and Perelle and Ehrman (1994), writing is also an activity used for self-reported handedness, so it was essential to keep it in the inventory. Broom holding and box opening had a lower correlation coefficient with handedness, but this relationship was still significant and strong.

Self-reported versus calculated laterality

Reiß et al. (1998) have suggested that self-reported handedness could be a possible way of assessing handedness; however, it is a robust way of handedness assessing and the best agreement between calculated and self-reported handedness was shown for right-handed females. Our study found a 100 % match between self-reported and calculated handedness in both right-handed males and females. Left-handed individuals were classified correctly in approximately 80 % of cases (79.4 % of females and 88 % of males),

and both the two ambidextrous females participating in our study were classified incorrectly as right-handed. These results suggest that self-reported handedness is a sufficient way to quickly determine an individual's laterality, but it is only accurate for right-handed individuals. For left-handers, there is a 20 % chance that the result will be incorrect, and there is a very high probability that ambidexters will be classified differently to by self-report. On the other hand, there is a meta-analysis by Papadatou-Pastou et al. (2008), which has found a different discrepancy between self-reported and measured handedness for right-handers and left-handers, achieving more accurate results in left-handed individuals, in contrast to our results.

Cultural influence

In humans, handedness is not only a physical trait but also a cultural trait, and when assessing lateralities, it is important to be aware of how the individual's culture approaches handedness or other side preferences (Dragović, Badcock, Sanja, Gregurović, & Šram, 2013; Kushner, 2013). In central and eastern Europe, where the Czech Republic and the Slovak Republic are located, it was customary to enforce the use of the right hand (especially for writing and drawing) in schools until the 1970s. However, in many families, it was common to make children switch to using the right hand even later on (Dragović et al., 2013). In terms of methodology, this calls for focusing at least one question on the respondent's handedness or hand preference in childhood or about original handedness. From our data, 16 individuals were excluded because they were forced to switch from dominant left-handers to right-handers during school years, even though they were born after the seventies. A similar trend was observed among Asian children living in the United States, where 6.5 % of left-handed individuals were found (Haryck, Goldman, & Petrinovich, 1975). This rate was over 3.5 % in Chinese children at almost the same time (Teng et al., 1976). The percentage of Asian left-handers living in the United States was higher than Asian left-handers living in Asia, but it was still not about the usual 10 % (Papadatou-Pastou et al., 2020). This may suggest that families and absorbed culture have an influence on handedness even in an environment open to left-handers. Another example can be the Indian population, where only 3.2 % of children aged from 4 to 11 years showed a preference for the left hand in comparison to a French study with 9.6 % of left-handed children. In a group of individuals from 6 to 18 years of age, the prevalence of left-handers in India was 4.2 % (Singh, Manjary, & Dellatolas, 2001). For studies aiming to examine the origin of laterality, functional manifestations of laterality or brain morphology, it is necessary to know whether the individual switched hands or

not. As Klöppel et al. (2010) have stated, there are structural changes in the primary sensorimotor cortex and basal ganglia in individuals who have switched. Therefore, these individuals should be assessed separately.

Another source of bias in handedness studies can be the use of tools (Flatt, 2008; Wenze & Wenze, 2004). The EHI includes specifically the use of a spoon and scissors. For a spoon, there may be a similar pattern as with writing and drawing – learning to hold the spoon with the right hand, as is usual for right-handers. However, only 3 individuals (excluded from the study) added the information that they had to use their right hand instead of their preferred left hand during childhood. The use of the spoon itself was very strongly positively correlated with handedness, which shows that this variable is reliable in the handedness inventory, despite the possible cultural influence (which must be taken into account). For scissors, it is possible that many left-handers use their right hand for this activity because scissors are mostly made for right-handers. This could lead to naturally left-handed children learning to use their right hand if their hand preference was not taken into account during their preschool and school years (Wenze & Wenze, 2004). Despite this problem with the use of scissors, our results showed a strong correlation with handedness for both sexes.

Chewing side preference

Chewing side preference is associated with brain lateralization (Nissan, Gross, Shifman, Tzadok, & Assif, 2004; Serel Arslan et al., 2017), but results from different studies are not consistent. This inconsistency may be due to differences in dental health, undergone procedures and general condition of the oral cavity. All these factors can affect chewing patterns throughout life (Diernberger, Bernhardt, Schwahn, & Kordass, 2008). Our results are in partial agreement with the results from a study by Athab Abduljabbar et al. (2022), where the authors found that most participants chewed bilaterally. In our study, bilateral chewing was found in females (about 50 %), while in males, right-side chewing was slightly more frequent, which is consistent with Nissan et al. (2004), whose study participants were also right-handed. The right-handed individuals in our study, especially males, mostly also tended to chew on the right side. The percentage of crossed hand/chewing laterality was relatively low, with a maximum of 20 %. However, there were many females in each category of handedness with a preference for both sides (about 50 %). The fact that chewing side preference is a manifestation of brain laterality is apparent in studies where this preference significantly correlates with other known lateralities (Nissan et al., 2004; Serel Arslan et al., 2017). We found a statistically signifi-

cant moderate correlation of chewing side preference with self-reported and calculated handedness, apart from calculated handedness in females, where the correlation was weak. This suggests that there is a significant relationship with the classic representative of brain laterality, despite the findings of Athab Abduljabbar et al. (2022), who found no correlation between objectively assessed chewing side preference and handedness. This discrepancy in the results may be due to different methodological approaches, though more studies have found results similar to ours. Furthermore, chewing side preference is connected with chin morphology, where the volume of the chin is larger on the side opposite to the preferred chewing side (Heikkinen, Vuollo, Harila, Sidlauskas, & Heikkinen, 2022).

Footedness

Preference for one foot or leg is considered a manifestation of dominant brain hemisphere lateralization (Elias & Bryden, 1998). Despite the fact that motor control of the foot is also influenced by peripheral motor control (Kato & Asami, 1998), it may be a better measure of brain lateralization than handedness, which could be strongly influenced by the individual's culture (Akabalieva, 2023). This makes footedness a better predictor of language function than handedness (Elias & Bryden, 1998). A study by Carey et al. (2001) has observed that for motor performance, the right foot is dominant in more than 75 % of cases. However, Akabalieva (2023) found that there were more left-footed (as well as left-eyed) individuals in the group of patients with schizophrenia than in the control group. Our results showed a moderate correlation with handedness (and only a weak correlation with calculated handedness in males). This suggests that there is a statistically significant relationship between handedness and footedness, but it is not a strong one. It is therefore unclear whether footedness is a better predictor of brain laterality. Nevertheless, the different existing methods (Sulzbacher, Thomson, Farwell, Temkin, & Lu Holubkov, 1994) for assessing laterality in terms of footedness and handedness could play a role in deciding which laterality manifestation is the better marker of true laterality. In this study, we decided to use the task of "kicking into a goal" because this task was referred to in many studies (Çetkin et al., 2020; Sulzbacher et al., 1994; Van Melick, Meddeler, Hoogeboom, Nijhuis-van Der Sanden, & Van Cingel, 2017). Furthermore, a study by Van Melick et al. (Van Melick et al., 2017) reported a 100 % agreement of this task with self-reported footedness, unlike other activities.

The number of individuals with a dominant right foot was greater than the number of individuals with no foot preference or with a left-foot preference, which is consistent

with a study by Carey et al. (2001). Crossed hand/foot laterality was not very common, especially so in right-handed males, where the side of the dominant hand and foot matched in 75–90 % of cases. In left-handers, there was a greater rate of individuals with crossed hand/foot laterality.

Eyedness

The relationship between eyedness and handedness has been studied for a long time (Bourassa, 1996; Çetkin et al., 2020; Dane et al., 2009). A meta-analysis by Brourassa (1996) has found that there are more left-eyed individuals in the group of left-handers than in the group of right-handers, and there is no sex difference in the incidence of eyedness or in the association between handedness and eyedness. Our results showed a weak association between eyedness and handedness in females and no significant association between these two preferences in males. We also found no sex differences in the association between eyedness and handedness. From a clinical point of view, a study by Dane et al. (2009) discussed an association of schizophrenia prevalence with handedness and eyedness. The study found that compared to the control group, there were more schizophrenia patients with mixed handedness, and in males there was a higher rate of crossed eye/hand laterality in left-eyed individuals. Similar results, with more left-eyed individuals, were reported also in a study by Akabalieva (2023). Our results showed that there was a predominance of non-crossed eye/hand laterality (52–72.7 %), while crossed eye/hand laterality was present in a maximum of 36 % of cases (left-handed males). These results are consistent with Annett and Turner (Annett & Turner, 1974). Females showed a lower percentage of crossed eye/hand laterality than males, which corresponds to the findings of Dane et al. (Dane et al., 2009), who suggested that these differences could be related to sex.

Conclusion

In conclusion, the study of handedness, footedness, eyedness and chewing side preference is an important topic in biological anthropology. These traits originate from a congenital preference for one dominant brain hemisphere and are very often associated with language disorders or schizophrenia, which originates from the same dominant hemisphere. An activity such as chewing side preference is linked with functional adaptation of the craniofacial complex and could be significant from a biomedical point of view. The present study showed that self-reported handedness could be a good predictor of true handedness in the case of right-handed individuals. For left-handers there

was a mismatch in approximately 20 % of cases, and self-reported ambidexters were incorrectly classified as right-handers. Individual items on the EHI were significantly associated with true handedness. Eyedness (in females only), footedness and chewing side preference were associated with handedness mostly with a statistical significance, though the correlation was only moderate. Additionally, eyedness was not associated with handedness in males. We also found that the best match was between the preferred side for chewing, foot or eye and the dominant hand. However, crossed lateralities of hand/eye, hand/foot and hand/chewing side are more common in left-handed individuals, and preference for both sides in chewing is more common in females.

Acknowledgments

We would like to thank all the subjects who participated in this study and to Mgr. Markéta Gregorová, Ph.D. for her diligent proofreading of this paper. This work was supported by the Charles University Grant Agency as project No. 372221.

References

Akabalieva, K. V. (2023). Combined foot and eye dominance scale as a useful tool for the assessment of lateralization. *European Psychiatry, 66*(S1), S1064–S1064. https://doi.org/10.1192/j.eurpsy.2023.2258

Annett, M. (1970). A classification of hand preference by association analysis. *British Journal of Psychology, 61*(3), 303–321. https://doi.org/10.1111/j.2044-8295.1970.tb01248.x

Annett, M., & Turner, A. (1974). Laterality and the growth of intellectual abilities. *British Journal of Educational Psychology, 44*(1), 37–46. https://doi.org/10.1111/j.2044-8279.1974.tb00764.x

Athab Abduljabbar, Z., Svensson, K. G., Hjalmarsson, L., Franke Stenport, V., & Eliasson, A. (2022). Chewing side preference and laterality in patients treated with unilateral posterior implant-supported fixed partial prostheses. *Journal of Oral Rehabilitation, 49*(11), 1080–1086. https://doi.org/10.1111/joor.13366

Bourassa, D. C. (1996). Handedness and eye-dominance: A meta-analysis of their relationship. *Laterality, 1*(1), 5–34. https://doi.org/10.1080/713754206

Brandler, W. M., Morris, A. P., Evans, D. M., Scerri, T. S., Kemp, J. P., Timpson, N. J., … Paracchini, S. (2013). Common variants in left/right asymmetry genes and pathways are associated with relative hand skill. *PLoS Genetics, 9*(9), e1003751. https://doi.org/10.1371/journal.pgen.1003751

Carey, D. P., Smith, G., Smith, D. T., Shepherd, J. W., Skriver, J., Ord, L., & Rutland, A. (2001). Footedness in world soccer: An analysis of France '98. *Journal of Sports Sciences, 19*(11), 855–864. https://doi.org/10.1080/026404101753113804

Çetkin, M., Bayko, S., & Kutoğlu, T. (2020). Hair whorl direction: The association with handedness, footedness, and eyedness. *Developmental Neuropsychology, 45*(1), 17–26. https://doi.org/10.1080/87565641.2019.1700419

Cuellar-Partida, G., Tung, J. Y., Eriksson, N., Albrecht, E., Aliev, F., Andreassen, O. A., … Medland, S. E. (2020). Genome-wide association study identifies 48 common genetic variants associated with handedness. *Nature Human Behaviour, 5*(1), 59–70. https://doi.org/10.1038/s41562-020-00956-y

Dane, S., Yildirim, S., Ozan, E., Aydin, N., Oral, E., Ustaoglu, N., & Kirpinar, I. (2009). Handedness, eyedness, and hand–eye crossed dominance in patients with schizophrenia: Sex-related lateralisation abnormalities. *Laterality: Asymmetries of Body, Brain and Cognition, 14*(1), 55–65. https://doi.org/10.1080/13576500802061883

Diernberger, S., Bernhardt, O., Schwahn, C., & Kordass, B. (2008). Self-reported chewing side preference and its associations with occlusal, temporomandibular and prosthodontic factors: Results from the population-based study of health in pomerania (SHIP-0). *Journal of Oral Rehabilitation, 35*(8), 613–620. https://doi.org/10.1111/j.1365-2842.2007.01790.x

Dragović, M., Badcock, J. C., Sanja, M., Gregurović, M., & Šram, Z. (2013). Social stereotyping of left-handers in Serbia. *Laterality: Asymmetries of Body, Brain and Cognition, 18*(6), 719–729. https://doi.org/10.1080/1357650X.2012.755993

Elias, L. J. Bryden, M. P. (1998). Footedness is a better predictor of language lateralisation than handedness. *Laterality, 3*(01), 41–51.

Elias, L. J., Bryden, M. P., & Bulman-Fleming, M. B. (2019). Waterloo Handedness Questionnaire—Revised [Data set]. https://doi.org/10.1037/t74294-000

Fagard, J., & Dahmen, R. (2004). Cultural influences on the development of lateral preferences: A comparison between French and Tunisian children. *Laterality: Asymmetries of Body, Brain and Cognition, 9*(1), 67–78. https://doi.org/10.1080/13576500342000167

Faurie, C., Bonenfant, S., Goldberg, M., Hercberg, S., Zins, M., & Raymond, M. (2008). Socio-economic status and handedness in two large cohorts of French adults. *British Journal of Psychology, 99*(4), 533–554. https://doi.org/10.1348/000712608X291563

Flatt, A. E. (2008). Is being left-handed a handicap? The short and useless answer is "yes and no." *Baylor University Medical Center Proceedings, 21*(3), 304–307. https://doi.org/10.1080/08998280.2008.11928414

Haryck, C., Goldman, R., & Petrinovich, L. (1975). Handedness and sex, race, and age. *Human biology, 47*(3), 369–375.

Heikkinen, E. V., Vuollo, V., Harila, V., Sidlauskas, A., & Heikkinen, T. (2022). Facial asymmetry and chewing sides in twins. *Acta Odontologica Scandinavica, 80*(3), 197–202. https://doi.org/10.1080/00016357.2021.1985166

Jensen, B. H., Hougaard, A., Amin, F. M., Larsson, H. B. W., & Ashina, M. (2015). Structural asymmetry of cortical visual areas is related to ocular dominance. *NeuroReport, 26*(17), 1071–1076. https://doi.org/10.1097/WNR.0000000000000470

Jung, H. S., & Jung, H.-S. (2009). Hand dominance and hand use behaviour reported in a survey of 2437 Koreans. *Ergonomics, 52*(11), 1362–1371. https://doi.org/10.1080/00140130903067805

Kato, Y., & Asami, T. (1998). Difference in Stimulus-Response Compatibility Effect in Premotor and Motor Time between Upper and Lower Limbs. Perceptual and Motor. *Skills, 87*(3), 939–946. https://doi.org/10.2466/pms.1998.87.3.939

Khamnei, S., Sadat-Ebrahimi, S.-R., Salarilak, S., Savadi Oskoee, S., Houshyar, Y., Shakouri, S. K., … Zamanlu, M. (2019). Manifestation of hemispheric laterality in chewing side preference and handedness. *BioImpacts, 9*(3), 189–193. https://doi.org/10.15171/bi.2019.23

Klöppel, S., Mangin, J.-F., Vongerichten, A., Frackowiak, R. S. J., & Siebner, H. R. (2010). Nurture versus Nature: Long-Term Impact of Forced Right-Handedness on Structure of Pericentral Cortex and Basal Ganglia. *The Journal of Neuroscience, 30*(9), 3271–3275. https://doi.org/10.1523/JNEUROSCI.4394-09.2010

Komarc, M., & Harbichová, I. (2012). Czech version of Edinburgh handedness inventory. *Československá psychologie, LVI*(4).

Kushner, H. I. (2013). Why are there (almost) no left-handers in China? *Endeavour, 37*(2), 71–81. https://doi.org/10.1016/j.endeavour.2012.12.003

McManus, C. (2022). Cerebral Polymorphisms for Lateralisation: Modelling the Genetic and Phenotypic Architectures of Multiple Functional Modules. *Symmetry, 14*(4), 814. https://doi.org/10.3390/sym14040814

Medland, S. E., Duffy, D. L., Wright, M. J., Geffen, G. M., Hay, D. A., Levy, F., … Boomsma, D. I. (2009). Genetic influences on handedness: Data from 25,732 Australian and Dutch twin families. *Neuropsychologia, 47*(2), 330–337. https://doi.org/10.1016/j.neuropsychologia.2008.09.005

Muraleedharan, A., Ragavan, S., & Devi, R. (2019). Are Footedness and Lateral Postures Better Predictors of Hemispheric Dominance Than Handedness: A Cross-sectional Questionnaire-Based Clinical and Pedigree Study. *Journal of Neurosciences in Rural Practice, 11*, 130–134. https://doi.org/10.1055/s-0039-3400699

Nissan, J., Gross, M. D., Shifman, A., Tzadok, L., & Assif, D. (2004). Chewing side preference as a type of hemispheric laterality. *Journal of Oral Rehabilitation, 31*(5), 412–416. https://doi.org/10.1111/j.1365-2842.2004.01256.x

Ocklenburg, S., & Güntürkün, O. (2018a). Altered Hemispheric Asymmetries in Neurodevelopmental, Psychiatric, and Neurological Disorders. In *The Lateralized Brain* (s. 313–338). Elsevier. https://doi.org/10.1016/B978-0-12-803452-1.00012-6

Ocklenburg, S., & Güntürkün, O. (2018b). Evolution of Asymmetries. In *The Lateralized Brain* (s. 27–55). Elsevier. https://doi.org/10.1016/B978-0-12-803452-1.00002-3

Ocklenburg, S., & Güntürkün, O. (2018c). Handedness and Other Behavioral Asymmetries. In *The Lateralized Brain* (s. 123–158). Elsevier. https://doi.org/10.1016/B978-0-12-803452-1.00005-9

Ocklenburg, S., & Güntürkün, O. (2018d). *The lateralized brain the neuroscience and evolution of hemispheric asymmetries*. Elsevier.

Oldfield, R. C. (1971). The assessment and analysis of handedness: The Edinburgh inventory. *Neuropsychologia, 9*(1), 97–113. https://doi.org/10.1016/0028-3932(71)90067-4

Papadatou-Pastou, M., & Martin, M. (2017). Cerebral laterality for language is related to adult salivary testosterone levels but not digit ratio (2D:4D) in men: A functional transcranial Doppler ultrasound study. *Brain and Language, 166*, 52–62. https://doi.org/10.1016/j.bandl.2016.12.002

Papadatou-Pastou, M., Martin, M., Munafò, M. R., & Jones, G. V. (2008). Sex differences in left-handedness: A meta-analysis of 144 studies. *Psychological Bulletin, 134*(5), 677–699. https://doi.org/10.1037/a0012814

Papadatou-Pastou, M., Ntolka, E., Schmitz, J., Martin, M., Munafò, M. R., Ocklenburg, S., & Paracchini, S. (2020). Human handedness: A meta-analysis. *Psychological Bulletin, 146*(6), 481–524. https://doi.org/10.1037/bul0000229

Perelle, I. B., & Ehrman, L. (1994). An international study of human handedness: The data. *Behavior Genetics, 24*(3), 217–227. https://doi.org/10.1007/BF01067189

Peters, M., & Durding, B. M. (1979). Footedness of Left- and Right-Handers. *The American Journal of Psychology, 92*(1), 133. https://doi.org/10.2307/1421487

Porac, C., & Coren, S. (1981). *Lateral Preferences and Human Behavior*. Springer New York. https://doi.org/10.1007/978-1-4613-8139-6

Potdevin, D., Adibpour, P., Garric, C., Somogyi, E., Dehaene-Lambertz, G., Rämä, P., … Fagard, J. (2023). Brain Lateralization for Language, Vocabulary Development and Handedness at 18 Months. *Symmetry, 15*(5), 989. https://doi.org/10.3390/sym15050989

R Core Team. (2019). *R: A Language and Environment for Statistical Computing*. Vienna, Austria: R Foundation for Statistical Computing. Získáno https://www.R-project.org/

Reiß, M., Reiß, G., & Freye, H.-A. (1998). Some Aspects of Self-Reported Hand Preference. *Perceptual and Motor Skills, 86*(3), 953–954. https://doi.org/10.2466/pms.1998.86.3.953

Rubene, Z., Daniela, L., & Medne, D. (2019). Wrong Hand, Wrong Children? The Education of Left-Handed Children in Soviet Latvia. *Acta Paedagogica Vilnensia, 42*, 10–28. https://doi.org/10.15388/ActPaed.42.1

Serel Arslan, S., İnal, Ö., Demir, N., Ölmez, M. S., & Karaduman, A. A. (2017). Chewing side preference is associated with hemispheric laterality in healthy adults. *Somatosensory & Motor Research, 34*(2), 92–95. https://doi.org/10.1080/08990220.2017.1308923

Schmitz, J., Metz, G. A. S., Güntürkün, O., & Ocklenburg, S. (2017). Beyond the genome—Towards an epigenetic understanding of handedness ontogenesis. *Progress in Neurobiology, 159*, 69–89. https://doi.org/10.1016/j.pneurobio.2017.10.005

Singh, M., Manjary, M., & Dellatolas, G. (2001). Lateral Preferences Among Indian School Children. *Cortex, 37*(2), 231–241. https://doi.org/10.1016/S0010-9452(08)70570-7

Somers, M., Ophoff, R. A., Aukes, M. F., Cantor, R. M., Boks, M. P., Dauwan, M., … Sommer, I. E. (2015). Linkage Analysis in a Dutch Population Isolate Shows No Major Gene for Left-Handedness or Atypical Language Lateralization. *Journal of Neuroscience, 35*(23), 8730–8736. https://doi.org/10.1523/JNEUROSCI.3287-14.2015

Suar, D., Mandal, M. K., Misra, I., & Suman, S. (2013). Patterns of hand preference and unintentional injuries among Indian attempted hand switchers and hand non-switchers. *Laterality: Asymmetries of Body, Brain and Cognition, 18*(6), 652–670. https://doi.org/10.1080/1357650X.2012.742532

Sulzbacher, S., Thomson, J., Farwell, J. R., Temkin, N. R., & Lu Holubkov, A. (1994). Crossed dominance and its relationship to intelligence and academic achievement. *Developmental Neuropsychology, 10*(4), 473–479. https://doi.org/10.1080/87565649409540596

Teng, E. L., Lee, P.-H., Yang, K., & Chang, P. C. (1976). Handedness in a Chinese Population: Biological, Social, and Pathological Factors. *Science, 193*(4258), 1148–1150. https://doi.org/10.1126/science.986686

Toosy, A. T., Werring, D. J., Plant, G. T., Bullmore, E. T., Miller, D. H., & Thompson, A. J. (2001). Asymmetrical Activation of Human Visual Cortex Demonstrated by Functional MRI with Monocular Stimulation. *NeuroImage, 14*(3), 632–641. https://doi.org/10.1006/nimg.2001.0851

Van der Haegen, L., Westerhausen, R., Hugdahl, K., & Brysbaert, M. (2013). Speech dominance is a better predictor of functional brain asymmetry than handedness: A combined fMRI word generation and behavioral dichotic listening study. *Neuropsychologia, 51*(1), 91–97. https://doi.org/10.1016/j.neuropsychologia.2012.11.002

Van Melick, N., Meddeler, B. M., Hoogeboom, T. J., Nijhuis-van Der Sanden, M. W. G., & Van Cingel, R. E. H. (2017). How to determine leg dominance: The agreement between self-reported and observed performance in healthy adults. *PLOS ONE, 12*(12), e0189876. https://doi.org/10.1371/journal.pone.0189876

Vuoksimaa, E., Koskenvuo, M., Rose, R. J., & Kaprio, J. (2009). Origins of handedness: A nationwide study of 30161 adults. *Neuropsychologia, 47*(5), 1294–1301. https://doi.org/10.1016/j.neuropsychologia.2009.01.007

Wenze, G. T., & Wenze, N. (2004). Helping Left-Handed Children Adapt to School Expectations. *Childhood Education, 81*(1), 25–31. https://doi.org/10.1080/00094056.2004.10521288

Westmoreland, P. (2023). Harms of Handedness. In P. Westmoreland (Ed.), *How Handedness Shapes Lived Experience, Intersectionality, and Inequality* (s. 181–213). Springer International Publishing. https://doi.org/10.1007/978-3-031-23892-5_7

Appendix

Additional information:

Sex:	**Age:**	**Birthplace:** ANO	**Nationality:**	**Left-handers in family (who):**

1	• **Hormonal disorders** (growth, thyreopathy, etc.):	YES	NO
2	• **Doing sports:** Which sport do you do? From what age?	YES	NO
3	• **Have you ever had braces?** If YES, write the age period.....	YES	NO
4	• **Have you had any injury of an upper limb in the past?** If YES, which one + age?	YES	NO
5	• **Have you had any surgery of an upper limb in the past?** If YES, which one + age?	YES	NO
6	• **Have you undergone physiotherapy or rehabilitation in childhood?** If YES, which one + age? (torticollis, etc.)	YES	NO
7	• **Do you have any congenital facial malformation?** If YES, which one?	YES	NO
8	• **Do you have any congenital upper limb malformation?** If YES, which one?	YES	NO
9	• **Have you had any head/teeth injury in the past?** (fracture, injury with long-term If YES, which	YES	NO
10	• **Have you had any head/teeth surgery in the past?** (fracture, injury with long-term If YES, which	YES	NO

Current and regular use of medication or other substances:

1	• **Hormonal contraception:**	YES	NO	5	• **Anabolic steroids:**	YES	NO
2	• **Hormonal medication:**	YES	NO	6	• **Regular use of alcohol:**	YES	NO
3	• **Cytostatics:**	YES	NO	7	• **Smoking:**	YES	NO
4	• **Immunosuppressive**	YES	NO	8	• **Regular use of other**	YES	NO

*Side preferences (**R**++ = strictly right, **R**+ = more right, **0** = without preference, **L**− = more left, **L**−− = strictly*

	Activity:	**Dominant side for activity:**		
1	• **Writing**	L	R	BOTH
2	• **Drawing**	L	R	BOTH
3	• **Throwing**	L	R	BOTH
4	• **Scissors**	L	R	BOTH
5	• **Toothbrush**	L	R	BOTH
6	• **Knife (without fork)**	L	R	BOTH
7	• **Spoon**	L	R	BOTH

8	**• Broom (upper hand)**		L	R	BOTH
9	**• Striking a match**		L	R	BOTH
10	**• Opening a box/lid**		L	R	BOTH
11	**• Dominant lower limb (kicking a ball)**		L	R	BOTH
12	**• Dominant eye (preferred eye for looking into a microscope)**		L	R	BOTH
13	**• Dominant chewing side?**		L	R	BOTH
14	**• What is your handedness?**	Left-handed	Right-	Ambidextrou	Other
15	**• Switched from** ……..……. hand to ……..……. hand.				

Povzetek

Lateralizacija se kaže kot senzorična ali mišična preferenca. Te preference so pogosto ključne za (1) izračun ročnosti (določen z merilno lestvico Edinburgh Handedness Inventory – EHI) in določitev samoocene ročnosti, (2) opis razmerja med ročnostjo in različnimi stranskimi preferencami, zlasti prednost nog, oči in žvečenja. Vzorec dane raziskave izhaja iz 133 vprašalnikov o lateralnosti in EHI, ki so jih izpolnili zdravi odrasli (po lastni oceni 72 desničarjev, dva obojeročna posameznika in 59 levičarjev). Rezultati so pokazali, da sta se samoocena in izračunana levoročnost pri desničarjih 100-odstotno ujemali. Pri levičarjih je bilo približno 80-odstotno ujemanje, saj je bilo le osem posameznikov razvrščenih kot obojeročnih, dva posameznika pa kot desničarja. Med dejavnostmi EHI in ročnostjo je bila močna korelacija. Preferenca nog in žvečilne strani je bila zmerno povezana z ročnostjo. Očesnost je bila le šibko povezana. Pomembnih razlik med spoloma nismo ugotovili. Zaključimo lahko, da obstaja pomembna povezava med samooceno in izračunano ročnostjo. Natančnost pri kategorizaciji ročnosti je bila 100 % pri desničarjih in 80 % pri levičarjih. Pisanje in risanje je bilo najbolj povezano z ročnostjo, medtem ko je bila korelacija z očmi najšibkejša. Prekrižana lateralnost je bila bolj prisotna pri levičarjih.

KLJUČNE BESEDE: ročnost, lateralnost, stranska preferenca, človek

CORRESPONDENCE: Katarína Harnádková, Charles University, Viničná 7, 128 00 Prague 2, Czech Republic, E-mail: harnadkk@natur.cuni.cz