

# Body composition and selected anthropometric traits of elite Polish female judokas in relation to the performance of right-dominant, left-dominant, or symmetrical judo techniques in vertical posture (*tachi waza*)

## Authors' Contribution:

- A Study Design
- B Data Collection
- C Statistical Analysis
- D Manuscript Preparation
- E Funds Collection

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**Received:** 19 August 2016; **Accepted:** 12 September 2016; **Published online:** 30 September 2016

**AoBID:** 11322

## Abstract

### Background & Study Aim:

Judo is a sport with a complex structure of short and “intense movements”. A judo competitor must possess high levels of strength, agility, and technical and endurance skills. The study aim is the relationship the body composition, the degree of symmetrization of muscle mass of the limbs, skinfolds and hand grip strength with respect to the preferred side of attacks in vertical posture (*tachi waza*) during judo matches.

### Material & Methods:

Twenty-five female members of the Polish national judo team (20.2 ±3.1 years) and 34 non-training women (20.1 ±0.8 years) participated in the study. Depending on the preference of attack direction during combat the judokas in vertical posture were divided into right-dominant, left-dominant, and symmetrical. All subjects were right-handed. Anthropometric measurements and body composition (BIA method) components were compared.

### Results:

The female judokas featured a higher BMI, intracellular water, upper limb circumferences, and thinner triceps, abdominal and calf skinfolds than the control. The thicker suprailliac skinfold in judokas can be associated with the necessity to maintain body stability during judo bouts. In control an asymmetry (right-left) in the circumferences of the forearm (0.4 cm), thigh (0.3 cm) and thickness of the abdominal (0.6 mm), triceps (-0.4 mm) and suprailliac skinfolds (-0.9 mm) was noted. In the right-dominant an asymmetry in the forearm circumference (0.4 cm) and suprailliac skinfold was found (1.9 mm). The left-dominant featured only an asymmetry in the thickness suprailliac skinfold (3.2 mm). No morphological asymmetry was observed among the symmetrical judokas. Dynamic asymmetry of hand grip strength was observed in control and only right-dominant judokas (2.1 kg).

### Conclusions:

In the right-handed judokas preferred direction of attacks removes morphological and dynamic signs of asymmetry. The estimation of the degree of symmetrization of the body build and body motor functions can be used in the process of judo training management.

### Key words:

anthropometry • attack directions • body balance disturbance tolerance skills • combat sports • hand strength

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### Conflict of interest:

The authors of this study declare that they have no conflicts of interest.

### Ethical approval:

The study was approved by the Bioethics Committee of the University School of Physical Education in Wrocław (Poland) with the date 08.10.2014.

### Provenance & peer review:

Not commissioned; externally peer reviewed

**Source of support:** Departmental sources

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**Muscle confusion** – noun the act of using several different exercises for a single muscle so that it cannot adapt to a predictable workout and is therefore forced to work harder [49].

**Tachi-waza** – judo throwing techniques executed from a standing position. These include *te-waza* (hand techniques), *koshi-waza* (hip techniques), and *ashi-waza* (foot and leg techniques) [48], including also sub classification *sutemi-waza* (rear-fall and side-fall judo throws; synonym – “dedication throws”).

**Ne-waza** (prone techniques), a related concept is that of **katame-waza** (grappling techniques) – judo techniques executed from a horizontal posture: *osaekomi-waza* (pinning techniques), *shime-waza* (strangle technique), *kansetsu-waza* (joint holds).

**Body composition** – athlete's predisposition in terms of the proportion of active mass and inactive mass in the body.

**Body balance disturbance tolerance skills** – the ability to maintain the vertical posture in circumstances of the fall hazard [25]

**Technique** – noun a way of performing an action [49]

**Symmetry of movements** – the range and level of symmetry technique training (the process of levelling the abilities of oth legs) also serve as a test which evaluates the coordination abilities [46].

**The ability of movements symmetrisation** – is an ability of transmission (transfer) technique of movements from one side of the body or one part of the body to the other [47].

**Randori:** a match controlled by judo rules.

## INTRODUCTION

Judo is a sport with a complex structure of “short and intense movements” (in the sense of distance and the time of exposition during combat in vertical posture; *tachi waza*) of different parts of the body, alternating among three categories: preparing an attack, offensive, defensive [1]. During judo fighting in horizontal posture (*ne waz*) the time of movements exposition and also muscular confusion are even more challenging in the not only a physiological sense. These two categories of stimuli (alternately fighting in the vertical posture and horizontal posture) determine the fundamental adaptive changes in judo athletes in the many years of training [2-6].

A judo competitor must possess high levels of strength, agility, and technical and endurance skills [7-11]. Results of numerous studies indicate relationships between morphological traits, motor skills and successful performance in judo competitions [12-14]. Judokas feature lower body fat and greater muscle mass. Studies also show that reduced subcutaneous adipose tissue has a positive impact on the development of judokas' motor skills [14, 15-22]. The exception can be the amount of hip fat, which is greater in judo competitors than in others [23].

The mastery of body postural control techniques (*tachi waza*) in order to maintain or restore body balance is a significant component of judo practice [24-26]. During a judo fighting the competitors change their body posture along the long axis but also in response to the force exerted by the opponent [26-28]. The opponent's actions are never completely predictable thus a judoka's skillful adjustment of body posture to ensure stability is accomplished through the use of forces of attack, defense and opponent's efforts to maintain body balance [29] (in fact: body balance disturbance tolerance skills [25]).

High significance in effective judo performance is attached to symmetry of motor functions, which in judo competitors is greatly augmented [30, 31]. It was proven that one-sided body posture significantly diminishes a judoka's defense capacity against the opponent's attacks from the other side

of the body [32]. Symmetrization requires balancing motor abilities on both sides of the body, whereas transferring a movement technique from one body side to the other increases judoists' technical and tactical capabilities as well as performance effectiveness [32]. On the other hand, a marked asymmetry in function and stability is not only a hindrance in attaining success in judo, but may also lead to numerous injuries [31].

The existing functional system in asymmetric sports stimulates bone and muscle growth and increases limb circumferences on the dominant body side [33]. Functional asymmetry has affects differences in strength (dynamic asymmetry) and body build (morphological asymmetry) [33]. The morphological asymmetry of upper and lower limb circumferences was examined by Stefaniak [34], and in his studied group of men and women the asymmetry revealed the dominance of the right side. A similar right-dominant dynamic asymmetry in judoists, measured by hand grip strength, was found by Detanico et al. [10] and Kurt et al. [35]. Some authors posit that lateralization understood as functional dominance, i.e. preferred performance of various sports skills, can be acquired in the process of development of motor skills during judo training [32, 36].

On the other hand, according to Sterkowicz et al. [37] handedness and footedness are significantly correlated with the choice of preferred attack sides during judo combat. Dopico et al. [36] claim there is no relationship between the preferred use of the upper or lower limb while performing simple and complex motor actions (motor dominance) and executing judo techniques to the right side, to the left side or symmetrically (functional dominance). Most results of studies on morphological and dynamic asymmetry in combat sports athletes reveal relationships with the athletes' self-declared or test-measured lateralization [e.g. 34]. There has been no data on the effects of functional dominance acquired during specialist training, related to the athlete's preference of the side of attack, on manifestations of morphological asymmetry. In fact, judo performance can be more correlated with the direction

of judo technique execution than with a judoka's right- or left-handedness [36]. Franchini et al. [14] pointed to the necessity of research on relationships between anthropometric traits and techniques used by athletes in competitive conditions.

The study aim is the relationship the body composition, the degree of symmetrization of muscle mass of the limbs, skinfolds and hand grip strength with respect to the preferred side of attacks in vertical posture (*tachi waza*) during judo matches.

## MATERIAL AND METHODS

### Participants

The study group consisted of 25 members of the Polish national women's judo team, aged  $20.17 \pm 3.12$  years. The subjects' mean training experience was 9.5 years. In the pre-competitive season the competitors trained offensive judo techniques for 2 hours, 6 times a week. The control group comprised 34 female students of physiotherapy aged  $20.08 \pm 0.84$  years, who did not practice any competitive sports. All participants declared to be right-handed (writing, eating) and self-estimated their right- or left-dominance (functional dominance) in performing their most frequently used judo techniques. Following Dopico et al. [36] and Adam et al. [38], the subjects were divided into three groups, depending on the side of their preferred direction of attacks: 1) right-dominant (on the right side, with the right leg, with the right arm); 2) left-dominant (on the left side, with the left leg, with the left arm); and 3) symmetrical (combining two techniques). The subjects were instructed about the testing procedure and expressed their written consent (those under the age of 18 submitted their parents' or guardians' written consent) to participate in the experiment.

### Procedures

The anthropometric measurements were taken in the morning, and not directly before the competitive season, due to the possibility of judo competitors to use some body mass regulation methods in order to become classified into specific weight categories. The following traits were measured: body height, body mass, waist circumference, hip circumference, four limb circumferences (arm, forearm, thigh, calf) and six skinfolds (*triceps*, *subscapular*, *rib*, *suprailiac*, *abdominal*, *calf*). The

limb circumferences (to the nearest 0.5 cm) and skinfold thickness (to the nearest 0.2 mm) were measured on both sides of the body. The body mass index (BMI) [ $\text{kg}/\text{m}^2$ ] and waist hip ratio (WHR) were calculated.

Bioelectrical impedance analysis (BIA) was used to estimate the following body components (tetrapolar STA/BIA RJL analyzer, Akern 101/S, Italy): body fat (BF) [kg; %], fat free mass (FFM) [kg, %], total body water (TBW) [l; %], intracellular water (ICW) [l], extracellular water (ECW) [l] and body cell mass (BCM) [kg, %]. Right and left hand-grip strength (static strength of forearm muscles) was measured with a Takei hand dynamometer (to the nearest 0.5 kg). All measurements were carried out according to commonly accepted anthropometric standards.

The baseline characteristics were the results of anthropometric measurements for the control group of non-training women. Quotient coefficients for the analyzed measures were calculated following the formula  $B / P \times 100$ , where: **B** value of anthropometric measurements in the group of judokas; **p** value of measurements in the control group, and expressed in percent values.

### Statistical analysis

All the statistical calculations were made using *Statistica* 10.0. Differences between two samples of independent variables (group of judokas vs control group) were checked with Student's t-test for independent samples or with Mann-Whitney U-test, depending on the group size and data distribution. Differences between two samples of dependent variables (right-side and left-side measurements in the groups) were checked with Student's t-test or with the Wilcoxon signed-rank test, depending on group size and data distribution. The level of statistical significance was set at  $p < 0.05$  and  $p < 0.01$ . In order to assess the direction and intensity of changes in the anthropometric measurements the method of comparative profiles method was used, which permitted description of a single or multiple characteristics in relation to a baseline characteristic [39].

## RESULTS

The judokas did not differ in terms of age and body height from their non-training counterparts, but featured significantly higher BMI, body mass and intracellular water (Table 1). No significant

differences were revealed in body fat (as estimated by the BIA) and fat distribution (as estimated with the circumference measurements and WHR).

In comparison with the control group the female judoists had significantly greater arm and forearm circumferences on both limbs; however, no significant differences were found in the circumferences of the legs between the groups (Table 2). Out of the six skinfold thickness measurements, four revealed statistically significant differences between the two groups. The judokas had thinner *triceps*, *abdominal* and *calf* skinfolds, measured on both sides of the body. The thickness of the *suprailiac* skinfold was, however, greater in the judokas (statistically significant on the right side). The hand grip strength measurements revealed no significant differences between the group of judokas and the control group (Table 1, Figure 1).

In the control group morphological asymmetry expressed by the differences in limb circumferences was in agreement with the women’s declared lateral motor asymmetry. Statistically significant differences were noted between the circumferences of the forearms and the thighs. In each case,

the asymmetry was right-sided (Tables 2 and 3). In the judokas, statistically significant differences were only found between the forearm circumferences, with a marked right-dominance (Table 2).

As for the distribution of subcutaneous fat, expressed by skinfold thickness measurements, a statistically significant morphological asymmetry was only revealed for the *triceps*, *suprailiac* and *abdominal* skinfolds in the control group, and only for the *suprailiac* skinfold in the group of judokas (Table 2 and 3). In the case of the *suprailiac* skinfold the direction of morphological asymmetry was different in both groups of women: left-dominant in the control group, and right-dominant in the group of judokas (Table 2).

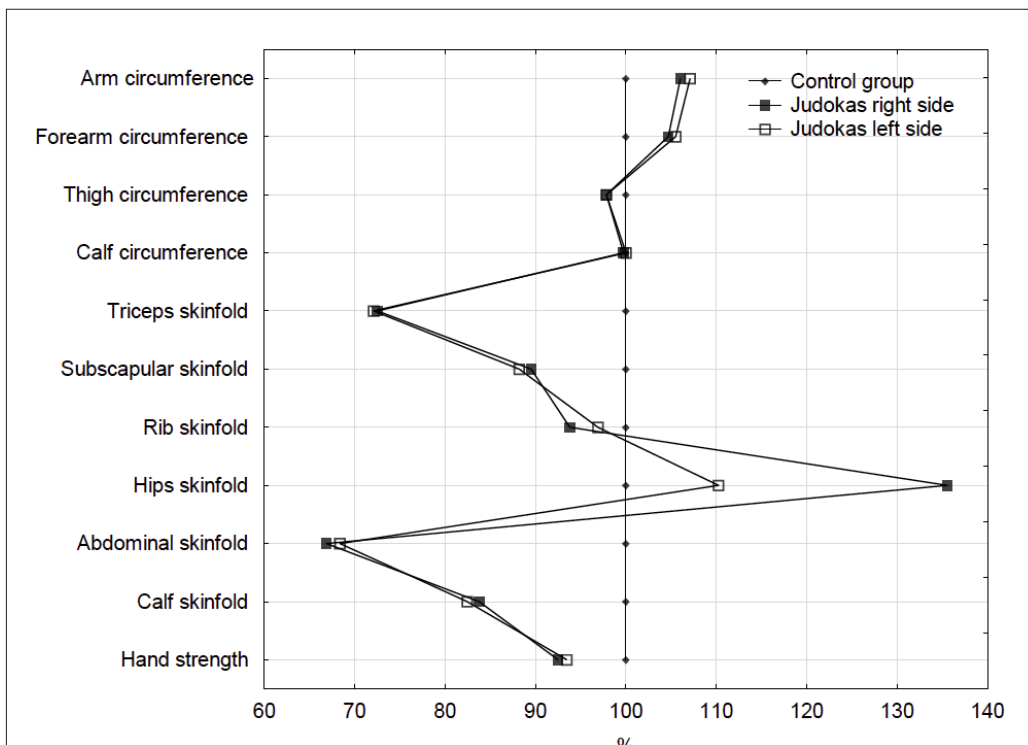
The comparison of hand grip strength measurements indicated a marked dynamic asymmetry with right-side dominance in the non-training women (statistically significant), and no statistically significant changes in the group of judokas (Tables 2 and 3).

The vast majority (72%) of right-handed judokas represented a right-side functional dominance while performing basic judo techniques. Left-side

**Table 1.** Body composition and anthropometric measurements (means and ± standard deviation) in female judokas and inactive sports.

Variable	Female	
	judokas (n = 25)	inactive sports (n = 34)
Age (years)	20.17 ±3.12	20.08 ±0.84
Body height (cm)	164.96 ±6.93	165.99 ±5.52
Body weight (kg)	<b>60.56* ±9.48</b>	<b>56.01* ±7.03</b>
BMI (kg/m <sup>2</sup> )	<b>22.13** ±2.01</b>	<b>20.33** ±2.31</b>
Waist (cm)	68.88 ±5.15	66.69 ±4.36
Hips (cm)	94.84 ±6.19	94.10 ±4.46
WHR	0.73 ±0.03	0.71 ±0.03
Fat mass (kg)	15.94 ±3.79	14.17 ±3.18
Fat mass (%)	26.12 ±3.26	24.70 ±3.17
Fat free mass (kg)	44.63 ±6.53	42.57 ±3.69
Fat free mass (%)	73.88 ±3.26	75.30 ±3.17
Total body water (l)	32.99 ±4.06	31.66 ±2.21
Total body water (%)	54.84 ±3.61	56.02 ±3.28
Intracellular water (l)	<b>19.57* ±1.73</b>	<b>18.78* ±1.23</b>
Extracellular water (l)	13.42 ±2.53	12.88 ±1.39
Body cell mass (kg)	23.58 ±3.38	22.27 ±2.24
Body cell mass (%)	39.14 ±2.25	39.45 ±2.27

Comparison between the judokas and inactive sports \*<0.05; \*\*<0.01



**Figure 1.** Selected somatic traits of the female judokas (n = 25) in comparison with the control group (n = 34).

functional dominance was only observed in 16% of the right-dominant judokas. Whereas 12% of the examined judokas declared the symmetrical use of techniques during judo randori and competition. The right-dominant female judokas featured a right-dominant morphological asymmetry in the forearm circumferences, like in the control group (Table 3).

The judokas who preferred left-side attacks and symmetrical attacks displayed no morphological asymmetry in limb circumferences, i.e. no statistically significant differences between the right and the left sides of the body were found. However, it may be noted a change in direction of asymmetry, with a predominance of left upper limb in right-dominant and symmetrical judo athletes compared with the control group. Marked symmetrisation in skinfold thickness can be noted in the female judokas – the most significant in the symmetrical group – in comparison with the control group. A significant morphological asymmetry can be noted in the *suprailiac* skinfold thickness. Unlike in the control group, this skinfold on the right side was significantly thicker than on the left side of right-dominant and left-dominant judokas. The symmetrical judokas did not feature any asymmetry of the *suprailiac* skinfold thickness (Table 3).

Only in the judokas who preferred attacks on the right side, was the dynamic asymmetry of hand grip strength – like in the control group – in agreement with the declared lateral motor asymmetry. The female left-dominant or symmetrical judokas revealed no statistically significant differences between the right and the left hand grip strength. The judokas preferring attacks on the left side showed a shift in the asymmetry in favor of the left hand (Table 3).

## DISCUSSION

One of the objectives of the present research was estimation of total body fat and fat distribution in young professional female judokas. Judo specific training loads do cause changes in the practitioners' body composition. Body mass and body composition regulation are important tasks during judo training, which is strictly associated with classification of judo athletes into different weight categories [14, 40, 41]. Most often, due to increases in muscle mass and decreases in fat mass during sport training, slight changes in athletes' body mass take place with significant changes in their body composition [33]. The noted increases in body mass and BMI in the examined athletes as compared with the control group result from subtle changes in proportions of body components (body fat and fat free mass).

**Table 2.** Anthropometrical measurements on the left and the right body sides female judokas and inactive (means and  $\pm$  standard deviation).

Variable	Body said	Female		P between judokas and inactive sports
		judokas (n = 25)	inactive sports (n = 34)	
Arm circumference (cm)	right	26.90 $\pm$ 2.03	25.37 $\pm$ 1.87	<0.01
	left	27.00 $\pm$ 1.92	25.21 $\pm$ 1.90	<0.01
Forearm circumference (cm)	right	23.66 $\pm$ 1.46	22.60 $\pm$ 0.99	<0.01
	left	23.38 $\pm$ 1.52	22.16 $\pm$ 1.09	<0.01
	p	*	**	
Thigh circumference (cm)	right	54.88 $\pm$ 3.81	56.09 $\pm$ 3.38	
	left	54.55 $\pm$ 3.80	55.75 $\pm$ 3.43	
	p		*	
Calf circumference (cm)	right	35.06 $\pm$ 2.74	35.15 $\pm$ 1.93	
	left	35.04 $\pm$ 2.70	35.04 $\pm$ 1.81	
Triceps skinfold (mm)	right	11.37 $\pm$ 2.78	15.68 $\pm$ 6.08	<0.01
	left	11.58 $\pm$ 3.07	16.05 $\pm$ 6.03	<0.01
	p		*	
Subscapular skinfold (mm)	right	9.74 $\pm$ 1.86	10.88 $\pm$ 3.15	
	left	9.72 $\pm$ 2.05	11.02 $\pm$ 3.06	
Rib skinfold (mm)	right	9.83 $\pm$ 3.17	10.48 $\pm$ 4.23	
	left	10.02 $\pm$ 3.13	10.34 $\pm$ 3.54	
Suprailiac skinfold (mm)	right	15.82 $\pm$ 5.63	11.67 $\pm$ 4.21	<0.01
	left	13.87 $\pm$ 4.21	12.58 $\pm$ 4.35	
	p	**	*	
Abdominal skinfold (mm)	right	11.11 $\pm$ 3.04	16.62 $\pm$ 5.44	<0.01
	left	10.98 $\pm$ 3.54	16.06 $\pm$ 6.34	<0.01
	p		*	
Calf skinfold (mm)	right	5.16 $\pm$ 1.27	6.16 $\pm$ 1.90	<0.05
	left	5.26 $\pm$ 1.42	6.38 $\pm$ 1.81	<0.05
Hand grip strength (kg)	right	25.58 $\pm$ 4.47	27.65 $\pm$ 4.18	
	left	23.91 $\pm$ 3.48	25.58 $\pm$ 4.08	
	p		**	

p (\*<0.05 or \*\*<0.01) comparison between the right and the left body sides

The larger intracellular water volume observed in the judokas is the evidence of their greater muscle mass. This was also confirmed by Silva et al. [42], who showed that reduced ICW (intracellular water) increased the risk of losing grip strength in elite judokas. Similarly greater arm and forearm circumferences in the examined female judokas indicate higher muscularity of their upper limbs. An increased muscle mass of the arms in elite judokas was also noted by Drid et al. [43]. This is a confirmation of observations of other authors that properly conducted judo training leading to successful

performance is strongly correlated with the development of muscle mass and shows no correlations with an increase in general fatness [14-19]. Also fat distribution, measured with waist circumferences and WHR (waist hip ratio), showed no significant differences between the two groups of women. There were, however, differences in the distribution of subcutaneous fat estimated with skinfold thickness measurements. In five out of six examined skinfolds their thickness was lower (statistically significant for the arm, *abdominal* and *calf skinfolds*) in the judokas than in the control group.

**Table 3.** The average value of the difference measurements performed on the right and left body sides (among judokas in relation to judo throwing techniques)

Variable	Control group (n = 34)	Judokas (n = 25)		
		Attack directions		
		right-dominant (n = 18)	left-dominant (n = 4)	symmetrical (n = 3)
Arm circumference (cm)	0.16	0.06	-0.75	-0.17
Forearm circumference (cm)	0.44**	<b>0.36*</b>	-0.13	0.33
Thigh circumference (cm)	0.34*	0.10	1.38	0.33
Calf circumference (cm)	0.10	-0.08	0.13	0.50
Triceps skinfold (mm)	-0.37*	-0.36	-0.05	0.47
Subscapular skinfold (mm)	-0.14	-0.02	-0.00	0.27
Rib skinfold (mm)	0.14	-0.01	-1.05	-0.07
Suprailiac skinfold (mm)	-0.91*	<b>1.88*</b>	<b>3.20*</b>	0.67
Abdominal skinfold (mm)	0.56*	0.07	0.45	0.33
Calf skinfold (mm)	-0.22	-0.14	0.00	0.07
Hand strength (kg)	2.07**	<b>2.05*</b>	-1.1	1.77

\* &lt; 0.05; \*\* &lt; 0.01

Only the thickness of the *suprailiac* skinfold was statistically greater in the judokas. Similar results were obtained by Hasegawa et al. [23]. The greater adiposity of the hip area in the judokas can be used to maintain body balance on the *tatami* (mats).

Despite the observed differences in the circumferences of the upper limbs between the group of judokas and the control group no differences in hand grip strength between both groups were noted. The lack of these differences was also observed by Dias et al. [44]. According to their study, male judoists were not stronger than the controls but more resistant to fatigue. This can be related to the specificity of judo training, in particular, to longer hand grip maintenance [44].

The other task of this study was to examine whether the motor functions of the limbs and the trunk affect the symmetrisation of limb muscularity and distribution of subcutaneous fat during performing basic judo techniques. Studies show that judo competitors train their dominant body side [37], as evidenced by the greater strength in their dominant extremities [10, 34].

On the other hand, the symmetrisation of body build and mastery of techniques of maintaining body balance are required to ensure body stability during the opponent's attacks [29]. Dopico et al. [36] studied relationships between motor

dominance and functional dominance in judo practitioners. They noted that the vast majority of judokas (66-86%) were right-dominant while performing specific judo techniques. This was also confirmed by the present study in which 72% of right-handed female judokas preferred right-side attacks during judo throws. The remaining 28% of the female judokas declared their preference of attacks on the left side or symmetrically. Sterkowicz et al. [37] also pointed to a strong correlation between motor dominance and preferred side of attacks in judo throws. According to Dopico et al. [36] the probability of sport success does not have to be associated with the standard classification of judokas into right- and left-handed. They claim that a greater probability of success is related to the effective performance of judo techniques on the left side of the body (functional dominance).

Adam et al. [32] proved that judokas often attacked on the right side, however, the effectiveness of their left-side attacks is greater, regardless of their respective weight category. Left-side attack, symmetrisation and variability of combat techniques greatly improve the chances of successful performance in judo competitions [37]. This is why judo training should be directed towards improvement of functional dominance [36]. Our study results show that such training is conducive to better symmetrisation of body

build, which can greatly improve body balance during a judo throw and help avoid injuries [31]. The observed improved symmetry of motor functions, expressed by the measurement of hand grip strength in right-handed female judokas preferring attacks on the left side or both sides can be a manifestation of their more versatile mastery of judo techniques. A greater symmetry in arm and leg movements in elite judokas as compared with non-training controls was described by Mikheev et al. [30].

Correlations between the strength accuracy of the limbs and morphological asymmetry in male and female judokas was also examined by Stefaniak [34]. He showed that smaller asymmetry of thigh circumferences was associated with a higher degree of strength accuracy of the legs, but not of the arms. An analysis of profiles of judo techniques preferred by left-handed competitors revealed a more balanced distribution than the profiles of right-handed competitors. The effectiveness of judo throws to the left or with the left side of the body is similar or higher than the effectiveness of throws performed on the other side [32]. The actions of left-handed judokas are less predictable, and the efficiency of their attacks and control over the opponent's actions are greater [30, 37, 45]. Therefore athletes with bilateral dominance should have a tactical advantage over their opponents and greater chances of successful performance [37].

The present study examined the impact of preferred side of attacks during judo fight in vertical posture on the symmetrisation of selected body build and body function traits in female judo competitors. The most frequently noted judokas are right-handed individuals preferring attacks on the right side. Thus competitors preferring the left or symmetrical direction of attacks during

a judo fight in vertical posture constitute a visible minority among elite Polish female judokas. In the future we intend to carry out similar studies among male judokas and also include left-handed competitors, which may be difficult due the low number of such individuals among judo competitors in general. Lateralization (handedness and footedness) can be estimated with commonly used tests. The estimation of functional asymmetry (side of attacks in judo) should be based an analysis of the most frequently used techniques in judo training.

## CONCLUSIONS

The present study shows that elite female judokas (members of the Polish national women's team) features comparable general fatness and fat distribution to the control group. The judokas have greater muscle mass of the limbs and fatness of the hips, which can affect maintaining body balance during judo throws. The results of the study indicate that functional dominance, understood as the preferred side of attacks during the performance of basic judo techniques, in right-handed female judo competitors, removes the morphological asymmetry of the circumferences of the limbs and of the majority of skinfolds as well as the dynamic asymmetry of hand grip strength. The study confirms the research results of those authors who state that the probability of sport success does not have to be associated with the standard classification of judo practitioner into right- and left-handed, but is rather more related to the type of applied sport techniques. The assessment of the degree of symmetrization of body build and body motor functions can be helpful in the process of control of judo training, and also in relation to successful performance in judo competitions.

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**Cite this article as:** Socha M, Witkowski K, Jonak W et al. Body composition and selected anthropometric traits of elite Polish female judokas in relation to the performance of right-dominant, left-dominant, or symmetrical judo techniques in vertical posture (*tachi waza*). Arch Budo 2016; 12: 257–265