

# The level of physical activity of the working inhabitants of Warsaw practising martial arts and combat sports

## Authors' Contribution:

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

Elżbieta Biernat<sup>1ABCDE</sup>, Dariusz Boguszewski<sup>2CDE</sup>

<sup>1</sup> Warsaw School of Economics, Collegium of World Economy, Department of Tourism, Warsaw, Poland

<sup>2</sup> Medical University of Warsaw, Rehabilitation Department, Physiotherapy Division, Warsaw, Poland

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## Abstract

**Background & Study Aim:** Martial arts and combat sports are a worldwide popular form of exercise. They are trained professionally as well as recreationally. They lead to self-improvement and supporting physical fitness. The aim of the study was relationships between professional and amateur inhabitants of Warsaw practicing combat sports and martial arts training and the level of physical activity.

**Material & Methods:** There were 157 persons practicing combat sports and martial arts who partook in the research. They were selected from the group of inhabitants of Warsaw aged 15-69 years (n=6547) working in public institutes or learning/studying in Varsovian schools/colleges (academies, schools, theatres, offices, councils, town halls, hypermarkets, shops, hospitals, clinics and scientific departments). The investigative tools were two questionnaires: IPAQ and author's one (by means of which biometrical data and the information on the subject of places and the character of practiced martial art and sport was collected). For the statistical elaboration the Chi-square test and Tukey Honest Significant Difference (HSD) tests were used.

**Results:** The studied persons most often ( $p < 0.05$ ) were characterized with the moderate (56.1%) level of physical activity. The highest fraction of persons with high level of physical activity was noted among those training professionally (24.6%), though there was no essential difference in this regard among those exercising recreationally. It was inverse in the case of the low level which relatively more often ( $p < 0.05$ ) referred to those undertaking martial arts and combat sports during their free time (35.0%). The entire weekly energy input of persons practicing martial arts and combat sports recreationally ( $1700.6 \pm 2728.3$  MET-min/week) indeed differed ( $p < 0.05$ ) from the energy-expense of persons training professionally ( $2825.9 \pm 2569.1$  MET-min/week).

**Conclusions:** The level of physical activity of Varsovians practicing martial arts and combat sports is in the vast majority sufficient for maintaining health. The character of trainings is a factor which conditions the lack of fulfilment of WHO norms.

**Key words:** amateur sport, health prophylaxis, professional sport

**Author's address:** Elżbieta Biernat, Department of Tourism, Collegium of World Economy, Warsaw School of Economics, Aleja Niepodległości 162, 02-554 Warsaw, Poland; e-mail: elzbieta.biernat@sgh.waw.pl

**Martial Arts** – are systems of fight practices (practiced in many reasons: self-defence, competition, self-improvement, physical health and fitness, mental and physical development)

**Combat sports** – are a competitive contact sports with one-on-one combat. Determining the winner depends on the particular contest's rules. In many combat sports, a contestant wins by scoring more points than the opponent or by disabling opponent

**The International Physical Activity Questionnaires (IPAQ)** - the purpose of the questionnaires is to provide common instruments that can be used to obtain internationally comparable data on health-related physical activity. More detailed information on the IPAQ process and the research methods used in the development of IPAQ instruments is available at [www.ipaq.ki.se](http://www.ipaq.ki.se) [32,71]

**Varsovians** – inhabitants of Warsaw, the capital city of Poland.

## INTRODUCTION

Far East martial arts and combat sports are not only an exotic fragment of physical education, but also an essential part of global civilization [1, 2]. It is true that the transfer to Western culture has slightly changed their character [3] into forms practised mostly within the framework of fitness, however, due to their values [4-6] they are still very popular [7,8]. Practised both professionally as well as recreationally, they lead to self-improvement and maintenance of physical fitness [9-12], and long-term and persevering work results in a specified lifestyle [13,14]. An essential place in this style is occupied by engagement, self-reflection and regularity in training, and consequently permanent care for own health and comfort [15] as well as avoidance of risky behaviours [16]. Martial arts, even when realized as a hobby, constitute an important element of life quality improvement and prevention of civilization diseases [17]. Each element of the technique (at present there are about 200 techniques in the world) protects the person exercising from physical problems by improving blood circulation [12] and posture [10], reducing stress [18], inhibiting the decrease of musculoskeletal system functioning [19], reducing the risk of falls and injuries following them [20-23]. The specificity of martial arts and combat sports demands engagement of practically all training and coordinative motor abilities such as speed, strength, endurance and equilibrium [24,25] (both in recreational training and sports rivalry). All this makes people practicing judo, karate, other numerous Far Eastern martial arts as well as wrestling, boxing or fencing become “the testing ground” of scientific research (practically in all fields of science associated with sport, physical effort and health). Physiologists, doctors, psychologists, along with representatives of other sciences connected with the development of sport and physical education have been closely cooperating for a long time in monitoring health and physical capacity during active training of these sports activities and observing their long lasting results [26,27].

The main objective of this study was the relationships between professional and amateur combat sports and martial arts training and the level of physical activity. The problems of health-related physical activity standards (of professional and amateur athletes) and socio-demographic factors were analysed.

The above assumption leads to the supporting objectives of the study. One of them could be doing research among people practising martial arts and combat sports, particularly to evaluate the beneficial health measures such as the level of physical activity.

It is interesting to investigate whether the character of trainings (professional or recreational) can be the factor which determines this level? Do those practising combat sports leisurely have the same chance to realize health related norms of physical activity (recommended by the World Health Organization) as those systematically training in clubs under instructors' eyes? It seems possible thanks to the implemented rules of regularity, self-discipline, strong will and constant psychophysical self-improvement) and the shaped, both in sport and everyday life, desirable personality features [28].

## MATERIAL AND METHODS

A sample (n=157) of people training martial arts and combat sports participated in the study. They were chosen from the group of Varsovians aged 15-69 years (n=6547) working in Warsaw public institutions (higher education schools, schools, theatres, offices, municipalities, hypermarkets, shops, hospitals, clinics and science institutes) or studying in Warsaw higher education schools. The selection of the whole test group (n=6547) involved a two-stage draw (3-10 institutions employing people of a given profession, and then a 30 percent sample). A slightly different procedure was applied in the case of pupils/students. In each drawn school/college there was drawn one class/student group of a defined level and then all its members present on a given day underwent the tests.

The study was done in the form of a questionnaire. The direct (standardized) interview was led by trained and superintended pollsters, according to a defined schedule (the number of questions asked and their formula were identical for all the respondents).

There were two questionnaires applied. The first questionnaire used was called *Participation of Warsaw Inhabitants in Sport, Leisure and Tourism*. The second one was *International Physical Activity Questionnaire (IPAQ)*. The first one collected information about the places and character of the trained martial arts and combat sports in the last year (professional and recreational). The professional practice meant a training done in an organized way (the condition for classification was an athletic club membership and participation in trainings and contests), and the recreational one implied that trainings were done for own pleasure, during free time. On the basis of a declaration of participation in these forms, there was chosen a group of 157 persons (4.1% of the whole sample), which became the object of the present study.

Apart from the questions concerning the undertaken martial arts and combat sports, pollsters collected data concerning gender, age, education, body height and mass, gross income per person in the family and marital status. Based on the data, the respondents were divided into individual categories: age (<19, 20-29, 30-39, 40-49, ≥ 50 years), marital status (single, divorced, widowed, in a permanent relationship – marriage or partnership), education (higher, middle, student), income (<1300, 1300-2099, 2100-2699, >2700 PLN) and BMI (underweight, normal, overweight, obese). BMI categorization for persons under 18 was done according to Cole's index [29]. In the case of adults, the value of the variable and the adherence to individual categories were calculated on the basis of the WHO classification [30]. The numbers of the examined subjects in each category are presented in Table 1.

The second questionnaire – a shortened version of the International Physical Activity Questionnaire (IPAQ) – enabled to collect information about the frequency and duration of all physical efforts (intensive, moderate and walking) undertaken by the respondents in the last week. Based on the estimated energy expenditure for each type of efforts (in MET-min/week), after the standard count [31], the level of physical activity (high, moderate or low) was established. 1 MET is equal to oxygen consumption at rest and amounts to 3.5 ml O<sub>2</sub>/kg of body mass per minute.

The relationships between the character of practised martial arts and combat sports (professional and recreational), the declared efforts (intensive, moderate and walking) and the level of physical activity (low, moderate or high) were evaluated with the Chi-square test, and between the average MET-min/week of the entire weekly energy expenditure with the use of Tukey's HSD test.

**Table 1.** Characteristics of the research group (n=157)

Characteristics of the research group	Martial arts and combat sports practitioners				
	Professional (n=57)		Amateur (n=100)		
	n	%	n	%	
Gender	Men	43	75.4	62	62.0
	Women	14	24.6	38	38.0
Age	≤19 years old	25	43.9	25	25.0
	20-29	22	38.6	54	54.0
	30-39	6	10.5	16	16.0
	40-49	2	3.5	2	2.0
	≥50	2	3.5	3	3.0
Marital status	In a relationship	7	12.3	14	14.0
	Single	49	86.0	86	86.0
Education	University level	21	36.8	44	44.0
	High-school level	11	19.3	32	32.0
	Student	25	43.9	24	24.0
Income (in family per capita)*	<1300 PLN	12	21.1	22	22.0
	1300-2099	3	5.3	14	14.0
	2100-2700	1	1.8	10	10.0
	>2700	3	5.3	5	5.0
BMI	underweight	10	8.8	5	10.0
	normal	61	75.4	43	61.0
	overweight	25	14.0	8	25.0
	obese	2	1.8	1	2.0

\* Income (in family per capita): <1300 PLN (325€; 349\$); 1300-2099 (325-524€; 349-562\$); 2100-2700 (525-675€; 563-724\$); >2700 (675€; 724\$)

The relationships between the level of physical activity (low, to moderate/high) and the factors such as character of trainings, gender, age, BMI, marital status, education and income were rated by means of the log-linear analysis. In order to define the optimal model for testing there was found the value of the Chi-square test for main effects without interactions, and then extended models were analysed with regard to higher-order interactions. The significance of the analysed correlations in the studied model was rated on the ground of partial and marginal relationships. The partial relationship informs us if the suitable interaction has an influence on the adjustment of the model, when all the other effects of the same rank are already in the model. The marginal relationships, however, make it possible to compare the model without any interactions with the model which takes into account only the given correlation. In order to adjust the model to the observed numbers, there was used an iterative procedure, which was interrupted when the difference between well-fitting and observed marginal distribution was not greater than the criterion of convergence = 0.01. The differences between individual categories of qualitative variables were analysed by means of the Chi-square test. The results obtained in the analysis were presented by means of fractions and odds ratios together with 95% confidence intervals. The analyses were performed with the

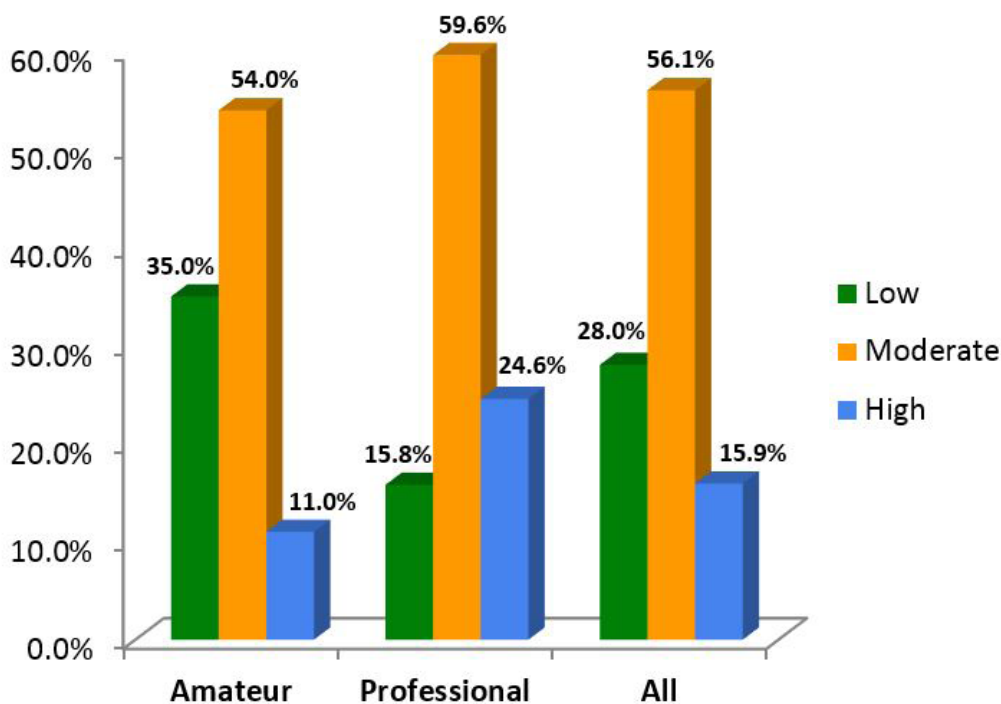
use of the statistical set STATISTICA 9.0 PL (IBM SPSS Statistics). In the estimation of the significance of effects the level  $p < 0.05$  was assumed.

## RESULTS

Among all the working and studying inhabitants of Warsaw practising martial arts and combat sports ( $n=157$ ), 36.3% declared membership of athletic clubs and professional participation in trainings and contests whereas 63.7% of the respondents declared recreational form of practising those disciplines.

Generally, the respondents more often ( $p < 0.05$ ) were characterized by the moderate (56.1%) level of physical activity, than low (28.0%) or the high one (15.9%). A similar phenomenon was observed in each group – practising recreationally (54.0%) and professionally (59.6%). Both, in the first as well as in the second case, the moderate level appeared more often ( $p < 0.05$ ) than low (respectively 35 and 15.8%) and the high one (respectively 11.0 and 24.6%) (Figure 1).

The highest percentage of subjects with a high level of physical activity was noted among those training professionally (24.6%), although there were no significant differences in that in relation to those exercising recreationally. The opposite situation was in the



**Figure 1.** Percentages of martial arts and combat sports practitioners (amateur, professional, all) according to their levels of physical activity (low, moderate, high)

case of low level practice, which relatively more often ( $p < 0.05$ ) concerned those undertaking martial arts and combat sports in their free time (35.0%).

The entire weekly energy expenditure of people practicing martial arts and combat sports recreationally ( $1700.6 \pm 2728.3$  MET-min/week) is significantly different ( $p < 0.05$ ) from the energy expenditure of those training professionally ( $2825.9 \pm 2569.1$  MET-min/week).

In the case of intensive efforts, both professionals (54.4%) and amateurs (84.0%) more often ( $p < 0.05$ ) declared the expenditure smaller than 600 MET-min/week and not higher. However, those exercising leisurely, more often ( $p < 0.05$ ) reported the expenditure of this kind than professionals (Table 2).

**Table 2.** Percentages of people undertaking intensive and moderate efforts and walking (in MET-min./week) depending on the character of their sports practice (professional/amateur)

MET-min./week	Martial arts and combat sports practitioners			
	Professional (n=57)		Amateur (n=100)	
	n	%	n	%
Intensive efforts				
<600	31	54.4 <sup>a</sup>	84	84.0 <sup>b,c</sup>
600-1499	12	21.1	30	30.0
1500-3000	7	12.3	9	9.0
>3000	7	12.3	19	19.0
Moderate efforts				
<600	31	54.4 <sup>b</sup>	82	82.0 <sup>b,c</sup>
600-1499	19	33.3 <sup>c</sup>	13	13.0
1500-3000	5	8.8	2	2.0
>3000	2	3.5	3	3.0
Walking				
<600	33	57.9	60	60.0
600-1499	17	29.8	34	34.0
1500-3000	5	8.8	4	4.0
>3000	2	3.5	2	2.0

<sup>a</sup> - <600 vs. others; <sup>b</sup> - <600 vs. >1500; <sup>c</sup> - amateur versus professional

The situation is similar with regard to moderate efforts, the expenditure <600 MET-min/week was more frequent (in both groups;  $p < 0.05$ ), however, it appeared significantly more often ( $p < 0.05$ ) among those training combat sports recreationally (82.0%) than among the ones training professionally (54.4%).

A reverse situation concerned the range 600-1499 MET-min/week, because it was relatively more often ( $p < 0.05$ ) noted among professionals (33.3 vs 13.0%).

Walking did not distinguish respondents in this regard.

The factors which determined the level of physical activity of Varsovians training martial arts and combat sports were the character of undertaken trainings and age (Table 3). The calculated odds ratio (OR) showed that subjects exercising recreationally (35%) in relation to those training professionally (15.8%) were at three times greater risk (OR=0.34) of not fulfilling the health related WHO norms (occurrence of low physical activity level). A similar risk concerns young people (18.0%), respondents aged 30-39 (40.9%; OR=0.32) and those  $\geq 50$  (40.0%; OR=0.33). In comparison with 20-29 year olds (30.3%) and 40-49 year olds (25.0%), the risk is smaller and amounts respectively to OR=0.66 and 0.51.

## DISCUSSION

In compliance with the latest recommendations of the World Health Organization (WHO) [32] for healthy persons aged 18–64 years, the minimum amount of physical effort should be 600 MET- min/week which equals to at least 150 min/week of moderate efforts or at least 75 min/week of intensive efforts, or their suitable combination. In order to obtain additional health benefits, adults should prolong the time of moderate efforts to 300 min/week or the time of intensive efforts to 150 min/week, or the equivalent of the combination of moderate and intensive efforts should equal 1200 MET-min/week. With reference to subjects over 65 years of age, there are generally the same objectives as for younger and healthy adults. However, strength training (at least 2 days per week) including the main groups of muscles seems to be of great importance for this age group. Also, particularly for people with poor mobility, balance exercises helping to prevent falls and early disability due to civilization diseases (at least 3 days per week) [33] are essential.

All these recommendations can be successfully realized through martial arts and combat sports, which are a recognized and valued tool restoring and supporting health [34-38], fitness and exercise capacity of a person [12,39]. These sports are valued not only in China, where 14.1% of school children train them regularly, or in Japan where judo is an element of physical education in schools, but also in the USA where 8.1% of the citizens train and in many other countries worldwide

**Table 3.** Determinants of physical activity level, odds ratios (OR) and 95% confidence interval limits (95% CI)

Determinants	Low		Moderate/high		p	OR	95% CI
	n	%	n	%			
Type of training					0.009756		
Professional	9	15.8	48	84.2		1	-
Amateur	35	35.0	65	65.0		0.34	0.15-0.77
Gender					NS		
Men	31	29.5	74	70.5		0.63	0.30-1.32
Women	13	25.0	39	75.0		1	-
Age					0.045207		
≤19 years old	9	18.0	41	82.0		1	-
20-29	23	30.3	53	69.7		0.51	0.21 - 1.21
30-39	9	40.9	13	59.1		0.32	0.10 - 0.97
40-49	1	25.0	3	75.0		0.66	0.06- 7.08
≥50	2	40.0	3	60.0		0.33	0.05 -2.27
Marital status					NS		
In a relationship	9	42.9	12	57.1		0.47	0.18- 1.20
Single	35	25.9	100	74.1		1	-
Education					NS		
University level	22	33.8	43	66.2		0.44	0.18-1.07
High school level	13	30.2	30	69.8		0.52	0.20- 1.37
Student	9	18.4	40	81.6		1	-
Income (in family per capita)*					NS		
<1300 PLN	2	18.2	9	81.8		1	-
1300-2099	9	26.5	25	73.5		0.62	0.11- 3.42
2100-2700	6	35.3	11	64.7		0.41	0.07-2.53
>2700	2	25.0	6	75.0		0.67	0.07-6.11
BMI					NS		
Underweight	2	13.3	13	86.7		1	-
Normal	27	26.0	77	74.0		0.44	0.09- 2.07
Overweight	13	39.4	20	60.6		0.24	0.05-1.23
Obese	1	33.3	2	66.7		0.31	0.02-5.19

\* Income (in family per capita): <1300 PLN (325€; 349\$); 1300-2099 (325-524€; 349-562\$); 2100-2700 (525-675€; 563-724\$); >2700 (675€; 724\$)

NS – non-significant; odds ratios (OR) were counted in relation to low physical activity level

[40-44]. Bergier et al. [45] think that this special form of activity is losing nowadays its strictly military value and can successfully contribute to the improvement of public health. The multiplicity of techniques guarantees the possibility of choosing one or several of them and practicing them actively from childhood till old age [19,20] regardless of the state of health, physical condition, social and professional status [46] or financial

capacity. It is not without significance that this is a relatively cheap preventive measure not requiring any special preparations or technological conditions [47-49].

The conducted research shows that martial arts and combat sports are undertaken by 4.1% of Varsovians (out of which 63.7% practise recreationally and 36.3% professionally). These people in the vast majority

(72%), regardless of the character of the undertaken trainings, fulfil the WHO recommendations. The moderate level of physical activity (estimated by means of IPAQ) is attained by 56.1% of the respondents, and high by 15.9%. It is true that in each group (training professionally and recreationally) the moderate level (respectively 59.6 and 54%) appears relatively more often ( $p < 0.05$ ) than the high one (respectively 24.6 and 11%), however it does not have any significant meaning for the realization of the health related WHO recommendations because people who achieve the moderate level are classified as those who fulfil one of following three criteria (according to the IPAQ methodology):

- 3 or more days of physical intense efforts not less than 20 minutes daily,
- 5 or more days of moderate efforts or walking not less than 30 minutes daily,
- 5 or more days of any combination of physical activity (walking, moderate or intense efforts) exceeding 600 MET- min / week

According to the latest recommendations, these criteria reflect the necessary amount of *Health-Enhancing Physical Activity* [50], therefore, the achievement of any of them benefits our health [51].

Besides, 15.9% of the studied Varsovians attain defined by the WHO so called additional health benefits. These are respondents who (in compliance with the IPAQ methodology) fulfil one of the following criteria of high-level physical activity:

- 3 or more days of physical intensive efforts, altogether at least 1500 MET-min/week,
- 7 or more days of any combination of physical activity (walking, moderate or intensive efforts) exceeding 3000 MET-min/week.

Taking this position, we can say that as many as 72% of the studied Varsovians training martial arts and combat sports value the meaning of prevention and support their own state of health. We say as many as 72%, because in comparison with other studies, the percentage of physically active people is overwhelming. The available reports point that almost 2/3 of Poles (60%) and Europeans (67%) do not fulfil these recommendations [52]. Similarly, it is approximately 60% among Americans and Brazilians [53-56].

Although, both among highly as well as moderately active Varsovians, there were no essential differences noticed depending on the character of trainings (professional and recreational), however there were some in the case of the low level. It has been

proved that people practicing martial arts and combat sports unprofessionally (35.0%) significantly more often than professionals (15.8%) do not fulfil the WHO health-enhancing norms (and are at three times greater risk of the low level of physical activity). In fact, we might wonder why 15.8% of professionals are characterized by the low level of physical activity. It may be that outside trainings they lead a sedentary lifestyle. Meanwhile, researchers more and more often draw attention to the fact that the consequences of sitting can be independent from the protective role of regular physical activity. Sedentary lifestyle brings other physiological consequences than inadequate physical activity – often even more harmful [57-59].

It seems obvious, however, that those training systematically in athletic clubs (under the watchful eyes of instructors) achieve a higher level of activity, but in the case of this research – this does not refer to the high level. Similarly, in earlier research Biernat et al. [60] noticed that persons playing football leisurely (51.7%) more often ( $p < 0.001$ ) reach the low level of activity than those training in an athletic club (0%). There were no significant differences between the highly active – training professionally (2.5%) and highly active – training unprofessionally (3.3%). Generally, as in Warsaw research, both groups differ ( $p < 0.05$ ) in the entire energy expenditure (professional footballers –  $1323 \pm 150$  MET-min/week; amateur footballers –  $696 \pm 249$  MET-min/week). In the case of Varsovians these mean values are also significantly different ( $p < 0.05$ ) and amount respectively to  $2825.9 \pm 2569.1$  MET-min/week for professionals and  $1700.6 \pm 2728.3$  MET-min/week for amateurs.

The second factor which is connected with the lack of fulfilment of the WHO health enhancing recommendations is the age of the respondents. Of course, the youngest persons – according to most reports [61,62] – are most active and thereby they are at the smallest risk. Martial arts and combat sports are practised by 43.9% of people aged  $< 19$ . In relation to them, those aged  $\geq 50$  and training qualify for the low level of physical activity three times more often. Biernat et al. [46] suggest that older people value less the documented evidence – especially for this age group [63-65] – of health benefits connected with martial arts [66,67]. Cynarski et al. [68] claim that demonstrations of martial arts are comprehended by people rather as forms of promotion of sports disciplines. It is hard to say whether it has a connection with the insufficient activity of 30-40 year olds. It seems that the reason behind over three times greater risk of insufficient physical activity among

people aged 30-39 and almost double among those aged 40-49 can be modern (sedentary and busy) lifestyle. These are after all people in their working age, which can also partly refer to 20-29-year-olds (OR=1.96). Scientists also draw attention to the visible tendency of decrease in the level of physical activity along with reaching a higher level of education (a higher class or a higher year of studies) [69,70], which is not very optimistic. Concluding, martial arts and combat sports, being the source of equilibrium, harmony and health, the wealth of movement and self-realisation possibilities, should be promoted as lifelong sports in the whole society (and especially among young people). Maybe practical activities organized at work and in schools (opening sports clubs) will bring a change to people's lifestyles. Effective campaigns are necessary to inform people of the problem and the consequences of a sedentary lifestyle. There should also be some programmes fighting sedentary behaviours. Further research monitoring the percentage of people practising these forms is necessary, too. The lack of it in accessible literature represents difficulty in drawing conclusions (what authors of the present study are fully aware of).

## CONCLUSIONS

The level of physical activity of Varsovians training martial arts and combat sports is in the vast majority

sufficient for maintaining health which points to a great potential connected with practising those sports.

The promotion of martial arts and combat sports as a lifelong physical activity in society is justified. It not only enables to reach the required health norms, but also shapes certain features of character indispensable in the process of systematic physical activity.

The character of trainings is a factor which conditions the lack of fulfilment of the WHO health enhancing norms. Thus, forms of organized training should be encouraged by opening specialized clubs implementing appropriate training programmes run by professional staff. The age of respondents is another determinant.

The suggestion that future recommendations regarding physical activity should include guidelines referring to the time spent sitting, seems essential. The time spent in a sitting position can sometimes result in different consequences than those resulting from insufficient levels of physical activity.

## COMPETING INTERESTS

Authors declare that we do not have any financial or personal relationships with other people or organizations that could inappropriately influence the paper.

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