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The influence of the self-defence training on the level of physical fitness for uniformed services candidates

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Abstract

Background & Study Aim: Close combat, in a very broad sense including combat sports, martial arts, combat techniques, self-defence, etc., is an important element of military preparation. The aim of the study was the influence of the self-defence training on the level of physical fitness for uniformed services candidates and the correlations between indicators of physical fitness and indicators of body composition.

Material & Methods: The study involved 23 cadets aged 18 years (candidates for special forces) who were pursuing a self-defence program. Self-defence training lasted six months, from October 2017 and in April 2018. InBody720 was used to analyse the body composition. The level of physical fitness was determined on the basis of the International Physical Fitness Test (IPFT). The IPFT was applied twice. Test was conducted in the Laboratory of Physical Effort and Genetics in Sports at Gdansk University of Physical Education and Sport. Statistical analysis was carried out using Statistica ver 12.

Results: Results of the study showed a positive impact of the applied self-defence training on the level of selected physical fitness features. Results of the study proved that subjects demonstrated a high level of physical fitness. A number of correlations between the analysed indicators were found.

Conclusions: Subjects were characterised by high indicators of physical performance, which proves that the applied self-defence training was an appropriate means of stimulating a comprehensive motor development of young people preparing to serve in special forces.

Keywords: cadet • physical preparation • somatic characteristics • special forces

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INTRODUCTION

Physical preparation – activities aiming at raising the athletes fitness potential at the highest level mainly through perfecting functions of various organs and systems in the body. It is frequently called a fitness preparation.

Somatic characteristics – somatic features defining the properties of human body composition. It is often used, e.g. to define the body somatotype, proportions or composition of the body.

Cadet – a student of a uniformed school focused on basic military training and general education.

Special forces – elite military or police formations designed to perform unconventional tasks in harsh conditions, most often in selected small groups of soldiers or officers characterized by a very high level of training.

Performance – *noun* the level at which a player or athlete is carrying out their activity, either in relation to others or in relation to personal goals or standards [34].

Self-defence *noun* fighting techniques used for defending oneself against physical attack, especially unarmed combat techniques such as those used in many of the martial arts [34].

Defensive education, which encompasses widely understood physical culture, involves all soldiers of the Polish Army, serves the creation, promotion and maintenance of good health, fitness and mental and physical resilience [1]. Close combat, in a very broad sense including combat sports, martial arts, combat techniques, self-defence, etc., is an important element of military preparation [2]. Many practitioners and theoreticians, not only from military fields, perceive the ability to fight in direct contact as one of the basic elements of a direct preparation of soldiers, especially of special units [3].

Physical fitness and health are and will remain the basic criteria of suitability for military service [4]. Trześniowski [5] defines physical fitness as human readiness to take up and solve difficult movement tasks in various life situations that require strength, speed, dexterity, flexibility, agility, endurance as well as certain acquired and shaped motor skills and habits based on appropriate mobility talents. The basis for physical fitness lies in complex biological processes and mechanisms, and its manifestation are movement phenomena defined by indicators of motor development [6].

A fit person is versatile; he/she quickly and optimally adapts to the environment and new movement tasks [7]. This is vital in terms of physical fitness in the uniformed services and in preparation stages to such services. In selection to professional service, candidates are subjected to fitness tests. Shaping pro-health attitudes and caring about the required level of physical fitness should be a priority already at the early stages of previous school education.

The issue of the important role of physical education and of the development of soldiers' physical fitness has been a subject of research, among others, by Kęsik [8], Sokołowski [9], Śmiałek [10], or soldiers in extreme situation Tomczak [11-14]. Extensive data on physical education in the Polish Army [15-17] as well as the conscripts' physical fitness [4] has been collected. Research has also been conducted on the variability of the somatic composition characteristics and of motor skills of the soldiers of the compulsory military service and of students of physical education [18], and on the impact of selected elements of lifestyle on shaping the level of cadets' morphofunctional development [19]. Unfortunately, no similar studies related to youth attending school of a uniformed profile have been found.

Therefore, an attempt has been made to determine the level of physical fitness of 18-year-old cadets and senior cadets from secondary school classes of the profile "special forces" who participated in mandatory self-defence classes. Particular attention has been given to determining the impact of 6-month self-defence training on the subjects' physical fitness level the correlation between the indicators of height, body weight and bioimpedance and the indicators of physical fitness.

The aim of the study was the influence of the self-defence training on the level of physical fitness for uniformed services candidates and the correlations between indicators of physical fitness and indicators of body composition.

MATERIAL AND METHODS

Participants

The study involved 23 cadets and senior cadets, pupils of the Spartacus Uniformed Secondary School in Gdańsk pursuing a 6-month self-defence program. The group comprised 10 girls and 13 boys. The mean body weight in the group of girls was 62.94 ±10.1 kg and the mean body height 164.9 ±7.7 cm. In the group of boys, the mean body weight was 82.3 ±14.1 kg and the mean body height 177.9 ±5.2 cm.

Study design

The subjects attended mandatory self-defence classes of three hours per week and one hour of physical education. Among others, the curriculum included basics of the techniques of falls (*ukemi*), throwing techniques (*nage waza*), grappling (*katame waza*), strikes and kicks (*atemi waza*) and ways of releasing from grappling and grips.

InBody720 was used to analyse the body composition (the examination was performed after 6 months of training). The following indicators were analysed: SMM – skeletal muscle mass, FFM – fat free mass, BFM – body fat mass, PBF – percentage of body fat, BMI – body mass index.

The level of physical fitness was determined on the basis of the International Physical Fitness Test (IPFT), which was conducted within two

days [20]. An assessment of fitness in trials one to tree was performed on the first day. Trials from four to eight were performed on the second day. The calculations of the results obtained in particular trials were made on the basis of tables according to the groups of the calendar age. The study was conducted twice, in October 2017 and in April 2018 at the Laboratory of Physical Effort and Genetics in Sports and in sports facilities at Gdansk University of Physical Education and Sport in Gdańsk. All the examined persons expressed their consent to participate in the study.

Statistical analysis

Statistical analysis was carried out using the StatSoft statistical package Inc. (2014) STATISTICA (data analysis software system) version 12.0 [21] and the EXCEL spreadsheet. Quantitative variables were characterised with the arithmetic mean, standard deviation, median, minimum and maximum values (range) and 95% CI (confidence interval). However, qualitative variables were presented by means of the number and percentage values. To check whether a quantitative variable came from a population with a normal distribution, the Shapiro-Wilk W test was used. To check the hypothesis of equal variances, the Levene (Brown-Forsythe) test was used. The significance of differences between the two groups was verified with the t-Student test. In order to establish the relationship of the strength and the direction between the variables, a correlation analysis was applied to calculate the Pearson correlation coefficients. In all calculations, the significance level of p = 0.05 was adopted.

RESULTS

The mean level of girls' fitness in the IPFT at baseline was 417.8 ±69.5 points (min max 314÷525). The percentage of girls with a low fitness level was 10.0% (one person), of those with an average one 60.0% (six persons) and with a high one 30.0% (three persons). The mean level of girls' fitness in the IPFT after 6 months amounted to 439.3 ±45.5 points (min max 365÷528). The percentage of girls with an average level of fitness was 80.0% and proved to be higher compared to the first study. The percentage of persons with a high level of fitness decreased from 30% to 20% (Table 1).

In the group of girls after 6 months of self-defence training, the efficiency in the test *50 m run* significantly increased (p = 0.0117), just as in the test *arm hang* (p = 0.0180). In the other tests, the results obtained in the second measurement did not change in a statistically significant way: *800 m run* (p = 0.2076), *standing long jump* (p = 0.3270), *sit-ups* (p = 0.5663), *grip strength* (p = 0.7150), *forward bend* (p = 0.5294), *shuttle run 4x10 m* (p = 0.6776). The level of physical fitness after 6 months did not change statistically significantly (p = 0.5294) (Figure 1).

Table 1. IPFT results in the group of girls (n = 10) at baseline and after 6 months (2nd test).

IPFT trials	1st test			2nd test		
	Mean & SD		Min÷Max (points)	Mean & SD		Min÷Max (points)
	values of trials	points		values of trials	points	
50 m run (s)	8.57 ±0.7	48.2 ±18.4	3÷70	8.4 ±0.7	56.2 ±8.8	36÷72
800 m run (s)	251.3 ±44.2	46.8 ±11.8	22÷67	242.5 ±40.0	49.2 ±11.3	22÷66
Standing broad jump (cm)	181.7 ±25.3	56.6 ±12.6	36÷73	181.7 ±22.5	56.8 ±11.3	39÷75
Sit-ups (number)	23.1 ±3.8	56.3 ±8.5	45÷70	24.5 ±3.0	57.5 ±6.9	48÷70
Grip strength (kg)	27.0 ±5.0	48.6 ±9.4	35÷63	27.2 ±5.7	48.9 ±10.6	35÷64
Forward bend (cm)	14.1 ±6.2	55.8 ±12.1	42÷81	14.3 ±4.8	55.4 ±8.0	43÷69
Shuttle run 4x10 m (s)	11.1 ±0.7	63.1 ±6.4	49÷72	11.23 ±0.9	62.2 ±7.8	51÷72
Arm hang (s)	12.4 ±10.5	42.4 ±23.0	0÷67	15.46 ±11.1	53.1 ±7.3	43÷67
Level of fitness (sum of points)		**417.8 ±69.5**	**314÷525**		**439.3 ±45.5**	**365÷528**

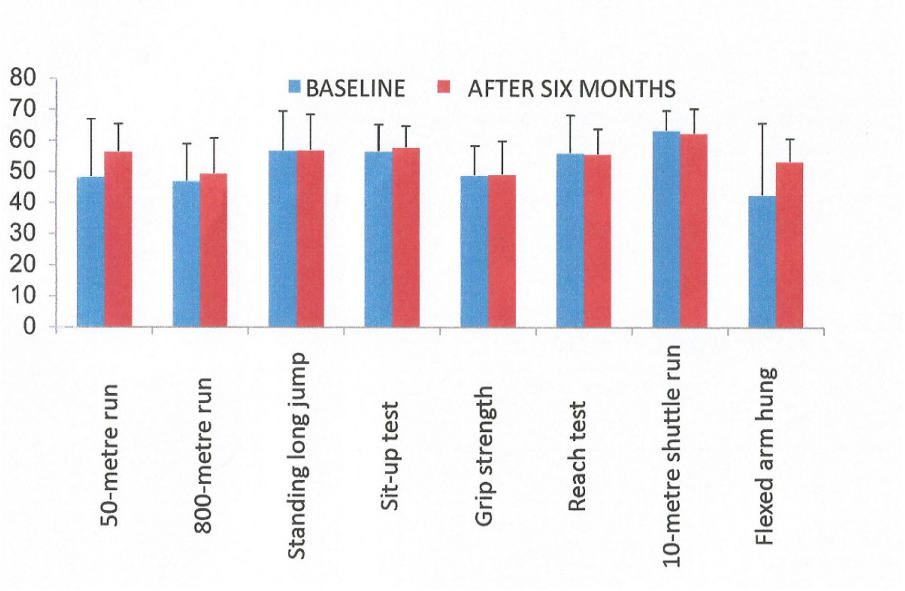

Figure 1. Comparison of the IPFT results at baseline and 6 months in the group of girls (n = 10).

The mean level of boys' fitness in the IPFT test at baseline was 403.3 ±37.2points (min max 347÷482). The percentage of boys with an average level of fitness was 92.3% and with a high one 7.7%. The mean level of boys' fitness in the IPFT test after 6 months amounted to 420.6 ±40.8 points (min max 350÷499). The percentage of boys with an average fitness level was 92.3% and with a high one 7.7% (Table 2).

After 6 months of training in the group of boys, their performance in the *50 m run* significantly increased (p = 0.0051) as well as in the test *1000 m run* (p = 0.0030). Statistically significantly better results were also observed in the *sit-ups* test (p = 0.0251) and in the *grip strength* test (p = 0.0199). No statistically significant differences were observed between the results obtained in both measurements in the *standing broad jump* test (p = 0.0869), *forward bend*

Table 2. IPFT results in the group of boys (n = 13) at baseline and after 6 months (2nd test).

IPFT trials	1st test			2nd test		
	Mean & SD		Min÷Max (points)	Mean & SD		Min÷Max (points)
	values of trials	points		values of trials	points	
50 m run (s)	7.3 ±0.6	50.3 ±10.2	33÷69	7.1 ±0.5	54.7 ±9.7	36÷74
800 m run (s)	246.4 ±29.2	44.0 ±10.6	28÷59	241.2 ±28.3	46.2 ±10.4	29÷60
Standing broad jump (cm)	231.9 ±28.5	54.2 ±12.5	32÷82	233.5 ±30.4	55.0 ±13.4	34÷84
Sit-ups (number)	26.2 ±2.8	51.6 ±6.1	38÷60	27.8 ±2.2	55.1 ±4.8	47÷60
Grip strength (kg)	44.5 ±6.0	46.2 ±6.6	35÷59	46.8 ±5.6	48.5 ±6.2	39÷59
Forward bend (cm)	10.8 ±3.6	53.8 ±4.8	43÷61	10.8 ±3.5	53.6 ±4.6	46÷59
Shuttle run 4x10 m (s)	10.5 ±0.7	55.0 ±7.1	45÷68	10.4 ±0.5	56.0 ±5.6	45÷62
Arm hang (s)	5.3 ±3.7	48.2 ±8.7	37÷69	6.7 ±3.6	51.5 ±8.2	40÷69
Level of fitness (sum of points)		**403.3 ±37.2**	**347÷482**		**420.6 ±40.8**	**350÷499**

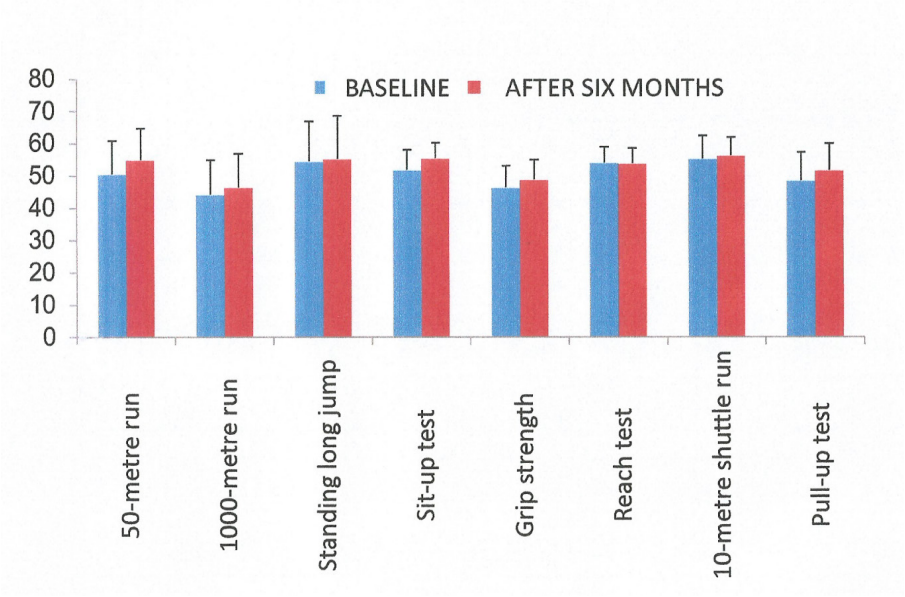

Figure 2. The IPFT results at baseline and after 6 months in the group of boys (n = 13).

(p = 0.8612), *shuttle run 4x10 m* (p = 0.5925) and in the *pull-ups* test (p = 0.0590). After 6 months of training, the level of physical fitness in the group of boys significantly increased compared to the level obtained in the first measurement (p = 0.0006) (Figure 2).

The boys were characterized by a significantly higher SMM (p = 0.0001) and FFM (p = 0.0023) value compared to girls. In the examined group of boys, a significantly higher PBF value in comparison to girls (p = 0.0287) was also observed. No statistically significant correlations were found in the case of BFM and BMI (Table 3).

Based on the obtained results, it was found that in the group of girls, along with an increase in the SMM level, the result value in the *50 m run* (r = −0.72) decreased, as did the result value in the *800 m run* (r = −0.79). On the other hand, along with an increase in the BFM level, the result value in the *grip strength* test increased (r = 0.68), and the result value in the *shuttle run 4x10m* (r = 0.71) also grew. The study also showed that with the increase in BMI in the examined group of girls, the result of the *grip strength* trial also increased (r = 0.77). It was also observed that in the examined group of girls, an increase in body height was accompanied by a decrease in the result of the *800 m run* trial (r = −0.72) (Table 4).

In the group of boys, the number of correlations between the analysed indicators proved to be smaller than in the case of girls. With increased body weight, the result in the *grip strength* test grew (r = 0.62). No statistically significant

Table 3. Comparative characteristics of the groups of girls and boys in terms of bioimpedance indicators.

Variable	Group of girls (n = 10)		Group of boys (n =13)		P-value
	Mean & SD	Min÷Max value	Mean & SD	Min÷Max value	
SMM (kg)	25.7 ±3.7	19.7÷31.1	38.4 ±5.2	30.8÷51.1	0.0001
FFM (kg)	45.1 ±5.5	36.8÷52.5	63.2 ±15.3	22.7÷88.0	0.0023
BFM (kg)	16.7 ±7.4	10.0÷32.5	14.5 ±10.7	4.9÷36.3	0.2313
PBF (%)	26.4 ±8.2	17.7÷40.4	16.7 ±10.0	7.0÷36.3	0.0287
BMI (kg/m^2)	23.2 ±4.2	18.9÷33.1	26.0 ±4.0	21.5÷33.0	0.1765

SMM skeletal muscle mass, **FFM** fat free mass, **BFM** body fat mass, **PBF** percentage of body fat, **BMI** body mass index.

Table 4. Correlation of the indicators body height and body weight and bioimpedance indicators with physical fitness indicators after 6 months of training in the group of girls (n = 10).

IPFT trials	Body height (cm)	Body mass (kg)	SMM (kg)	FFM (kg)	BFM (kg)	PBF (%)	BMI (kg/m^2)
50 m run (s)	–0.50	–0.40	–0.72	–0.57	0.39	0.42	0.17
800 m run (s)	–0.72	–0.42	–0.79	–0.63	0.13	–0.06	0.11
Standing broad jump (cm)	–0.61	–0.26	–0.45	–0.37	0.00	–0.30	0.21
Sit-ups (number)	–0.11	–0.23	–0.01	0.32	0.39	0.40	0.00
Grip strength (kg)	0.12	0.55	0.39	0.23	0.68	0.53	0.77
Forward bend (cm)	–0.19	–0.33	–0.42	–0.30	–0.09	0.24	–0.23
Shuttle run 4x10 m (s)	0.01	–0.30	–0.31	–0.24	0.71	0.60	–0.05
Arm hang (s)	–0.29	0.01	–0.13	–0.05	0.04	–0.48	0.16
Fitness level	–0.43	–0.27	–0.41	–0.31	0.49	0.40	0.16

SMM skeletal muscle mass, **FFM** fat free mass, **BFM** body fat mass, **PBF** percentage of body fat, **BMI** body mass index.

correlations between bioimpedance indicators and physical fitness indicators were found in the examined group of boys (Table 5).

DISCUSSION

Physical education, especially self-defence training [22-24] and many extreme forms of physical activity (including combat sports) [25, 26], being an integral part of defence education, goes beyond the specifics of the army and, among others, encompasses all stages of psychophysical development in the pre-conscription period [11]. Sterkowicz [27] draws attention to the validity of qualifying soldiers trained in eastern martial arts for special-purpose groups. Combat sports develop physical fitness and teach how to behave in situations of direct health threat [27].

The development of coordination and fitness motor skills constitutes a foundation both for specialized training of soldiers and for achievements in eastern martial arts [28]. The extent of motor preparation, especially the level of muscle strength, is the most important factor in the model of a soldier optimally trained in close combat [2]. Combinations of such motor skills as strength-endurance and strength-speed seem to be the most important in hand-to-hand

Table 5. Correlations of the body height and body weight and bioimpedance indicators with physical fitness indicators after 6 months of training in the group of boys (n = 10).

IPFT trials	Body height (cm)	Body mass (kg)	SMM (kg)	FFM (kg)	BFM (kg)	PBF (%)	BMI (kg/m^2)
50 m run (s)	0.04	–0.03	0.22	0.12	–0.06	–0.19	0.11
1000 m run (s)	–0.18	–0.09	–0.09	0.15	0.33	0.32	0.13
Standing broad jump (cm)	0.34	0.11	0.18	–0.16	–0.12	–0.18	0.15
Sit-ups (number)	–0.17	–0.24	–0.37	–0.13	0.09	0.10	–0.03
Grip strength (kg)	0.23	0.62	0.38	0.06	0.55	0.48	0.42
Forward bend (cm)	0.39	0.06	0.05	0.20	0.20	0.17	0.04
Shuttle run 4x10 m (s)	0.01	–0.14	0.04	–0.23	–0.25	–0.29	0.05
Pull-ups (number)	0.18	–0.19	–0.04	0.19	–0.05	–0.14	–0.26
Fitness level	0.10	–0.02	0.02	0.07	0.12	0.04	0.09

SMM skeletal muscle mass, **FFM** fat free mass, **BFM** body fat mass, **PBF** percentage of body fat, **BMI** body mass index.

combat [2]. While performing tactical tasks, the level of soldiers' endurance and strength and their efficiency are crucial [29].

Combat training in the army is aimed at effort as close to reality as possible. To cope with the training regime, a trainee must be characterized by high physical and mental fitness. Through physical education trainees develop the characteristics needed by a leader, e.g. perseverance, endurance, mental mobilisation during tasks and toughening of the organism [10].

In this context, research related to physical fitness of young people with a school rank of a cadet and a senior cadet who participate in a self-defence program in secondary school of a uniformed profile has been undertaken. The subjects also attended mandatory classes in specialised subjects and they participated in practical activities organized by the school in cooperation with appropriate uniformed formations. In assessing the level of physical fitness, indicators of the International Physical Fitness Test (IPFT) were taken into consideration. According to the obtained data in the group of girls, the mean value of points achieved in IPFT indicates an average level of fitness (417.8 ±69.5 in the first measurement and 439.3 ±45.5 in the second one). According to the IPFT assessment scale, the value of 481 points and above is assessed as high [20]. The level of physical fitness after 6 months of self-defence training in the group of girls did not change in a statistically significant way. The statistically valid differences were related to the increase in performance in the trials *50 m run* and *arm hang*. Female participants in the 6-month self-defence classes earned lower sums of points in the IPFT when compared, for example, to 16–18-year-old judo athletes (490.6 pts) [30] and senior judo athletes (534.4 points) [31]. It should also be noted that in the second measurement in the group of girls, no low level of physical fitness was noted.

As in the group of girls, the examined boys were characterised by an average level of physical fitness. However, after 6 months of self-defence training, the level of physical fitness significantly increased. Significantly better results were obtained in the *50 m run*, *1000 m run*, *sit-ups*, and *grip strength* trials. A comparative analysis also showed a greater number of correlations between somatic indicators and the results obtained in particular IPFT trials in the group of girls.

Research by Zawadzki et al. [1] revealed that the worst-formed motor traits in a group of conscripts in longitudinal studies in 1960–1991 were generally endurance and agility. Then only the level of the upper limbs and the shoulder girdle strength in the examined conscripts corresponded to the satisfactory assessment criterion. Later studies on pilots' physical fitness generally demonstrate good physical fitness, but more than every fifth pilot manifested only a sufficient level of physical preparation [32]. Doliński [19] showed that cadets (age 19.4 years) declaring increased sports activity achieved better results in the test of relative strength, explosive strength of lower limbs and in the run with weapons.

Poklek [33] draws attention to the important role of physical fitness of the examined officers demonstrating that, as its level rises, emotional control and control of own behaviour is intensified. Subjects with higher physical fitness are characterised by rational motivation for their behaviours, owing to which their action is thought out and devoid of impulsiveness in times of emotional tension. Kalina [3] concludes that if there is no time in the army for elementary defensive education of conscripts, at least for elite units (where close combat is an important part of training), those young people should be selected who are trained in judo, aikido, ju-jitsu or similar relatively mild fighting methods.

Taking up the research, authors also wanted to draw attention to the need for appropriate physical preparation at stages preceding the service in various uniformed formations. Serdyński [18] showed that men of low mobility and relatively high adiposity were conscripted into the compulsory military service in the Rzeszow unit.

CONCLUSIONS

A positive effect of the applied self-defence training on the level of physical fitness of cadets and senior cadets has been demonstrated. The subjects were characterised by average and high indicators of physical fitness, which proves that the applied self-defence training was an appropriate means of stimulating comprehensive motor development of youth preparing for service in special forces.

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