






General physical fitness of recreational krav maga trainees and non-trainees at the age of 18 during the pandemic COVID-19

Authors' Contribution:

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

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Abstract

Background & Study Aim:

The ability to defend oneself is a socially important element from the perspective of security, law and personal dignity. Therefore, fighting systems are popularized as decent self-defence to which all have the right. The purpose of the study was to verify the general physical fitness of 18-year-old males training krav maga in relation to their non-training peers.

Material & Methods:

The International Physical Fitness Test, which consists of 8 trials, was used. Eighteen-year-old males (n = 40), including 20 recreationally trained in krav maga for one year (two times a week for 90 minutes each) and their 20 non-trained peers, were examined.

Results:

The recreational krav maga trainees showed significantly better results in the 50-meter run, 1000-meter run, pull-up bar overhang, 4 x 10-meter shuttle run, sit-ups from lying on their backs, and trunk bending while standing. The results of krav maga training show that the only motor ability that exceeds the average standard for the Polish population of eighteen-year-old boys is agility (measured by trial 4 x 10 m of rufes).

Conclusions:

Recreational krav maga training for one year among 18-year-old adepts significantly differentiates their physical fitness in relation to their peers in terms of speed, endurance, arm muscle strength, agility, abdominal muscle strength, and flexibility. However, restrictions during the Covid-19 pandemic regarding limited use of sports facilities and direct contact with trainers are documented by lower results of tests of general physical fitness compared to those practicing martial arts in comfortable circumstances.

Key words:

International Physical Fitness Test • judo • self-defence,

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Conflict of interest:

Authors have declared that no competing interest exists

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Krav maga – self-defence system created in the 1930s in Czechoslovakia by Imie Lichtenfeld and developed by him in the following decades in Israel. Krav maga continues to expand on practitioners' experiences and incorporate effective solutions from other self-defence systems, combat sports and martial arts [45].

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 [46].

Technique – *noun* a way of performing an action [46].

IPFT – abbreviation of the test name adopted by the authors of this work: development by the International Committee on the Standardisation of Physical Fitness Test [20].

INTRODUCTION

The ability to defend oneself is a socially important element from the perspective of security [1], law [2] and personal dignity [3]. Therefore, fighting systems are popularized as decent self-defence to which all have the right [4]. Among the known fighting methods, there are some that fit the mission of martial arts, combat sports and self-defence systems [5]. A good example of this is karate, where 'spiritual' self-improvement is combined with athletic and non-athletic combat [6]. There are also fighting methods within combat sports and self-defence systems [7]. Such an example is judo, where sports fighting skills are tested in nonsports confrontations [8]. But from the perspective of effective self-defence, systems that strictly concern this motor and mental activity are recommended – because there the training objectives are aimed at non-sport fighting in defence against assault [9]. Such a world-renowned fighting system is *krav maga* [10]. It is based on effective techniques from various fighting methods, the goal of which is to deprive the attacker of the ability to continue fighting. *Krav maga* is based on natural human reflexes and is geared toward maximum effectiveness with a minimum of movements [11]. *Krav maga* assumes a determined attitude on the part of the adept during a conflict. Defend yourself and attack with the least amount of risk. *Krav maga* is devoid of a philosophical envelope [12] with the assumption that everyone has the right to defend themselves against an attack, regardless of the means. Therefore, training is based on anticipating threats, avoiding them, being conscious of the mind and acting under stress [13]. This fighting system includes hard strikes with upper and lower extremities, grapples, levers, uppercuts, and throws. The targets are always the attacker's sensitive vital points: temple, eyes, throat, sternum, kidneys, solar plexus, crotch, knees, joints [14].

At this point, it should be noted that in self-defence systems there is no sports competition [15]. Instead, training tests by simulating threatening situations are characteristic [16]. Therefore, self-defence training can be trained competitively or recreationally [17]. Typically, uniformed services and qualified instructors train self-defence competitively [18]. For the rest of the population, recreational training is specific, where adepts undertake voluntary physical activity aimed at acquiring fighting skills in the stream of positive psychology [19].

However, there is a rule that should not be ignored: it is impossible to compensate for the aggressor's higher motor (energy) potential only with the ability to use motor fighting techniques in direct combat (repeated even many times, but during conventional training circumstances), neglecting one's own motor potential in the general sense (muscle strength, endurance, speed, agility, etc.).

Accordingly, the purpose of this study was to verify the general physical fitness of 18-year-old males training *krav maga* in relation to their non-training peers.

MATERIAL AND METHODS

Study subjects

The study included 40 men aged 18, who were divided into two samples. The first sample consisted of those who trained *krav maga* for one year twice a week for 90 minutes each in Wrocław sports clubs at a recreational level with the aim of acquiring self-defence skills. The second sample consisted of students of the Complex of Schools Number 25 in Wrocław not engaging in regular physical activity. The inclusion criteria were age 18 and voluntary willingness to participate in the study.

The project received a favourable opinion from the Senate Committee on Research Ethics of the University School of Physical Education in Wrocław with the number 7/2021.

Method

The International Physical Fitness Test [20] was used as the method. This test does not require specialized technical equipment and allows to reliably assess the physical fitness of the subjects. It consists of eight trials (in brackets the name according to the publication 20): 1) a 50-meter run (50 m dash); 2) a long jump from a standing position (standing broad jump); 3) a 1,000-meter run (1000 m run); 4) measurement of hand strength with a dynamometer (hand grip); 5) pull-ups with overhangs on a bar (pull-up); 6) a 4 x 10-meter shuttle run with carrying blocks (shuttle run); 7) sit-ups from lying on your back in 30 seconds (sit-ups); 8) forward bending of the trunk while standing (bend trunk).

We did not overestimate the raw scores when decomposing into T-scale points (e.g. a standing

broad jump result of 220- or 219 cm, the equivalent of points for a result of 218 cm = 48, because 49 points correspond to a result of 221 cm).

Procedure

The study was carried out in May 2021 (period of the COVID-19 pandemic), during the noon hours at the open facilities of the University School of Physical Education in Wrocław. All subjects were at least two hours after a meal and were carefully instructed on the tasks. Each instruction was preceded by a demonstration of the exercise in question.

Statistical analyses

The estimation of the results is based on the following indicators: frequency (n); mean (M); median; minimum (min); Maximum (max); standard deviation (SD or \pm). The significance of differences between pairs of empirical variables was determined on the basis of Student's *t*-distribution (*t*) and probability (*p*). In tables with raw results, "n" represents the number of replicates.

Ordinal variables of the presented results

In the presentation of individual results for each group, the ordinal variable was based on the Index GPF (general physical fitness, i.e. the sum of all IPFT trial points) from the highest to the lowest value. The person with the highest Index GPF (leader) was assigned a ranking position (RP) 1. In the case of identical indexes, the same RP was assigned (e.g. 16), and the letter "a" (e.g. 16a) was assigned to the person whose results of all eight trials were evaluated at the level of at least

50 points, and the letter "b" to a person who did not meet these criteria, etc. Alternatively, in circumstances where all the scores of the people evaluated with the same Index GPF are above or below 50 points, or it is a compilation of very diverse scores. The ranking position is preceded by the code: KM of people practicing *krav maga*; NT of non-training people.

RESULTS

Agility (measured by the result of a 10 x 10 meter shuttle run) is the highest rated motor ability of eighteen-year-old men from Wrocław (Poland) practicing *krav maga* recreationally (average score of 66 points, from 50 to 72). Their lowest developed feature (motor ability) is the speed measured by the time of running 50 meters (18 out of 20 results are rated below 50 points). Even the leader of the ranking (KM1 athlete) did not exceed the average result of the general population three times. Although the *krav maga* practitioner with the code KM4 was rated below the average population only once, the result of 27 points in the 100-meter run is the penultimate among the tested athletes and proves very low endurance. Among the remaining results below 40 points, the distribution includes from 2 to 5 trials, and in the entire group such results account for 44.13%. The Index GPF of eight *krav maga* practitioners exceeded 400 points, which only in terms of the arithmetic mean proves that the measured motor skills exceeded the average of the general population of Polish eighteen-year-olds (Table 1).

Table 1. Results of physical fitness of *krav maga* athletes (n = 20) – order variable from the highest value of Index GPF; shaded fields (result lower than 50 points).

| Code & RP | Index GPF [total points] | IPFT trial (ordinal variable: from the highest arithmetic mean of trial result) | | | | | | | |
|-----------|--------------------------|--|--------|---------|------------|------------|-----------|---------------------|-----------|
| | | shuttle run | sit-up | pull-up | 1000 m run | bend trunk | hand grip | standing broad jump | 50 m dash |
| KM1 | 437 | 68 | 60 | 48 | 70 | 53 | 51 | 45 | 42 |
| KM2 | 433 | 61 | 68 | 48 | 66 | 42 | 53 | 62 | 33 |
| KM3 | 431 | 72 | 49 | 54 | 55 | 43 | 54 | 53 | 51 |
| KM4 | 418 | 61 | 55 | 56 | 27 | 53 | 52 | 64 | 50 |
| KM5 | 415 | 68 | 57 | 43 | 43 | 46 | 50 | 59 | 49 |
| KM6 | 407 | 70 | 47 | 56 | 44 | 55 | 48 | 45 | 42 |

| Code & RP | Index GPF [total points] | IPFT trial (ordinal variable: from the highest arithmetic mean of trial result) | | | | | | | |
|------------|--------------------------|--|--------------|--------------|--------------|--------------|--------------|---------------------|--------------|
| | | shuttle run | sit-up | pull-up | 1000 m run | bend trunk | hand grip | standing broad jump | 50 m dash |
| KM7 | 403 | 69 | 60 | 46 | 56 | 58 | 51 | 36 | 27 |
| KM8 | 401 | 71 | 55 | 50 | 52 | 50 | 41 | 55 | 27 |
| KM9 | 399 | 59 | 55 | 59 | 62 | 46 | 55 | 39 | 24 |
| KM10 | 398 | 61 | 63 | 61 | 41 | 55 | 54 | 48 | 15 |
| KM11 | 393 | 50 | 51 | 48 | 53 | 45 | 52 | 52 | 42 |
| KM12 | 392 | 65 | 57 | 54 | 56 | 46 | 42 | 40 | 32 |
| KM13 | 390 | 71 | 49 | 46 | 39 | 59 | 52 | 42 | 32 |
| KM14 | 389 | 71 | 53 | 54 | 65 | 47 | 41 | 35 | 23 |
| KM15 | 388 | 69 | 57 | 54 | 57 | 43 | 42 | 54 | 12 |
| KM16a | 386 | 63 | 53 | 52 | 68 | 51 | 56 | 37 | 6 |
| KM16b | 386 | 69 | 71 | 64 | 18 | 42 | 46 | 49 | 27 |
| KM17 | 380 | 62 | 57 | 54 | 33 | 54 | 53 | 46 | 21 |
| KM18 | 372 | 71 | 68 | 46 | 48 | 39 | 40 | 54 | 6 |
| KM19 | 365 | 69 | 55 | 46 | 40 | 51 | 40 | 41 | 23 |
| M | 399.15 | 66.00 | 57.00 | 51.95 | 49.65 | 48.90 | 48.65 | 47.80 | 29.20 |
| SD | 19.60 | 5.63 | 6.51 | 5.63 | 14.03 | 5.78 | 5.61 | 8.65 | 13.73 |
| min | 365 | 50 | 47 | 43 | 18 | 39 | 40 | 35 | 6 |
| max | 437 | 72 | 71 | 64 | 70 | 59 | 56 | 64 | 51 |
| g1 | 0.477 | -1.312 | 0.696 | 0.414 | -0.542 | 0.106 | -0.507 | 0.260 | -0.014 |
| g2 | -0.246 | 1.826 | 0.060 | -0.450 | -0.151 | -1.066 | -1.403 | -0.894 | -0.767 |

Students who do not practice any sports, similarly to *krav maga* practitioners, are characterized by the highest agility (52.3 points on average; from 33 to 66) and the lowest speed (the average result of a 50-meter run is only 15.35 points; from 3 to 26). The highest value of Index GPF is 371 and the lowest is 259 and also 19 ranking positions of this indicator. Trials scores below 50 points dominate (73.75%) – individually from 4 out of eight trials to 8 (Table 2).

Comparing the raw scores from Table 3 over Table 4 proves that the lack of statistically significant

differences between the groups applies only to the results hand grip and standing broad jump (Table 5).

The profiles of these scores (in points) reveal the greatest dominance of *krav maga* practitioners in terms of three motor skills: upper extremity muscle strength, endurance and speed (Figure 1).

DISCUSSION

The results showed that 18-year-olds training recreationally for a year in *krav maga* are physically

Table 2. Results of physical fitness of non-training people (n = 20); shaded fields (result lower than 50 points) and trials order variable laic *krav maga* athletes (see Table 1).

| Code & RP | Index GPF [total points] | IPFT trial | | | | | | | |
|------------|--------------------------|--------------|-------------|--------------|-------------|--------------|--------------|---------------------|--------------|
| | | shuttle run | sit-up | pull-up | 1000 m run | bend trunk | hand grip | standing broad jump | 50 m dash |
| NT1 | 371 | 56 | 66 | 48 | 22 | 54 | 44 | 57 | 24 |
| NT2 | 365 | 64 | 55 | 54 | 35 | 47 | 46 | 41 | 23 |
| NT3 | 340 | 51 | 55 | 43 | 25 | 51 | 56 | 42 | 17 |
| NT4 | 339 | 52 | 60 | 37 | 20 | 49 | 53 | 53 | 15 |
| NT5 | 331 | 52 | 49 | 40 | 37 | 43 | 53 | 38 | 19 |
| NT6 | 319 | 59 | 43 | 43 | 41 | 47 | 36 | 41 | 9 |
| NT7 | 315 | 43 | 51 | 56 | 23 | 34 | 43 | 62 | 3 |
| NT8 | 313 | 59 | 38 | 46 | 43 | 39 | 43 | 33 | 12 |
| NT9a | 312 | 53 | 51 | 40 | 29 | 42 | 41 | 44 | 12 |
| NT9b | 312 | 50 | 38 | 43 | 29 | 45 | 57 | 44 | 6 |
| NT10 | 302 | 60 | 35 | 37 | 23 | 33 | 50 | 45 | 19 |
| NT11 | 298 | 61 | 51 | 37 | 5 | 40 | 39 | 39 | 26 |
| NT12 | 294 | 39 | 51 | 46 | 33 | 26 | 39 | 51 | 9 |
| NT13 | 289 | 49 | 35 | 40 | 31 | 16 | 56 | 59 | 3 |
| NT14 | 287 | 33 | 55 | 0 | 37 | 53 | 42 | 46 | 21 |
| NT15 | 278 | 52 | 43 | 43 | 28 | 23 | 42 | 41 | 6 |
| NT16 | 266 | 56 | 45 | 0 | 34 | 22 | 53 | 44 | 12 |
| NT17 | 265 | 59 | 51 | 0 | 26 | 47 | 44 | 19 | 19 |
| NT18 | 264 | 51 | 45 | 0 | 24 | 25 | 48 | 45 | 26 |
| NT19 | 259 | 47 | 41 | 0 | 27 | 43 | 38 | 37 | 26 |
| M | 305.95 | 52.30 | 47.9 | 32.65 | 28.6 | 38.95 | 46.15 | 44.05 | 15.35 |
| SD | 32.33 | 7.67 | 8.32 | 19.96 | 8.52 | 11.32 | 6.62 | 9.57 | 7.75 |
| min | 259 | 33 | 35 | 0 | 5 | 16 | 36 | 19 | 3 |
| max | 371 | 64 | 66 | 56 | 43 | 54 | 57 | 62 | 26 |
| g1 | 0.399 | -0.884 | 0.211 | -1.001 | -0.756 | -0.618 | 0.310 | -0.367 | -0.123 |
| g2 | -0.418 | 0.900 | -0.301 | -0.644 | 1.944 | -0.774 | -1.232 | 1.658 | -1.249 |

Table 3. Raw results of physical fitness of *krav maga* athletes (n = 20) – order variable laic Table 1).

| Code & RP | IPFT trial | | | | | | | |
|------------|-----------------|--------------|-------------|----------------|-----------------|----------------|--------------------------|---------------|
| | shuttle run [s] | sit-up [n] | pull-up [n] | 1000 m run [s] | bend trunk [cm] | hand grip [kG] | standing broad jump [cm] | 50 m dash [s] |
| KM1 | 9.2 | 30 | 5 | 174 | 10 | 49 | 212 | 7.9 |
| KM2 | 9.9 | 33 | 5 | 186 | 2 | 51 | 251 | 8.4 |
| KM3 | 8.8 | 25 | 8 | 216 | 3 | 52 | 230 | 7.3 |
| KM4 | 9.9 | 28 | 9 | 293 | 10 | 50 | 255 | 7.4 |
| KM5 | 9.2 | 29 | 3 | 248 | 5 | 48 | 245 | 7.5 |
| KM6 | 9.0 | 24 | 9 | 245 | 12 | 46 | 213 | 7.9 |
| KM7 | 9.1 | 30 | 4 | 212 | 14 | 49 | 190 | 8.8 |
| KM8 | 8.9 | 28 | 6 | 224 | 8 | 40 | 235 | 8.8 |
| KM9 | 10.1 | 28 | 10 | 196 | 5 | 53 | 196 | 9.0 |
| KM10 | 9.9 | 31 | 11 | 254 | 12 | 52 | 218 | 9.5 |
| KM11 | 11.0 | 26 | 5 | 221 | 4 | 50 | 229 | 7.9 |
| KM12 | 9.5 | 29 | 8 | 215 | 5 | 41 | 198 | 8.5 |
| KM13 | 8.9 | 25 | 4 | 259 | 15 | 50 | 205 | 8.5 |
| KM14 | 8.9 | 27 | 8 | 189 | 6 | 40 | 189 | 9.1 |
| KM15 | 9.1 | 29 | 8 | 211 | 3 | 41 | 233 | 9.6 |
| KM16a | 9.7 | 27 | 7 | 182 | 9 | 54 | 192 | 9.8 |
| KM16b | 9.1 | 34 | 12 | 315 | 2 | 44 | 222 | 8.8 |
| KM17 | 9.8 | 29 | 8 | 275 | 11 | 51 | 214 | 9.2 |
| KM18 | 8.9 | 33 | 4 | 234 | 0 | 39 | 233 | 9.8 |
| KM19 | 9.1 | 28 | 4 | 258 | 9 | 39 | 202 | 9.1 |
| M | 9.40 | 28.65 | 6.90 | 230.35 | 7.25 | 46.95 | 218.10 | 8.64 |
| SD | 0.56 | 2.70 | 2.59 | 37.99 | 4.34 | 5.19 | 20.38 | 0.78 |
| min | 8.8 | 24.0 | 3.0 | 174.0 | 0.0 | 39.0 | 189.0 | 7.3 |
| max | 11.0 | 34.0 | 12.0 | 315.0 | 15.0 | 54.0 | 255.0 | 9.8 |
| g1 | 1.312 | 0.325 | 0.263 | 0.530 | 0.142 | -0.444 | 0.203 | -0.238 |
| g2 | 1.826 | -0.197 | -0.902 | -0.191 | -1.062 | -1.423 | -0.999 | -0.971 |

Table 4. Raw results of physical fitness of non-training people (n = 20) – order variable laic Table 2.

| Code & RP | IPFT trial | | | | | | | |
|------------|-----------------|--------------|-------------|----------------|-----------------|----------------|--------------------------|---------------|
| | shuttle run [s] | sit-up [n] | pull-up [n] | 1000 m run [s] | bend trunk [cm] | hand grip [kG] | standing broad jump [cm] | 50 m dash [s] |
| NT1 | 10.4 | 32 | 5 | 305 | 11.0 | 43 | 240 | 9.0 |
| NT2 | 10.4 | 28 | 8 | 270 | 6.0 | 44 | 203 | 9.1 |
| NT3 | 10.4 | 28 | 3 | 299 | 9.0 | 54 | 205 | 9.4 |
| NT4 | 10.4 | 30 | 1 | 311 | 7.0 | 51 | 230 | 9.5 |
| NT5 | 10.4 | 25 | 2 | 266 | 3.0 | 51 | 195 | 9.3 |
| NT6 | 10.1 | 22 | 3 | 255 | 6.0 | 35 | 200 | 9.7 |
| NT7 | 11.7 | 26 | 9 | 302 | -3.0 | 42 | 250 | 9.9 |
| NT8 | 10.1 | 20 | 4 | 249 | 0.0 | 42 | 184 | 9.6 |
| NT9a | 10.7 | 26 | 2 | 288 | 2.0 | 40 | 210 | 9.6 |
| NT9b | 11.0 | 20 | 3 | 288 | 4.0 | 55 | 210 | 9.8 |
| NT10 | 10.0 | 19 | 1 | 303 | -4.0 | 48 | 213 | 9.3 |
| NT11 | 9.9 | 26 | 1 | 336 | 1.0 | 38 | 196 | 8.9 |
| NT12 | 12.1 | 26 | 4 | 277 | -9.0 | 38 | 225 | 9.7 |
| NT13 | 11.1 | 19 | 2 | 281 | -16.0 | 54 | 245 | 9.9 |
| NT14 | 12.7 | 28 | 0 | 265 | 10.0 | 41 | 215 | 9.2 |
| NT15 | 10.8 | 22 | 3 | 290 | -11.0 | 41 | 200 | 9.8 |
| NT16 | 10.4 | 23 | 0 | 274 | -12.0 | 51 | 210 | 9.6 |
| NT17 | 10.1 | 26 | 0 | 296 | 6.0 | 43 | 150 | 9.3 |
| NT18 | 10.9 | 23 | 0 | 301 | -10.0 | 46 | 211 | 8.9 |
| NT19 | 11.3 | 21 | 0 | 292 | 3.0 | 37 | 192 | 8.9 |
| M | 10.75 | 24.50 | 2.55 | 287.40 | 0.15 | 44.70 | 209.20 | 9.42 |
| SD | 0.74 | 3.73 | 2.54 | 20.80 | 8.03 | 6.17 | 22.56 | 0.34 |
| min | 9.9 | 19.0 | 0.0 | 249.0 | -16.0 | 35.0 | 150.0 | 8.9 |
| max | 12.7 | 32.0 | 9.0 | 336.0 | 11.0 | 55.0 | 250.0 | 9.9 |
| g1 | 1.313 | 0.155 | 1.268 | 0.158 | -0.604 | 0.314 | -0.404 | -0.226 |
| g2 | 1.434 | -0.775 | 1.441 | 0.327 | -0.778 | -1.130 | 1.602 | -1.220 |

Table 5. Comparison of physical fitness of *krav maga* athletes with non-training peers.

| Group | shuttle run [s] | sit-up [n] | pull-up [n] | 1000 m run [s] | bend trunk [cm] | hand grip [kG] | standing broad jump [cm] | 50 m dash [s] |
|-----------------------|-----------------------------------|--------------------------------|------------------------------|------------------------------------|--------------------------------|--------------------------------|------------------------------------|---------------------------------|
| krav maga (n = 20) | 9.40 ±0.56 8.8÷11 | 28.65 ±2.70 24÷34 | 6.90 ±2.59 3÷12 | 230.35 ±37.99 174÷315 | 7.25 ±4.34 0÷15 | 46.95 ±5.19 39÷54 | 218.10 ±20.38 189÷255 | 8.64 ±0.78 7.3÷9.8 |
| not training (n = 20) | 10.75 ±0.74 9.9÷12.7 | 24.50 ±3.73 19÷32 | 2.55 ±2.54 0÷9 | 287.40 ±20.80 249÷336 | 0.15 ±8.03 -16÷11 | 44.70 ±6.17 35÷55 | 209.20 ±22.56 150÷250 | 9.42 ±0.34 8.9÷9.9 |
| differences | 1.35 | 4.15 | 4.35 | 57.05 | 7.10 | 2.25 | 8.9 | 0.78 |
| t | 6.44 | 4.03 | 5.36 | 5.89 | 3.48 | 1.26 | 1.31 | 4.08 |
| p | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | | | <0.001 |

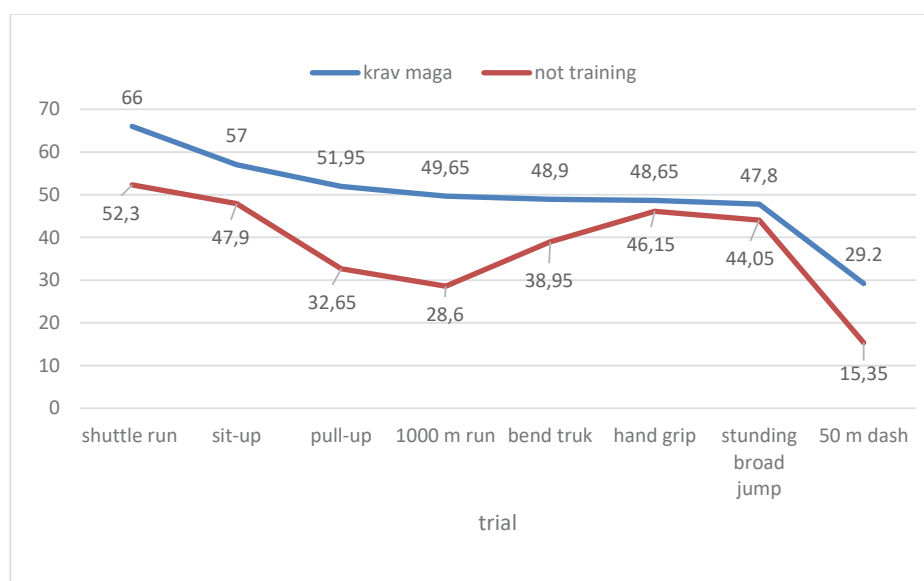


Figure 1. Profiles of results (in points) of the International Physical Fitness Test of 18-year-old men from Wrocław (Poland) practicing *krav maga* (n = 20) and not practicing any sport (n = 20).

fitter than their non-training peers in the 50-meter run, 1,000-meter run, pull-up bar overhang, 4 x 10-meter shuttle run, sit-ups from lying on their backs, and trunk bending while standing. In general, their speed, endurance, arm muscle strength, agility, abdominal muscle strength and flexibility are at a higher level. This shows that

physical activity aimed at acquiring self-defence skills has a significant impact on shaping the physical fitness of practitioners [21-24]. This is why any form of physical activity is so important in the context of maintaining broader health [25-27]. This indicates the attractiveness of different forms of exercise depending on interests [28-30].

However, the comparison of the results of *krav maga* practitioners (apart from their peers who are not active in sports) with seventeen-year-old judo athletes, mainly from Wrocław, is surprising that none (in terms of the average result) matches even the low criteria established at the end of the last century by Jagiełło [31, p. 173]. Therefore, not only the fact that the *krav maga* athletes we surveyed train recreationally (twice a week), but also during the period when the sanitary rigors of the COVID-19 epidemic were in force, should be considered the main factors of the limited stimulation of biological development by this art of self-defence. Unfortunately, the lack of empirical data (based on the results of not necessarily the same test) makes it impossible to compare their results with previous years.

This methodologically significant problem can be reversed. Maśliński et al. [8] using IPFT, six years ago they determined the general physical fitness of 11-12-year-old Wrocław judo athletes. Today, they are the peers of the *krav maga* athletes we studied. The lack of repeated studies of these judokas prevents such comparative studies based on raw scores (after all, the point equivalent is adjusted to the age of the examined person). However, in this simplified comparison, judokas dominate in speed (their average 50 m score: 6.65 seconds; 6.0 to 7.8), while the leader(s) of judo athletes performed more sit-ups (35 repetitions) than the *krav maga* leader, KM16b, of this trial (34 reps).

Of course, such comparisons are only to stimulate the imagination and draw attention to the important problem of repeating research on the same samples from the population in different periods and due to important circumstances. In this case, the most important factor is the impact of limited direct contact between the coach and the athlete as a result of the sanitary rigors caused by the COVID-19 pandemic [32-34].

A cognitively interesting issue (especially in the sense of prophylaxis in the long term) would be knowledge about the motor potential of mainly Wrocław judo athletes studied in 1995-1999 by Jagiełło [31] and Jagiełło et al. [35-37].

At this point, the limitations of the study should be noted. The population analysed refers to 18-year-old males from Wrocław. The sample size, temporal and spatial distribution were too small to refer to the entire Polish population. Therefore, the present study should be considered a pilot study. In addition, there are no data on the lifestyles of the queried subjects [38]. Data on somatic build and mass are also unknown [39]. Issues of motor potential can only be addressed by probabilistic inference [40]. The scientific literature relating to *krav maga* issues is steadily expanding, but still insufficient to form a theoretical framework. Therefore, it is recommended to continue research in the field of physical fitness undertaken in any form of exercise. The results of the present pilot study indicate the health-promoting values of self-defence training [41, 42]. In future analyses, based on a complementary approach, the methodological offer of innovative agonology may prove useful [5, 43, 44].

CONCLUSIONS

Recreational *krav maga* training for one year among 18-year-old adepts significantly differentiates their physical fitness in relation to their peers in terms of speed, endurance, arm muscle strength, agility, abdominal muscle strength, and flexibility. However, restrictions during the Covid-19 pandemic regarding limited use of sports facilities and direct contact with trainers are documented by lower results of tests of general physical fitness compared to those practicing martial arts in comfortable circumstances.

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