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# ASSOCIATION OF PHYSICAL ABILITIES TO ACADEMIC SUCCESS IN POLICE STUDENTS

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**SUMMARY**

As physical abilities are essential for good health and performance in police officers, they are also one of the major factors for the enrolment in a police academy. However, their relationship to academic success and efficacy has not yet been clearly established, especially in females. The aim of this research was to investigate the association of physical abilities with academic success measured by grade point average (GPA) and academic efficacy measured by time to graduate of female candidates for police studies. Physical abilities of 40 female candidates for the admission to the University of Criminal Investigation and Police Studies were analyzed at the time of selection and their study success and efficacy were obtained after they graduated. The correlation and regression analyses were used to investigate the association of physical abilities with GPA and time to graduate. The GPA was associated with repetitive power of upper extremities and whole-body contraction extension test (WBCE). It could be concluded that students whose physical exercise culture was better developed also had stronger chances of a favorable academic outcome. It could be argued that the UCIPS students who have a better-developed exercise culture also have stronger chances of a favourable academic outcome. The results of this research could be used as the foundation for future research that would investigate the association between physical abilities and success in policing jobs. This would help in the identification of the best individuals for the job and in the development of new selection, education, and exercise programs for police officers.

**Keywords:** recruitment; education of police officers; police; special physical education.

## INTRODUCTION

Physical abilities are among the main aspects of good health and performance in police officers; thus, they are regarded as one of the major factors in the process of enrolment in a police academy. The duties of a police officer may consist of a wide diversity of tasks, ranging from long hours sitting behind the desk or in a patrol car to psychologically and physically demanding tasks, such as protecting sports events, on-foot suspect chase, or entering a burning building. The police duty is to maintain social safety and security, often engaging a set of specialized motor skills such as martial arts, which highly depend on the level of physical abilities (Anderson et al., 2001, 2002; Kukić & Maamari, 2017; Sorensen et al., 2000). The strategic management of improvement and maintenance of the performance and health of POs should be based on a professional and sustainable expert system that would aim to increase the precision of the selection processes. The recruitment process is highly important for law enforcement agencies because a good selection may decrease the probability of premature discontinuation of the educational process in police students, and ultimately optimize the economic cost of educating future police officers.

Police students' physical abilities can play an important role in addressing the issue of predicting success in graduation (Lockie et al., 2019; Shusko et al., 2017). Therefore, the initial phase of the police officers professional education represents the selection process, whereby one of the main parameters is testing the level of physical abilities in order to identify the most capable candidates (Janković & Koropanovski, 2017; Strating et al., 2010). After the selection, it is necessary to further develop, maintain and control the POs' physical abilities because their inadequate level may be a limiting factor in the performance of professional duties and could lead to poor productivity, injuries and long-term disability, the final result of which may be the loss of human resources and economic costs (Lonsway, 2003). In that regard, an effective selection followed by an adequately efficient study process is highly significant for each police student, and for the development of a safe and secure society.

The enrollment criteria, which are fundamentally influenced by the university curricula and the duties that police students are required to conduct once they graduate, may differ between countries. Although it is generally expected that the selected candidates would be successful in the study process, research has showed that not all students graduate (Lockie et al., 2019; Nora et al., 2005). In that regard, several studies have investigated the effects of physical activity, the level of physical abilities and/or physical fitness on study success (Danbert et al., 2014; Lockie et al., 2019; Shusko et al., 2017). It has been reported that physical activity has a positive effect on students' academic success, whereby students who were recreational sports fitness members had a higher graduate point average (GPA) and cumulative credit completed (Danbert et al., 2014). Shusko et al. (2017) found that the low performance in push-ups and 1.5-mile run-time at the baseline of police academy studies was most strongly associated with failure to graduate, while Lockie et al. (2019) recently reported that recruits with better high-intensity running capacity and aerobic fitness had higher probability of completing the police academy.

Previous studies have reported the influence of physical education and various teaching programs on students' physical abilities in higher police education (Dimitrijević et al., 2014; Lagestad & van den Tillaar, 2014), while some studies have focused on the influence of recruits' physical abilities on completing the police academy (Lockie et al., 2019; Shusko et al., 2017). Overall, these studies have highlighted the need for the adequate initial level of PSs' physical abilities. However, it is unclear how these may reflect on the study process in terms of academic success and efficacy. Thus, the aim of this retrospective study was to determine the impact that PSs' initial physical abilities had on the study outcomes, defined by the GPA and time needed to graduate (TG). Therefore, the main hypothesis was that initial level of physical abilities would be associated with study outcomes.

## METHODS

### Participants

A retrospective data of physical abilities of 40 female candidates for the admission to the University of Criminal Investigation and Police Studies in Belgrade (UCIPS) were analyzed at the time of selection, and their study such as GPA and TG. The system of candidate selection for the UCIPS is designed as a multi-dimensional positive selection model, consisting of success achieved in previous education (maximum 40 points); health status with the evaluation of psychological structure and personal predispositions (eliminatory test); and physical ability assessment (maximum 20 points), general knowledge test (maximum 20 points) and Serbian language test (maximum 20 points) (Dimitrijević et al., 2014). Thus, the physical abilities accounted for 20% of total enrolment criteria. All participants and the testing personnel were informed about the aims and the long-term importance of the data collection. Signing an informed consent was a mandatory part of the selection process. The research was carried out in accordance with the conditions of the Declaration of Helsinki, considering the recommendations guiding physicians in biomedical research involving human subjects (Christie, 2000), and with the permission of the UCIPS Ethics Committee.

### Testing procedure

The candidates were divided into groups so that the assessments of all physical abilities could be done in one day in accordance with the UCIPS Laboratory standardized procedure for assessing basic physical abilities. A ten-minute running warm-up and ten-minute calisthenics and active stretching preceded the testing. Following a detailed explanation and qualified demonstration of each test, all participants performed a practice trial followed by two consecutive experimental trials, and the best result was used for further analysis. The rest periods lasted two minutes between the consecutive trials and 15 minutes between the two consecutive tests. Only tests of repetitive abdominal flexors power and aerobic endurance (Cooper 12-min running test) were performed once because a repetition trail would prevent fast body recovery and it would be time-ineffective, considering the number of participants that needed to be tested in a short time.

**Muscle force measurements**

Using a standardized measurement procedures previously reported in research (Dopsaj et al., 2000, 2019), maximal handgrip strength (HGS) was measured while the participant was in the sitting position with hand extended next to the body. The tensiometric probe with a built-in A/D converter connected to a software system was attached to the adjustable handgrip device allowing comfortable grip. After the signal was given, the participant executed maximal voluntary isometric contraction by squeezing the device as strong as possible, with no movements made in the front and lateral planes. The participants were cheered and encouraged verbally and they had live visual feedback of their force development.

**Muscular power of lower limbs**

Abalakov vertical jump test (ABL), consisting of a countermovement jump with arm swing, expressed as jump height in cm, was used to measure the explosive leg power in the vertical plane (Markovic & Jaric, 2004). The participant was instructed to jump as high as possible after performing a preceding countermovement with arm swing. The participant was also required to land approximately at the point of take-off. The test was conducted on a contact platform (Contact plate, Globus, Codogne, Italy; accuracy ± 0.001 second) that records flight time (t). The rise of the center of gravity above the ground (height in centimeters) was calculated from the time of flight (t, expressed in s) applying the ballistic law: h = 1/8 t2g (g = 9.81 m/s2), which was shown to be highly reliable, with ICC > 0.9 (Markovic et al., 2004).

The explosive leg power in the horizontal plane was assessed by a standing long jump (SLJ) test following the procedures of Pihlainen et al. (2018). The participant was instructed to jump as far as possible from the marked line with both feet, his hands free to swing. The distance from the starting to the landing point at the heel contact was measured in centimeters with 1 cm measurement precision (Markovic et al., 2007).

**Upper-body muscular power**

The repetitive arm extensor power was estimated with a test of the maximum number of push-ups performed within 10 seconds (PU10s). The initial position was with the body prone, arms extended, hands positioned at shoulder width, and only feet and palms touching the floor (Ebben et al., 2011). From the initial position, the participant went down with his chest to the ground, bending only the elbows, while the body remained in a firm starting position. The results were expressed in a number of correctly performed push-ups.

The abdominal flexor repetitive power was estimated as the number (No) of sit-ups in 30 seconds (SU30s), with alternate rotations of the upper body to the left and right and contact between the opposite knee and elbow (Dimitrijević et al., 2014). The participant lay on his back with legs bent at the knee at a 90-degree angle, feet fixed on the ground, palms crossed behind the head and the elbows apart. The participant performed an abdominal flexion with trunk rotation, first to one side, and then to the other side after returning to the starting position. The results were expressed in a number of correctly performed sit-ups.

### Aerobic endurance

General aerobic endurance was estimated by using the 12-minute Cooper running test (RUN), whereby the participants were required to cover the longest possible distance in 12 minutes, which was shown to have a high predicting value with $r = 0.93$ and $p < 0.001$ (Bandyopadhyay, 2015).

### Motor educability

Motor educability was assessed by the Whole-Body Contraction and Extension test (WBCE). The aim of the WBCE test was to estimate the participant's ability to apprehend and learn complex motor tasks (Kolarević et al., 2014). In the test, the participant lay supine on the mat, legs and arms fully extended, with arms above the head at shoulder width. One leg started bending so that the whole foot contacted the ground and continued to bend until the foot and the knee of the opposite leg (still extended) were in the same line. While holding this position, the participant turned to the side of the extended leg and after reaching the lateral position, he flexed the whole body simultaneously (trunk, arm and leg flexion) and assumed a position with open palms on each side of the head, elbows on the upper knees and feet in dorsiflexed position. Now the participant extended the whole body simultaneously, returning to the initial position, and repeated the entire movement with the other side of the body. The participant performed 24 whole-body consecutive alternate flexions and extensions, 12 on each side. The requirement was to perform the test as fast as possible, while each incorrect repetition was recorded as an error and the result was expressed as the total number of errors.

### Statistics

All data were analyzed using descriptive statistics to calculate the basic parameters of central tendency: the arithmetic mean (Mean), the standard deviation (St. Dev.), Minimum (Min.) and (Max.). Pearson's coefficient of correlative and the linear regression analysis were used to establish the association between physical abilities and study outcomes. Statistical significance was defined at 95 percent probability, i.e. at $p < 0.05$ level (Hair et al., 1998) and all statistical analyses were conducted in the SPSS for Windows, Release 11.5.0 (Copyright by SPSS Inc., 1989-2002).

## RESULTS

The descriptive parameters for the entrance exam physical abilities, the GPA and TG are shown in Table 1. The correlation analysis revealed that GPA was significantly associated with PU10s ($r = 0.320$, $p = 0.44$) and WBCE ($r = 0.343$, $p = 0.30$), while TG was not significantly associated to any of physical abilities.

*Table 1. Descriptive statistics.*

| Variables | Mean | St. Dev. | Min. | Max. |
|---|---|---|---|---|
| **GPA (No)** | 7.91 | .82 | 6.53 | 9.73 |
| **TG (months)** | 56.28 | 11.22 | 44.00 | 80.00 |
| **HGS (DN)** | 33.07 | 5.30 | 19.10 | 45.10 |
| **ABL (cm)** | 32.60 | 5.23 | 18.00 | 42.00 |
| **SLJ (cm)** | 177.23 | 20.59 | 123.00 | 212.00 |
| **PU10s (sec)** | 5.50 | 2.67 | 0.00 | 9.00 |
| **SU30s (sec)** | 22.40 | 3.04 | 16.00 | 29.00 |
| **RUN (m)** | 2234.18 | 222.43 | 1585.00 | 2745.00 |
| **WBCE (No)** | 5.35 | 5.60 | 0.00 | 22.00 |

***Note:*** *GPA – grade point average, TG – time to graduate, HGS – handgrip strength, ABL – Abalakov jump, SLJ – standing long jump, PU10s – number of push-ups in 10 seconds, SU30s – number of sit-ups in 30 seconds, RUN – Cooper running test, WBCE – whole body contraction-extension test*

The regression analysis revealed a significant moderate association of the initial level of physical abilities with the GPA of female police students (Figure 1). Within the regression model, the most significant unstandardized coefficients were PU10s and WBCE (Table 2). Regarding the TG, the regression analysis did not reveal significant association with initial level of physical abilities (SEE = 11.12, F = 1.10, R2 = 1.94, p = 0.386).

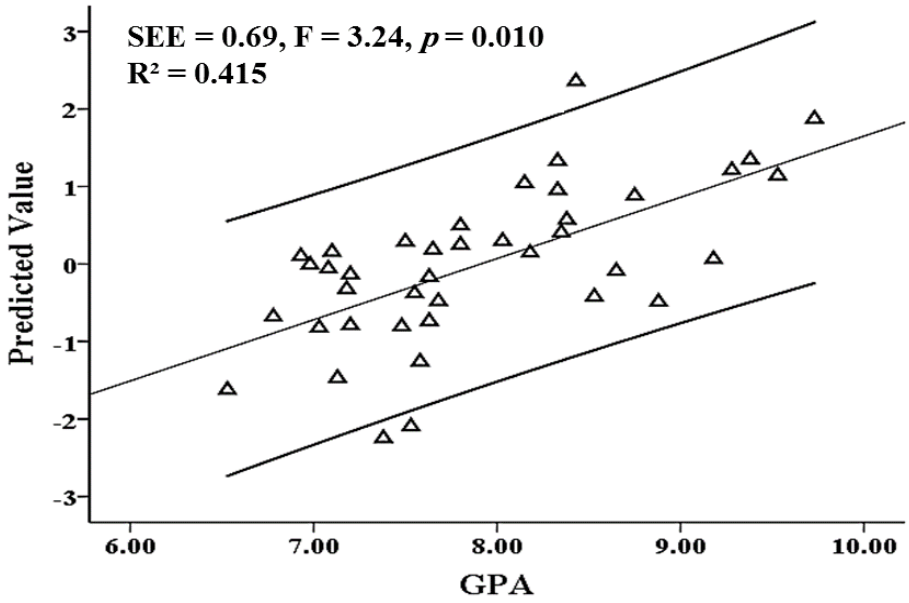


***Figure 1.*** *Regression analysis. Note: SEE – standard error of measurement, GPA – Grade point average..*

*Table 2. Unstandardized coefficients of GPA prediction from physical abilities.*

| Variables | Coefficients | | t | Sig. | Confidence Interval | |
|---|---|---|---|---|---|---|
| | B | St. Err. | | | Lower bound | Upper bound |
| **Constant** | 10.032 | 1.852 | 5.418 | .000 | 6.260 | 13.804 |
| **HGS** | .016 | .022 | .710 | .483 | -.030 | .062 |
| **ABL** | -.006 | .043 | -.145 | .885 | -.094 | .082 |
| **SLJ** | -.009 | .011 | -.792 | .434 | -.031 | .014 |
| **PU10s** | .234 | .066 | 3.551 | .001 | .100 | .369 |
| **SU30s** | -.080 | .051 | -1.574 | .125 | -.184 | .024 |
| **WBCE** | .062 | .024 | 2.627 | .013 | .014 | .110 |
| **RUN** | .000 | .001 | -.510 | .614 | -.002 | .001 |

***Note:*** *HGS – handgrip strength, ABL – Abalakov jump, SLJ – standing long jump, PU10s – number of push-ups in 10 seconds, SU30s – number of sit-ups in 30 seconds, RUN – Cooper running test, WBCE – whole body contraction-extension test*

## DISCUSSION

This study investigated the association of physical abilities with success and efficacy. The main findings showed that 41.5% of GPA could be explained by physical abilities. Specifically, PU10s and WBCE bear a significant coefficient of determination of students' GPA. Therefore, the main hypothesis of this study was true, which suggests that physical fitness is of crucial importance for successful graduation, hence preparation for police job.

The results of this study are somewhat similar to previous observational investigations, which found that candidates who enrolled in police academy study programs possessed better physical abilities than the ones who failed to enter the studies or who did not graduate (Lockie et al., 2019). This is particularly important, given that most of the education within the curricula at the UCIPS belongs to social sciences and law, while specialised physical education consists of three one-semester subjects, or 7.5% of the total GPA. This notion suggests that the view of how physical education could be implemented within the curricula of the UCIPS could potentially be reviewed and adjusted. More importantly, non-police university colleges might consider the strategies of enhancing their students' physical fitness to improve their study success, while at the same time they would improve their health and quality of life. However, the results suggest that not all physical abilities were equally sensitive and indicative of academic success. This could be related to the specificity of highly selected sample of participants based on their physical abilities (i.e., homogenous sample). However, future research is needed to investigate this notion.

Although physical fitness profile represented by all measured tests was a significant predictor of study success, only upper-extremity power and motor educability were sole significant predictors. More precisely, 23.4% of the variance in the GPA was explained by the repetitive power of upper extremities and 6.2% was explained by the ability to learn movement quickly. It is not clear why only these two variables played the most significant role among physical abilities. A potential factor contributing to this phenomenon may be rooted in the historical development of the police force and police education, originally designed with a male-dominant orientation, emphasizing men as primary duty performers (Anderson et al.,

2001; Rabe-Hemp, 2009; Starheim, 2019). Consequently, these inherent characteristics may persist, rendering the physical demands of the PU10s test, measuring upper limb strength, notably challenging. It appears that female candidates in police studies who demonstrate proficiency in executing this test through a "masculine approach" may navigate the academic process more successfully. Conversely, activities such as running and abdominal exercises, deemed biologically more aligned with women in comparison to push-ups (integral to the pushing and pulling arm pattern (Morris et al., 2020; Sterkowicz-Przybycień & Ambroży, 2013)), do not exhibit significant differentiation among the already highly selected participants. However, achieving proficiency in push-ups necessitates heightened training and motivation for women. It is conceivable that their motivation for physical performance may extend to a greater commitment to academic excellence.

Considering nature of the WBCE test, the ability to perform complex movement repeatedly with as low number of errors as possible it could be that the selection process is biased toward physically more capable female candidates. While WBCE performance alone plays a minor role in GPA of female students, its significance suggests that it may add to the overall quality (higher GPA) of the female police students (i.e., female police officers in the policing system of the Republic of Serbia). It should be noted that the WBCE is an indicator of motor intelligence, which is a component of general intelligence, hence providing a potential rationale for the observed correlation. However, given that GPA is only one indicator student's quality (Soh, 2010) nor the best predictor of job success (Bretz, 1989) future research is needed to investigate this further.

## CONCLUSION

This paper analysed the physical abilities of the candidates for the UCIPS with the aim to investigate the association between the initial level of physical abilities, and academic success and efficacy. The academic success and efficacy were measured by the GPA and the number of months the students needed to graduate, respectively. The correlation and regression analyses revealed a significant association of physical abilities on recruitment day and students' GPAs. Namely, better performance at the test of the repetitive power of upper extremities and the ability to learn complex motor tasks quickly were shared significant variance in GPA. It could be argued that the UCIPS students who have a better-developed exercise culture also have stronger chances of a favourable academic outcome. The results of this research could be used as the foundation for future research that would investigate the association between physical abilities and success in policing jobs. This would help in the identification of the best individuals for the job and in the development of new selection, education, and exercise programs for police officers.

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