UNIVERSITY OF NIŠ

ISSN 1451-740X (Print)
ISSN 2406-0496 (Online)
COBISS.SR-ID 113549324
UDC 796/799

FACTA UNIVERSITATIS

Series
PHYSICAL EDUCATION AND SPORT
Vol. 20, Nº 2, 2022

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FACTA UNIVERSITATIS, Series Physical Education and Sport is indexed in Sport database SPORTDiscus, SPONET (Germany), DOAJ (Sweden), Serbian Citation Index (Serbia).

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The cover photo: **Nenad Stojiljković –** Private archive
Publication frequency – one volume, three issues per year.
Published by the University of Niš, Republic of Serbia

Financial support: Ministry of Education, Science and Technological Development of the Republic of Serbia
Printed by ATLANTIS DOO, Niš, Serbia
Circulation 70

ISSN 1451-740X (Print)
ISSN 2406-0496 (Online)
COBISS.SR-ID 113549324
UDC 796/799

FACTA UNIVERSITATIS

SERIES **PHYSICAL EDUCATION AND SPORT**
Vol. 20, Nº 2, 2022

UNIVERSITY OF NIŠ

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FACTA UNIVERSITATIS

Series

Physical Education and Sport

Vol. 20, Nº 2, 2022

Contents

FACTA UNIVERSITATIS
Series: **Physical Education and Sport**, Vol. 20, No 2, 2022, pp. 89 - 99
https://doi.org/10.22190/FUPES200512008M

Research article

PRELIMINARY CONFIRMATORY FACTOR ANALYSIS OF THE SERBIAN VERSION OF THE ORIGINAL SPORT MOTIVATION SCALE (SMS-28)

UDC 796.01:159.9:316.628

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Abstract. *Self-determination theory is a dominant conceptual frame in the research of sports motivation, while the original Sport motivation scale, SMS-28, is adapted in many languages. The aim of this research was to translate and adapt the original scale into the Serbian language and to conduct a preliminary factor analysis in order to confirm a seven-factor solution. The sample included 608 active athletes on an international, national or lower competition level in different individual or team sports, of both genders, with a Median value for age of 18 years, an average of 10 years of sports experience. The results indicated good internal consistency of the Serbian version (Mean alpha 0.86), with only an amotivation subscale with a low alpha value (0.54). A simplex pattern of the self-determination continuum was confirmed. The confirmatory factor analysis suggested some good fit indices ($X^2/df=4.26$; SRMR=0.07; RMSEA=0.07; GFI=0.85; AGFI=0.81), while some indices did not meet the criteria of good model fit (CFI=0.81; NFI=0.77). We suggest further research should examine the scale on a more homogeneous sample in regard to competition level.*

Key words: *motivation, sport motivation scale, intrinsic motivation, extrinsic motivation, factor structure*

INTRODUCTION

Motivation is "a light motive" of many sports phenomena, in youth sport as well as in elite sport (Cox, 2005; Horn, 2008; Jowett & Lavallee, 2007; Weinberg & Gould, 1999).

Self-determination theory is one of the most influential theories of motivation to participate in sport. According to the theory (Deci, 1996; Deci & Ryan, 1985, 1999; Ryan,

Received May 12, 2020 / Accepted 22 July, 2022
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1995; Ryan & Deci, 2000, 2004, 2006), motivation is interpreted as a continuum. The more a social norm, or the value which is its essence, is internalized the more it becomes a part of the integrated self and a basis of self-determined behavior.

At one end of the motivational continuum, there is a state of complete lack of intention for action – *amotivation*. When lacking motivation, people either do nothing at all or carry out an activity passively and without any conscious intent. *Intrinsic motivation* is at the other end of the continuum, distinct from amotivation. Behavior which is intrinsically motivated represents a prototype of autonomous and self-determined behavior. When intrinsically motivated, people are involved in the activity due to interest for the activity itself and an inner satisfaction which ensues from participating in this activity. There are three types of intrinsic motivation: *intrinsic motivation to know*, *intrinsic motivation toward accomplishments* and *intrinsic motivation to experience stimulation* (Deci & Ryan, 1985).

Intrinsic motivation to know relates to several constructs such as curiosity, exploration, the epistemic need to know and to understand. *Intrinsic motivation toward accomplishments* can be defined as engaging an activity for the pleasure and satisfaction experienced when one attempts to accomplish or create something. This type of intrinsic motivation is related to psychological constructs such as mastery motivation, efficacy motivation, task-orientation. *Intrinsic motivation to experience stimulation* occurs when someone is engaged in an activity in order to experience excitement, sensory pleasures, aesthetic experiences etc. This type of intrinsic motivation is related to the concept of flow and peak performance (Deci & Ryan, 1999).

Between amotivation and intrinsic motivation there are several types of *extrinsic motivation*. *External regulation* is the least autonomous type of extrinsic motivation and represents a classic example of motivation with rewards and punishments. The locus of control is completely external. *Introjected regulation* implies that the external regula is internalized, but is not accepted as its very own in a deeper sense. This is a type of extrinsic motivation which is partly internalized but has not become a part of the integrated self. Introjection as a form of internalization is considered largely controlling. By applying behavior based on introjection, individuals endeavor to avoid feelings of guilt and shame or to achieve a contingent self-respect, i.e. self-evaluation which depends on certain results. *Regulation by identification* is to a certain extent a more self-determined type of extrinsic motivation than the previous two. When this type of extrinsic motivation is present, there is a conscious evaluation of the aim of behavior or regulae and the acceptance of behavior as personally important. Identification is an important aspect of the process of transforming the external regula into a genuine self-regula (Deci, 1996).

In order to measure motivational continuum in sport, the sport motivation scale (SMS) was designed (Briere et al., 1995; Pelletier et al., 1995). The scale consists of seven subscales that measure three types of intrinsic motivation (to know, to accomplish things and to experience stimulation), three types of extrinsic motivation (external, introjected and identified) and amotivation. Each subscale is measured by 4 items on the scale. Early research of a French and English version showed that seven subscales display the presence of the self-determination continuum. Support for this continuum was obtained through the display of a simplex pattern where adjacent subscales have positive correlations, while the subscales at the opposite ends of the continuum have the most negative correlations. The internal consistency of the subscale was assessed by Cronbach's alpha and the values varied from 0.74 to 0.80 (Pelletier et al., 1995).

In the past few decades, self-determination theory was tested in different cultures and life domains. Psychological instruments based on an SDT theoretical background were translated and adapted in many languages. It was shown that the SDT theoretical concept and instruments are applicable in the USA, Canada, South Korea and Russia (Howard, Gagne & Bureau, 2017; Vallerand et al., 1989; Vallerand & Ratelle, 2004; Chirkov, Ryan & Wellness, 2005). Also, the scale was adapted and translated into Hungarian, and validated on male and female athletes (Paic et al., 2017), into German and validated on male and female mountain runners (Burtscher, 2011), into Italian and validated on male and female athletes (Candela et al., 2013). There is also version of the scale in Arabic (Bayyat et al., 2016). The Arabic version of the scale was validated on a sample of students of the Physical Education Department of the University of Jordan. There is also a Brazilian version of the scale (Bara Filho et al., 2009), etc.

The aim of this research was to conduct a preliminary confirmatory factor analysis of the Serbian version of the Sport Motivation Scale (SMS-28), in order to check the seven-factor structure.

METHODS

Participants

The ample included 608 active athletes on the international, national or lower competition level in different individual or team sports (basketball, football, volleyball, handball, rowing, kayak, judo, shooting, tennis). Participants were of both genders, 25% females, 68% males, and 41 participants did not indicate their gender. The median value for age was 18 years, but 64 participants did not indicate their age. The oldest participant was 42 years old, and 95% of the sample were under the age of 30. The range of sports experience was from 5 to 22 years.

Instrument

The Sport Motivation Scale, SMS-28 (Pelletier et al., 1995) was translated from English to Serbian according to the parallel back translation procedure suggested by previous studies (Vallerand et al., 1989; Nunez et al., 2006). First, the scale was translated by a bilingual individual from English to Serbian. In second step, the translation was again performed by another bilingual individual without knowing the original scale. The procedure was repeated once again in order to have four bilingual individuals involved in parallel back translation to the SMS Serbian version. The different versions were evaluated by the individuals involved in the translation process and by an expert in sport psychology and self-determination theory. Adjustments to the scale and instructions were made. Finally, the Serbian version of SMS scale was obtained.

As the English scale, the Serbian version consists of 28 items, 4 items for each of the seven factors-subscales: intrinsic motivation to know (items 2, 4, 23, 27), intrinsic motivation towards accomplishments (items 8, 12, 15, 20), intrinsic motivation to experience stimulation (items 1, 13, 18, 25), extrinsic motivation by identification (items 7, 11, 17, 24), extrinsic motivation by introjection (items 9, 14, 21, 26), extrinsic motivation by external regulation (items 6, 10, 16, 22) and amotivation (items 3, 5, 19, 28). Each item answered the following question: "Why do you practice your sport?" and were rated on a 7-point Likert-type scale from (1) *does not correspond at all* to (7) *correspond exactly* with the midpoint (4) *correspond moderately* (the Final version of the scale in the Serbian language is in the Appendix).

Procedure

Participants were asked to take part in the study on a voluntary basis by filling out the Serbian version of the Sports Motivation Scale (SMS-28) anonymously, providing only basic demographic data such as gender and age.

Statistical analysis

The factor structure and model fit indices of the scale were assessed using confirmatory factor analysis (CFA) with a maximum likelihood method in statistical analysis software IBM SPSS Amos 20. The model fit was evaluated through several model fit indices: chi-square relative to degrees of freedom (X^2/df), standardized root mean residual (SRMR), root mean square error of approximation (RMSEA), the comparative fit index (CFI), normed fit index (NFI), goodness of fit (GFI), adjusted goodness of fit (AGFI). X^2/df values of less than five indicate a reasonable model fit (Marsh & Hocevar, 1985). For SRMR (Hu & Bentler, 1999) and RMSEA (Browne & Cudeck, 1993), suggested values of 0.08 and less are acceptable and indicate an adequate model fit. CFI and NFI values should be above 0.90 (Bentler & Bonett, 1980). GFI values should be equal to or greater than 0.85 and AGFI values equal to or greater than 0.80 (Cole, 1987; Marsh, Balla & McDonald, 1988). The internal consistency of the scale and its subscales (factors) were assessed using reliability analysis coefficient Cronbach's alpha in IBM SPSS 23.

RESULTS

Although there is no definite agreement in psychometric literature about values of fit indices, it is clear that the value of X^2/df meets < 5 criteria. SRMR is below 0.08, while RMESEA with a value of 0.07 meets the criteria of being below 0.1. GFI and AGFI are both above 0.80, while CFI and NFI are not above 0.90 (Table 1).

Table 1 Model fit indices

X^2	1401.65
df	329
X^2/df	4.26
SRMR	.07
RMSEA	.07
CFI	.81
NFI	.77
GFI	.85
AGFI	.81

Legend: X^2 – value of the CHI square test; df – degree of freedom; X^2/df – relative value of the CHI square test; SRMR = standardized root mean residual; RMSEA = root mean square error of approximation; CFI = comparative fit index; NFI = normed fit index; GFI – goodness of fit index; AGFI – adjusted goodness of fit index.

As shown in Figure 1, all item loadings are over 0.3 with the exception of item 28 ("*I often ask myself: I can't seem to achieve the goals that I set for myself")*.

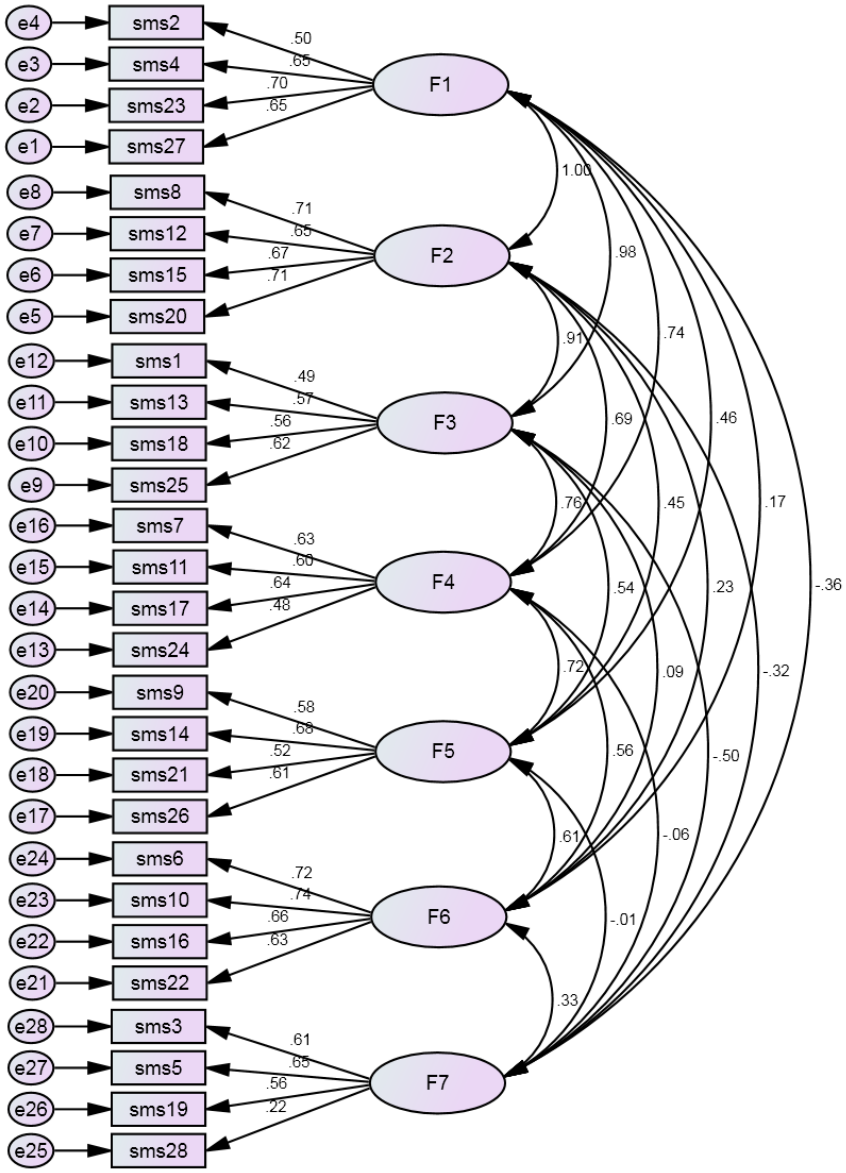

Fig. 1 Seven-factor model structure

The reliability analysis confirmed good internal consistency of the scale (Mean alpha 0.86). Since each subscale is made up of four items, Chronbach's alpha values vary from 0.78 for *Intrinsic motivation towards accomplishments* to only 0.54 for the *Amotivation* subscale (*IM to know*=0.72; *IM to experience stimulation*=0.65, *EM by identification* = 0.66; *EM by introjection*=0.68; *EM by external regulation*=0.75).

The correlation analysis confirmed the simplex pattern of the self-determination theory continuum. Intrinsic motivation factors are positively inter-correlated and negatively correlated with amotivation. Extrinsic motivation by identification and introjection are positively correlated with intrinsic motivation and with external regulation, but not with amotivation. Amotivation is only positively correlated with extrinsic motivation by external regulation (Figure 1).

DISCUSSION

The first version of the Sport Motivation Scale was designed in 1995 in French, as Echelle de Motivation dans les Sports (Briere et al., 1995). Briere et al. conducted three studies with the aim to develop, validate and determine the psychometric properties of the scale. Studies were conducted on Canadian adults, both male and female undergraduates, mean age of approximately 18 years, recreational players from different sports (ice hockey, football, basketball, badminton, handball, volleyball, dance-exercise, swimmers). In the first study, 70 items were used, while in the second study only 28 items were included. The third study conducted factor analysis and confirmed a seven-factor solution with 28 items. The same year, Pelletier et al. (1995) translated the scale into English and titled it the Sport Motivation Scale (SMS). The participants were also undergraduates, with an average age of 19, from different sports, and with at least two years of competitive experience at the high school or college level. Pelletier et al. concluded that scale has satisfactory reliability and validity in the English language, confirmed the seven-factor solution of the French scale and pattern recommended by the self-determination theory. Research conducted by Briere at al. (1995) and Pelletier et al. (1995) showed similar and satisfactory values in internal consistency with Cronbach's alpha ranging from 0.71 to 0.92, and 0.63 to 0.80. Levels of temporal stability were moderate in these two studies, from 0.54 to 0.82, and 0.58 to 0.84.

Soon after, new studies followed. By applying structural equation modelling, a simplex pattern was confirmed in accordance with self-determination theory. It has been shown that the scale is equally applicable to different samples of athletes, both male and female, team and individual sports, and the scale was also adapted for children. Studies also explored the correlation between SMS-28 and the antecedents and outcomes of sports motivation. It was shown that the SMS-28 can predict persistence in training, frequency of workout and probability of starting a physical activity (Chantal et al., 1996; Li & Harmer, 1996; Pelletier et al., 2001; 2007). Autonomous forms of motivation predict positive outcomes such as self-esteem, positive emotions, vitality, well-being, copying strategies, task vs. ego orientation (Conroy, 2004; Gagne et al., 2003; Amiot et al., 2004). The non-autonomous subscales seemed good predictors of negative phenomena such as exercise addiction, burnout, fear of failure and dropping out in sport (Hamer et al., 2002; Zahariadis et al., 2005; Mladenovic & Marjanovic, 2011; Alexandris et al., 2002; Standage et al., 2003; Cresswell & Eklund, 2005).

At the same time, there were many studies indicating the weakness of the scale (Vlachopoulos et al., 2000; Raedeke & Smith, 2001; Martens & Webber, 2002; Martin & Cutler, 2002). The seven-factor structure of the scale is the main issue that was in question and came out of the research of Mallet et al. (2007). They found a 6-factor solution, and conducted research on 614 Australians. The vast majority of their respondents were university freshmen engaged in competitive sports, but there were also 19% of elite athletes who represented Australia at international competitions (track and field, swimming).

Mallet et al. argued that the original scale has items that are cross loaded or poorly loaded onto hypothesized factors, and that there is a lack of discrimination between the three forms of intrinsic motivation. They suggested a unique intrinsic motivation scale. In their study, Mallet et al. also indicated that the identification factor was not statistically distinguishable from the intrinsic motivation. The integrated factor showed better internal consistency than the identified factor, and it measures the most self-determining form of extrinsic motivation. Mallet et al. questioned if statistical data are dependent on the sample. If that is the case, translation and adaptation of the scale in different languages and countries is a necessity.

In order to answer the critiques, a panel of experts on SDT (Pelletier et al., 2013) revisited the original sport motivation scale, SMS-28. They reviewed the structure of the scale and the face validity of all its items. Some items were removed, and some items were modified. Pelletier et al. (2013) agreed with the critics that including intrinsic motivation subscales into one scale is a good solution, since all varieties of intrinsic motivation are not important for many researchers in sport . Also, the authors of the new version of the sport motivation scale agreed that it is important to add an integration subscale. The total number of items were three instead of four per subscale. New revisited version of SMS, titled SMS-II, showed satisfactory reliability and construct validity. Pelletier et al. (2013) concluded that SMS-II better responds to critiques of the original scale, than for example SMS-6 (Mallet et al., 2007), but that it is important to further investigate the scale in different contexts, cultures, sports, age and over time.

Adaptation of the scale in different languages mostly included the original version of the scale that represents the seven-factor solution (Pelletier et al., 1995). In our research conducted in the Serbian language, we also aimed to explore the seven-factor solution of the original scale. The Greek and Spanish adaptations confirmed the psychometric properties established by Pelletier at al. in 1995 (Doganis, 2000; Nunez et al., 2006), but by conducting a confirmatory factor analysis we did not get an ideal model fit. Some of the fit indices in our research met the required psychometric criteria, while others were just below it (CFI and NFI). Other researchers also confirmed usage of the scale as a reliable instrument for measuring sports motivation, but also indicated specificity of the obtained results. For example, adaptation of the scale in Brazil (Bara et al., 2011) showed good reliability and validity of the Portuguese version, with an acceptable level of internal consistency. However, the Brazilian version showed some peculiarities since the lowest alpha value was noted for Amotivation. In our research we also obtained the lowest alpha value for the amotivation subscale, but that differs from studies that emphasized the weakness of the identified regulation subscale (Pelletier et al., 1995; Doganis, 2000; Nunez et al., 2006). The Italian adaptation of the scale supported the seven-factor solution, providing good validity and reliability in Italian language (Candela et al., 2014). As in Brazilian and our research as well, the amotivation subscale in Italian research was the only subscale that revealed a weaker structure. Another study, conducted by Burtscher et al. (2011) showed good internal consistency of the scale in German, but also suggested how important it is to conduct more studies on senior athletes in competitive sports. Burtscher et al. (2011) point out that extrinsic motivation plays a bigger role as the competitive level is higher. Studies that have examined the sport motivation scale and concept of sport motivation in light of self-determination theory, usually have young athletes as participants, exercisers and students of the first year at university. Application of the scale on athletes that perform at the international level may bring some insight not just in the psychometric properties of different versions of the scale, but also in the structure of motivation in elite sport.

Also, it is important to mention that some adaptations of the scale confirmed better validity of the SMS-II, such as the Hungarian study (Paic et al., 2017). Application of structural modeling in a study by Guzman et al. (2006) in Spanish provided results that go in line with the research started by Martens & Webber (2002), and Mallet et al. (2007).

In our research, the Serbian version of the original scale showed good internal consistency, with the amotivation subscale as the weakest point, as in Italian and Brazilian sample. Conducting a confirmatory factor analysis did not bring all the fit indices to a significant level. As suggested in the Australian and German studies of the scale, it might be important to apply the scale at different level of competitions. In our research, homogeneity of the sample was not provided. We had a wide age range, and athletes from many different sports and different levels of competitions. Future research on the Sport motivation scale in Serbian should additionally specify the sample, especially in terms of the level of competition.

CONCLUSION

A preliminary confirmatory factor analysis of the Serbian version of the original sport motivation scale indicated that a seven-factor model might fit well. As some other studies emphasized, it might be important to consider scale properties at different competition levels. In our study we had international competitors as well as lower competition level athletes. The seven-factor model is usually clearly obtained among college athletes. Including elite athletes in a sample along with lower level competition participants, as we did in our research, might question the seven-factor model fit. We suggest future research be conducted on elite athletes only, in order to provide evidence on the better model fit.

In our research the scale showed good reliability and internal consistency, with only the amotivation subscale displaying a low internal consistency. The simplex pattern suggested by the self-determination theory continuum is confirmed.

REFERENCES

Alexandris, K., Tsorbatzoudis, C., & Grouios, G. (2002). Perceived constraints on recreational sport participation: investigating their relationship with intrinsic motivation, extrinsic motivation and amotivation. *Journal of Leisure Research*, 34, 233-252.

Amiot, C. E., Gaudreau, P., & Blanchard, C. (2004). Self-determination, coping, and goal attainment in sport. *Journal of Sport & Exercise Psychology*, 26, 396-411.

Bara, F. M., Andrade, D., Miranda, R., Núñez, J. L., Martín-Albó, J. & Ribas, P. R. (2011). Preliminary validation of a brazilian version of the sport motivation scale. *Universitas Psychologica*, 10 (2), 557-566.

Bayyat, M.M., Almoghrabim A.H. & Khitam, M.A. (2016). Preliminary validation of an Arabic Version of Sport Motivation Scale (SMS-28). *Asian Social Science*, *12* (7), 186-196.

Bentler, P.M. & Bonett, D.G. (1980). Significance tests and goodness of fit in the analysis of covariance structures. *Psychological Bulletin*, *88*, 588–606.

Briere, N. M., Vallerand, R. J., Blais, M. R. & Pelletier, L. G. (1995). Developpement et validation d'une mesure de motivation intrinseque, extrinseque et d'amotivation en contexte sportif : l'Échelle de Motivation dans les Sports (EMS). *International Journal of Sport Psychology*, 26, 465-489.

Browne, M.W. & Cudeck, R. (1993). Alternative ways of assessing model fit. In Bollen, K.A. & Long, J.S. [Eds.] *Testing structural equation models*. Newbury Park, CA: Sage, 136–162.

Burtscher, J., Furtner, M., Sachse, P., & Burtscher, M. (2011). Validation of a German version of the sport motivation scale (SMS28) and motivation analysis in competitive mountain runners. *Perceptual and Motor Skills*, 112(3), 807-820.

Candela, F., Zucchetti, G. & Villosio, C. (2014). Preliminary validation of the Italian version of the original sport motivation scale. *Journal of Human Sport and Exercise*, 9 (1), 136-147.

Chantal, Y., Guay, F., & Dobreva Martinova, T. (1996). Motivation and elite performance: an exploratory investigation with Bulgarian athletes. *International Journal of Sport Psychology*, 27, 173-182.

Chirkov, V.I., Ryan, R.M. & Wellness, C. (2005). Cultural Context and Psychological Needs in Canada and Brasil: Testing a Self-Determination Approach to Internalization of Cultural Practices, Identity and Well-Being. *Journal of Cross-Cultural Psychology*, 36, 423-443.

Cole, D. A. (1987). Utility of confirmatory factor analysis in test validation research. *Journal of consulting and clinical psychology*, *55*(4), 584.

Conroy, D. (2004). The unique psychological meanings of multidimensional fears of failing. *Journal of Sport & Exercise Psychology*, 26, 484-491.

Cox, R.H. (2005). *Psihologija sporta: koncepti i primjene*. Jastrebarsko: Naklada Slap

Cresswell, S., & Eklund, R. (2005). Motivation and burn out among top amateur rugby players. *Medicine and Science in Sports and Exercise*, 37, 469-477.

Deci, E.L. (1996). *Why We Do What We Do: Understanding Self-Motivation*. New York: Penguin Books.

Deci, E.L. & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum Press.

Deci, E.L. & Ryan, R. M. (1999). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, 11, 227-268.

Doganis, G. (2000). Development of a Greek version of the Sport Motivation Scale. *Perceptual and Motor Skills*, 90, 505-512

Gagne, M., Ryan, R., & Bargmann, K. (2003). Autonomy support and need satisfaction in the motivation and well-being of gymnasts. *Journal of Applied Sport Psychology*, 15, 372-390.

Guzman, J.F., Carratala, E., Garcia-Ferriol, A. & Carratala, V. (2006). Propiedades psihometricas de una escala de motivation deportiva. *Motorcidad. European Journal of Human Movement*, 16, 85-98.

Hamer, M., Karageorghis, C., & Vlachopoulos, S. (2002). Motives for exercise participation as predictors of exercise dependence among endurance athletes. *Journal of Sports Medicine and Physical Fitness*, 42, 233-238.

Horn, T.S. (2008). *Advances in sport psychology. 3rd edition.* IL: Human Kinetics.

Howard, J. L., Gagne, M., & Bureau, J. S. (2017). Testing a continuum structure of self-determined motivation: A meta-analysis. *Psychological Bulletin*, 143 (12), 1346-1377.

Hu, L. & Bentler, P. (1999). Cutoff criteria for fit indices in covariance structure analysis: conventional criteria versus new alternatives. *Structural Equation Modeling, 6*, 1-55.

Jowett, S. & Lavallee, D. (2007). *Social psychology in sport*. IL: Human Kinetics.

Li, F., & Harmer, P. (1996). Testing the simplex assumption underlying the sport motivation scale. *Research Quarterly for Exercise and Sport*, 67, 396-405.

Mallet, C., Kawabata, M., Newcombe, P., Otero-Forero, A. & Jackson, S. (2007). Sport Motivation Scale – 6 (SMS-6): A revisited six-factor sport motivation scale. *Psychology of Sport and Exercise*, 8, 600-614.

Martens, M. P., & Webber, S. N. (2002). Psychometric properties of the sport motivation scale: An evaluation with college varsity athletes from the U.S. *Journal of Sport and Exercise Psychology*, 24, 254–270.

Martin, J. J., & Cutler, K. (2002). An exploratory study of flow and motivation in theatre actors. *Journal of Applied* Sport Psychology, 14, 344–352.

Mladenovic, M. & Marjanovic, A. (2011). Some differences in sports motivation of young football players from Russia, Serbia and Montenegro. *SportLogia*, 7 (2), 145-153.

Nunez, J. L., Martín-Albo, J., Navarro, J. G. & Gonzalez, V. M. (2006). Preliminary validation of a Spanish version of the Sport Motivation Scale. *Perceptual and Motor Skills*, 102, 919-930.

Paic, R., Kajos, A., Meszler, B. & Prisztoka, G. (2017). Validation of the Hungarian Sport Motivation Scale (H-SMS). *Cognition, Brain, Behavior. An Interdisciplinary Journal*, 21 (4), 275-291.

Pelletier, L. G., Tuson, D. M., Fortier, M. S., Vallerand, R. J., Brière, N. M. & Blais, M. R. (1995). Toward a new measure of intrinsic motivation, extrinsic motivation, and amotivation in sports: The Sport Motivation Scale. *Journal of Sport and Exercise Psychology*, 17, 35-53.

Pelletier, L., Fortier, M., Vallerand, R., & Brière, N. (2001). Associations among perceived autonomy support, forms of self-regulation, and persistence: a prospective study. *Motivation and Emotion*, 25, 279-306.

Pelletier, L., Vallerand, R., & Sarrazin, P. (2007). Measurement issues in self-determination theory and sport. In N. Chatzisarantis, & M. Hagger (Eds.), *Intrinsic motivation and self-determination in exercise and sport* (pp. 143-152). IL: Human Kinetics.

Pelletier, L., Rocchi, M.A., Vallerand, R.J., Deci, E.L. & Ryan, R.M. (2013). Validation of the revisited sport motivation scale (SMS-II). *Psychology of Sport and Exercise*, 14, 329-341.

Raedeke, T. D., & Smith, A. L. (2001). Development and preliminary validation of an athlete burnout measure. *Journal of Sport and Exercise Psychology*, 23, 281–306.

Ryan, R.M. (1995). Psychological Needs and the Facilitation of Integrative Processes. *Journal of Personality*, 63, 397-427.

Ryan, R.M. & Deci, E.L. (2000). Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions. *Contemporary Educational Psychology*, 25, 54-67.

Ryan, R.M. & Deci, E.L. (2004). An Overview of Self-Determination Theory: An Organismic-Dialectical Perspective, at Deci E.L. & Ryan R.M. (Eds.). *Handbook of Self-Determination Research*. Rochester NY: University of Rochester Press.

Ryan, R.M. & Deci, E.L. (2006). Self-Regulation and the Problem of Human Autonomy: Does Psychology Needs Choice, Self-Determination and Will? *Journal of Personality*, 74, 1557-1585.

Standage, M., Duda, J., & Ntoumanis, N. (2003). A model of contextual motivation in physical education: using constructs from self-determination and achievement goal theories to predict physical activity intentions. *Journal of Educational Psychology*, 95, 97-110.

Vallerand, R.J., Blais, M.R., Briere, N.M. & Pelletier, L.G. (1989). Construction et validation de l'echele de motivation en education (EME). *Canadian Journal of Behavioral Science*, 21, 323-349.

Vallerand, R.J. & Ratelle, C.F. (2004). Intrinsic and Extrinsic Motivation: A Hierarchical Model. In Deci E.L. & Ryan R.M. (Eds.). *Handbook of Self-Determination Research*. Rochester NY: University of Rochester Press.

Vlachopoulos, S. P., Karageorghis, C. I., & Terry, P. (2000). Motivation profiles in sport: A self-determination theory perspective. Research Quarterly for Exercise and Sport, 71, 387–397.

Weinberg, R.S. & Gould, D. (1999). *Foundations of sport and exercise psychology*. IL: Human Kinetics.

Zahariadis, P., Tsorbatzoudis, H., & Grouis, G. (2005). The sport motivation scale for children: preliminary analysis in physical education classes. *Perceptual and Motor Skills*, 101, 43-54.

PRELIMINARNA KONFIRMATORNA FAKTORSKA ANALIZA SRPSKE VERZIJE ORIGINALNE SKALE SPORTSKE MOTIVACIJE (SMS-28)

Teorija samodeterminacije je dominantan konceptualni okvir u istraživanjima sportske motivacije, dok je Skala sportske motivacije, SMS-28, adaptirana na mnoge jezike. Cilj ovog istraživanja bio je da se originalna skala prevede i adaptira na srpski jezik i da se sprovede preliminarna konfirmatorna faktorska analiza za potvrdu sedmofaktorskog rešenja. Uzorak se sastojao od 608 aktivnih sportista koji se takmiče na međunarodnom, nacionalnom ili nižem nivou takmičenja, iz individualnih i ekipnih sportova, oba pola, sa vrednošću medijane od 18 godina. Rezultati su pokazali dobru internu konzistentnost srpske verzije skale (srednja vrednost alfa 0.86), sa izuzetkom subskale nemotivisanosti koja je pokazala najnižu vrednost alfe (0.54). Simpleks patern kontinuuma samodeterminacije je potvrđen. Konfirmatorna faktorska analiza pokazuje dobre indekse pristajanja na nekim koeficijentima ($X^2/df=4.26$; SRMR=0.07; RMSEA=0.07; GFI=0.85; AGFI=0.81), dok neki indeksi nisu zadovoljoli kriterijum prihvatljivih vrednosti (CFI=0.81; NFI=0.77). Naredna istraživanja trebalo bi da provere faktorsku strukuru skale posebno uzimajući u obzir homogenost uzorka u odnosu na nivo takmičenja.

Ključne reči: *motivacija, skala sportske motivacije, intrinzička motivacija, ekstrinzička motivacija, faktorska analiza*

APPENDIX

Items of the Sport Motivation Scale (SMS-28) in Serbian.

SPORTOM koji sam izabrao BAVIM SE....

1. ...zbog uživanja u novim iskustvima.
2. ...zbog zadovoljstva što saznajem više o svom omiljenom sportu.
3. ...nekada sam imao dobre razloge da vežbam i bavim se sportom, a sada sam u dilemi da li treba da nastavim.
4. ...zbog zadovoljstva što učim nove veštine.
5. ...ne znam zaista, imam utisak da nisam u stanju da se bavim sportom.
6. ...da bi me ljudi koje poznajem poštovali.
7. ...zato što je to jedan od najboljih načina da se upoznaju novi ljudi.
8. ...zato što osećam veliko zadovoljstvo kada ovladam nekim teškim vežbama ili tehnikama.
9. ...zato što je bavljenje sportom aspolutno neophodno svakome ko želi da ostane u formi.
10. ...zbog ugleda i statusa.
11. ...zato što je to jedan od najboljih načina da razvijem sebe u celini.
12. ...zbog zadovoljstva koje osećam kada unapredim neke svoje slabe tačke.
13. ...zbog lepog doživljaja koji osećam kada učestvujem u sportskoj aktivnosti.
14. ...zato što moram da vežbam i bavim se sportom da bih se osećao dobro.
15. ...zbog zadovoljstva koje osećam dok usavršavam svoje sposobnosti.
16. ...zato što ljudi oko mene smatraju da je važno biti u formi.
17. ...zato što je to dobar način da se nauče mnoge stvari koje mogu biti korisne u životu uopšte.
18. ...zbog jakih osećanja koja imam dok se bavim sportom koji volim.
19. ...nije mi više jasno, mislim da mi nije mesto u sportu.
20. ...zbog zadovoljstva koje osećam kada izvedem neke teške poteze.
21. ...zato što bih se osećao loše ako ne bih učestvovao u sportu.
22. ...da pokažem drugima koliko sam dobar u sportu kojim se bavim.
23. ...zbog zadovoljstva koje osećam kada učim tehnike koje ranije nikada nisam poznavao.
24. ...zato što je to jedan od najboljih načina da održim dobre odnose sa prijateljima.
25. ...zato što volim da potpuno utonem u sportsku veštinu koju savladam.
26. ...zato što sam sebe primoravam da redovno vežbam i bavim se sportom.
27. ...zbog zadovoljstva što otkrivam nove strategije za postizanje uspeha.
28. ...često se pitam da li uspevam da dostignem ciljeve koje postavim sebi.

FACTA UNIVERSITATIS
Series: **Physical Education and Sport**, Vol. 20, No 2, 2022, pp. 101 - 112
https://doi.org/10.22190/FUPES220310009P

Research article

CARDIOVASCULAR RISK FACTORS IN PHYSICALLY ACTIVE FEMALE UNIVERSITY STUDENTS

UDC 796.08:612.1-055.2

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Abstract. *Cardiovascular diseases are the leading cause of death in the world, and occur as a result of many risk factors (obesity, high blood pressure, inadequate physical activity, hyperlipoproteinemia, inadequate diet and an unhealthy lifestyle). Given that in young adults most of these risk factors tend to remain at the same level or to even increase with age, especially after the second or third decade of life. This means that if young adults are in the at-risk group in terms of cardiovascular diseases, they usually stay in that group in later life. The research problem is to examine the strength and significance of possible linear correlations of certain cardiovascular risk factors in 53 physically active female university students (PE students), aged 19 to 25 years, as well as to examine possible differences between those with different lengths of sports experience (ranging from 0 to 5, 6 to 10 and 11 to 15 years). Their baseline characteristics (age, body height and mass, body mass index - BMI, resting metabolic rate - RMR, resting heart rate - RHR and length of sports experience) were determined, as well as the linear relationships of selected cardiovascular risk factors (body fat percentage - BF%, visceral fat level - Visc F, waist circumference - WC, arterial blood pressure - SBP and DBP). The data were analyzed (descriptive statistics, the Kolmogorov-Smirnov test, Pearson's and Spearman's correlation coefficient, ANOVA) using SPSS 21.0. The results of the analysis indicated a lack of statistically significant differences in cardiovascular risks factors between female PE students with different lengths of sports experience, and the existence of statistically significant ($p<0.001$), positive, mostly strong correlations, between most of the selected cardiovascular risk factors. When it comes to blood pressure parameters, although weak positive and statistically significant ($p<0.05$) correlations were established between SBP and BMI ($r=.273$), SBP and WC ($r=.308$), so as between DBP and body mass ($r=.284$), DBP and RHR ($r=.287$), DBP and RMR ($r=.292$), as well between DBP and WC ($r=.304$) and DBP and SBP ($r=.571$, $p<0.001$), it is unequivocal that the reduction of body mass at the expense of adipose tissue is necessary, as well as an increase in the moderate physical activity level and regularity, in order to reduce the risk of cardiovascular diseases in female PE students now as well as in older age.*

Key words: *adipose tissue, blood pressure, cardiovascular diseases, female PE students*

Received March 10, 2022 / Accepted May 17, 2022
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INTRODUCTION

Health is not only the absence of disease and infirmity, but it is complex and multifactorial - it is a state of complete physical, mental and social well-being (WHO, 1948). The fact that the human population is getting older, and that chronic diseases are becoming more frequent, emphasizes the connection between physical activity and health. Namely, due to the dramatic changes in the lives of people in industrialized countries in the last 100 years, the need of most people to be physically engaged has disappeared. Numerous technological changes have encouraged sedentary habits and significantly reduced energy consumption. This reduction in physical activity is, to say the least, dramatic, so a number of various health problems, caused by a sedentary lifestyle, increased significantly in the twentieth century, i.e. by reducing physical activity, we were faced with many inactivity-related diseases (Bouchard, Blair, & Haskell, 2007). In recent years, the contribution of physical activity to human health has been strongly emphasized. In our daily lives, physical activity plays an important role in maintaining and improving health, on the condition that it is based on the rules that are focused on both content and the intensity and frequency of physical exertion required (Stănescu & Vasile, 2014). Thus, conscious and intentional physical activity has become an extremely important component of a healthy lifestyle. The problem with physical activity is the fact that its rate changes over the course of life and it significantly decreases throughout education (Selmanović, Čale-Mratović, & Ban, 2014), and especially during the study period (less need for physical efforts, more sitting-related "activities") (Small, Bailey-Davis, Morgan, & Maggs, 2013). The transition from high school to college is a critical point in the decrease in the physical activity level (Bray, 2007; Kwan & Faulkner, 2011): approximately 35% to 75% of university students fail to achieve the recommended level of physical activity (Ćurković, Andrijašević, & Caput-Jogunica, 2014). This cannot apply to students of faculties of sport and physical education (PE). Namely, PE studies have a unique combination of theoretical and practical teachings, with a larger fund of classes provided for the implementation of the practical part of teaching. This type of teaching "does not allow" PE students to be physically inactive, and the selection process itself (entrance exam) is such that these studies can be enrolled only by those candidates who have a satisfactory level of motor, functional and other abilities. Thus, PE students are mostly former or current athletes, which means that their level of physical activity is significantly higher than the rest of the student population.

Cardiovascular diseases (myocardial infarction, stroke, hypertension, coronary artery disease) are the leading causes of death in the world (Janssen, 2007), but they are also a significant cause of disability and rising health care costs (Stojanović et al., 2009). These diseases occur as a result of many risk factors (obesity, high blood pressure, insufficient physical activity, hyperlipoproteinemia, inadequate diet and unhealthy lifestyle) (Hooper et al., 2001; Wildman et al., 2005; Irazusta et al., 2007). Additionally, socio-economic changes in society, population migration and others, can affect the prevalence of certain risk factors, thus leading to a higher prevalence of cardiovascular disease (Janssen et al., 2006; Bjerregaard, Eika Jørgensen, & Borch-Johnsen, 2007; Rogacheva et al., 2007). Cardiovascular disease in adults is considered a "pediatric" problem (Rowland, 2007) because epidemiological studies have shown a high correlation between morbidity and mortality caused by adult cardiovascular disease with early atherosclerotic lesions and the presence of cardiovascular risk factors at a younger age. Thus, most risk factors in young people tend to remain at the same level in older age. The effect of each of these factors is cumulative, and the combination of factors, as well as their combined presence, lead to multiplication and increase in risk with increasing age, especially after the second or third

decade of life (Stojanović et al., 2009). This means that young people who are in the at-risk group in terms of cardiovascular risk factors, most often remain in that group in later life, which indicates the need for early recognition and preventive action. This preventive action, in terms of lowering and mitigating cardiovascular risk factors, has proven successful in a large number of cases in different population groups, especially among young people (Panunzio et al., 2007; Qian et al., 2007). The main goal of the research is to determine the significance and strength of the relations between the selected cardiovascular risk factors (body fat percentage, visceral fat level, waist circumference, systolic and diastolic blood pressure) of physically active female PE students, as well as to examine the possible differences between those with different lengths of sports experience.

MATERIALS AND METHODS

Study participants

Fifty-three undergraduate female PE students, aged 19 to 25, volunteered to participate in this cross-sectional study, after being informed about the research and its scientific values and benefits. The most numerous are basketball and volleyball players (n=9 and n=8, respectively), then football and handball players (n=7, each), karate girls (n=4), dancers and swimmers (n=3, each), folk dancers, boxers, athletes and artistic gymnasts (n=2, each), and just one judoka, one tennis player, one rhythmic gymnast and one non-athlete. Based on the length of sports experience all of the study participants were divided into three groups: Group 1- from 0 to 5 years of sports experience (n=13), Group 2- from 6 to 10 years of sports experience (n=26) and Group 3- from 11 to 15 years of sports experience (n=14).

Measures and procedures

The study protocol was approved by the local ethics committee (No. 04-336/2), and the testing was performed in accordance with the ethical standards of the Declaration of Helsinki (WMA, 2013). All the measurements were taken by the authors in optimal climatic conditions, with the participants in their underwear, and according to the methods proposed by the International Biological Program (Weiner & Lourie, 1969). By interviewing the participants we collected the data on their age (date of birth) and length of sports experience, whereas their body height (cm) was determined by a Martin Anthropometer. The following body composition parameters, such as Body Mass (Weight, in 0.1 kg), Body Mass Index (BMI, in 0.1 kg/m^2), Body Fat percentage (BF%, in 0.1 %), Visceral Fat (Visc F, level) and Resting Metabolic Rate (RMR, in kcal), were assessed with a tetrapolar bioimpedance device – the Omron BF511 (Kyoto, Japan), after entering the data on participants' age, gender and body height. Using a measuring tape the Waist Circumference (WC, in 0.1 cm) data of the participants were obtained, and using the Omron digital tensiometer, the value of Resting Heart Rate (RHR, in bpm) was determined, as well as the values of systolic (SBP, in mmHg) and diastolic blood pressure (DBP, in mmHg).

Statistical analysis

The data were analyzed using the Statistical Package for the Social Sciences, version 21.0 (IBM SPSS 21.0, SPSS Inc, Chicago, USA). The descriptive statistics [average value (Mean), Standard Deviation (SD), minimum (Min) and maximum (Max)] were summarized for all the variables. The normality was tested using the one-sample Kolmogorov-Smirnov test (K-S). In order to determine the significance and the strength of the linear relationship

between the selected cardiovascular risk factors in physically active female university students, Pearson's correlation coefficient (r) was applied (for normally distributed variables), i.e. Spearman's correlation coefficient (for variables with statistically significant deviation from normal data distribution). In order to examine whether cardiovascular risk factors are lower in students who are involved in sport longer, a univariate analysis of variance (ANOVA), followed by Tukey's HSD Post Hoc test was applied and eta value determined to establish how pronounced possible differences between female PE students of different length of sport experience are. The level of significance was set at $p<0.05$.

RESULTS AND DISCUSSION

The baseline characteristics of the three subsamples and sample in total are presented in Table 1, and the descriptive statistics data of the selected cardiovascular risk factors are presented in Table 2.

Table 1 The baseline characteristics of female PE students

Subsamples	Variables	Mean±SD	Min - Max	K-S (Sig.)
Group 1, n=13	Age (yrs)	21.09 ± 1.11	19.01 – 22.34	.420
	Height (cm)	164.26 ± 4.22	156.5 – 170.0	.766
	Weight (kg)	63.55 ± 11.56	46.0 – 88.4	.431
	BMI (kg/cm^2)	23.52 ± 3.99	18.8 – 32.5	.533
	RMR (kcal)	1341.54 ± 119.94	1145.0 – 1583.0	.684
	RHR (bpm)	80.31 ± 8.99	68.0 – 102.0	.575
	SPEXP (yrs)	3.19 ± 1.6	0 – 5	.915
Group 2, n=26	Age (yrs)	21.05 ± 1.5	18.82 – 23.79	.285
	Height (cm)	167.28 ± 5.98	158.4 – 182.4	.910
	Weight (kg)	63.65 ± 7.32	46.2 – 80.5	.965
	BMI (kg/cm^2)	22.78 ± 2.39	18.4 – 28.1	.999
	RMR (kcal)	1366.58 ± 99.68	1148.0 – 1566.0	.987
	RHR (bpm)	79.77 ± 15.28	59.0 – 123.0	.727
	SPEXP (yrs)	8.33 ± 1.39	6 – 10	.288
Group 3, n=14	Age (yrs)	21.41 ± 1.74	18.7 – 24.97	.434
	Height (cm)	162.31 ± 7.45	153.0 – 179.0	.362
	Weight (kg)	59.76 ± 7.89	50.4 – 74.5	.922
	BMI (kg/cm^2)	22.69 ± 2.92	19.5 – 28.9	.454
	RMR (kcal)	1303.71 ± 105.97	1153.0 – 1537.0	.666
	RHR (bpm)	79.29 ± 12.22	63.0 – 107.0	.964
	SPEXP (yrs)	12.07 ± 1.27	11 – 15	.413
Sample in total, N=53	Age (yrs)	21.15 ± 1.46	18.7 – 24.97	.033*
	Height (cm)	165.23 ± 6.31†	153.0 – 182.4	.884
	Weight (kg)	62.6 ± 8.67	46.0 – 88.4	.950
	BMI (kg/cm^2)	22.94 ± 2.94	18.4 – 32.5	.380
	RMR (kcal)	1343.83 ± 107.69	1145.0 – 1583.0	.835
	RHR (bpm)	79.77 ± 12.98	59.0 – 123.0	.559
	SPEXP (yrs)	8.06 ± 3.49‡	0 – 15	.369

Legend: Mean - average value, SD - standard deviation, Min - minimum value, Max - maximum value, K-S - Kolmogorov-Smirnov test, Sig. - significance, n, N - number, Group 1 - with sports experience length from 0 to 5 years, Group 2 - with sports experience length from 6 to 10 years, Group 3 - with sports experience length from 11 to 15 years, yrs - years, BMI - body mass index, RMR - resting metabolic rate, RHR - resting heart rate, SPEXP - length of sports experience.

* absence of normal distribution (significant at $p<0.05$), † Group 2 vs. Group 3, F=3.299, Sig.=0.045 (in favor of Group 2)

‡ Between all of the three groups, F=133.565, Sig.=0.000 (in favor of Group 3, as well as Group 2), eta=.918

Table 1 shows the basic statistics for the baseline characteristics of the study participants for whom a normal distribution of data is observed. Based on an analysis of the data presented in the table, and based on the BMI cut-off point scale for adults (WHO, 1998), the highest percentage of participants (83.02%) is of normal weight; six of them (11.32%) are obese, two (3.77%) are obese - class I, and one (1.89%) is malnourished (BMI=18.4 kg/m^2). In a study conducted nine years ago, on a sample of PE student population from Belgrade, Serbia (Moskovljević, 2013), a slightly lower average value of BMI (21.17±1.93 kg/m^2) was recorded, as were in a study conducted on PE students from Niš, Serbia (Popović et al., 2020), but with higher average value of body height recorded (169.3±5.15 cm). When it comes to body mass, female student-athletes from Belgrade had a slightly lower average value (60.32±5.86 kg). There is a study conducted on the non-athlete student population - 120 students of the Medical Faculty of the University of Zagreb (Mašina, Zečić, & Pavlović, 2014), in which a similar average value was found (BMI=21.59 kg/m^2), as well as on 80 Dubrovnik (Croatia) students from different departments (Selmanović et al., 2014): 22.5 kg/m^2. However, in a study conducted on the American population of 2828 non-athlete university students (Pribis et al., 2010), a slightly higher average value (BMI=24.0±5.3 kg/m^2) was recorded, which can be attributed to the fact that higher BMI goes along with a sedentary lifestyle (the leading cause of student fat gain), but also to better socio-economic conditions in a country (Subramanian et al., 2011).

Pulse is an easily accessible parameter that provides information about various changes in the body, so many consider it "the key to the biological information system". Some authors (Alhalabi et al., 2017) consider RHR a marker of an individual's overall well-being, and not just a marker of cardiovascular health, so it is a parameter that should not be neglected. In healthy young people, normal RHR ranges from 60 to 80 bpm, and decreases with age. In well-trained athletes, due to higher stroke volume, but also increased parasympathetic activity, the pulse is lower, and in physically inactive persons it is higher due to the lower heart rate and sympathetic dominance. When it comes to the resting heart rate of physically active female PE students, on average, recorded RHR is at the upper limit of the health desirable range (79.77±12.98 bpm), which is slightly higher than the RHR values recorded in non-athlete female university students from America, and their average RHR value was 78.7±12.9 bpm (Pribis et al., 2010). In most of the participants (n=30, i.e. 56.6%) normal RHR values were recorded; a third of female PE students (n=18, i.e. 33.96%) had slightly increased RHR values; in four participants (7.55%) tachycardia was noted, and bradycardia in only one (1.89%), and she is one of two that train Athletics. Due to the fact that bradycardia (RHR<60 bpm) is a common physiological phenomenon among the population of athletes, especially in endurance sports (Doyen, Matelot, & Carré, 2019), like Athletics, as a chronic response of the cardiovascular system to intense training (Bahrainy et al., 2016), the obtained data are bit of a surprise. A possible explanation for such a small percentage of good training evidence among female PE students is the fact that many of them are probably former athletes, whose physical activity is now limited to attending practical classes at university.

Both bradycardia and tachycardia belong to cardiac arrhythmias, and are present among the population of athletes. Namely, long-term training leads to structural and electrical remodeling of a heart, which is a phenomenon known as the Athletic heart syndrome (Prior & La Gerche, 2012), characterized by dilatation and hypertrophy of all of four heart chambers and by the increased tone of the vagus at rest (Miljoen et al., 2019). Unfortunately, the Athletic heart syndrome has been recognized as a risk factor for the development of atrial arrhythmias,

and in one study (Miljoen et al., 2019), among 85 athletes, 50% of them had tachycardia. Of course, given that RHR is easily accessible, but also a very sensitive parameter, which at rest shows large variations (depending on gender, age, level of training, ambient temperature, body position, diet, hydration levels, the presence of caffeine in the blood, use of medication, emotional state, illness, etc.), we believe that these four recorded high values of RHR of the participants are probably only a reflection of their current (emotional) state, or possible device errors. Namely, measurement errors occur through three main sources: device errors, user errors, and patient errors (Padwal, Straus, & McAlister, 2001). Device errors are potentially the most common of these three sources (NICE, 2006). For many years, the standard instrument for measuring blood pressure was the mercury sphygmomanometer, but in recent years it has been replaced by automated electronic devices in many clinical settings (Wan et al., 2010), and electronic devices can cause measurement errors.

Table 2 Cardiovascular risk factors of female PE students

Subsamples	Variables	Mean±SD	Min - Max	K-S (Sig.)
Group 1, n=13	BF%	34.22 ± 6.94	25.2 – 47.6	.921
	Visc F	4.0 ± 1.23	2 – 6	.722
	WC (cm)	73.79 ± 9.55	60.0 – 97.3	.562
	SBP (mmHg)	110.77 ± 9.55	100.0 –130.0	.499
	DBP (mmHg)	70.0 ± 8.61	61.0 – 89.0	.303
Group 2, n=26	BF%	32.22 ± 5.45	22.2 – 43.9	.970
	Visc F	3.65 ± 0.98	2 – 6	.081
	WC (cm)	72.57 ± 5.29	63.5 – 92.0	.495
	SBP (mmHg)	115.27 ± 11.89	90.0 –143.0	.777
	DBP (mmHg)	73.58 ± 7.66	58.0 – 92.0	.907
Group 3, n=14	BF%	30.84 ± 6.99	15.5 – 43.5	.740
	Visc F	3.71 ± 1.2	2 – 6	.175
	WC (cm)	70.2 ± 4.65	63.0 – 81.0	.522
	SBP (mmHg)	113.36 ± 6.98	99.0 –123.0	.669
	DBP (mmHg)	73.86 ± 6.54	62.0 – 86.0	.907
Sample in total, N=53	BF%	32.35 ± 6.25	15.5 – 47.6	.743
	Visc F	3.75 ± 1.09	2 – 6	.003*
	WC (cm)	72.24 ± 6.46	60.0 – 97.3	.194
	SBP (mmHg)	113.66 ± 10.23	90.0 – 143.0	.690
	DBP (mmHg)	72.77 ± 7.66	58.0 – 92.0	.533

Legend: Mean - average value, SD - standard deviation, Min - minimum value, Max - maximum value, K-S - Kolmogorov-Smirnov test, Sig. - significance, n, N - number, Group 1 - with sports experience length from 0 to 5 years, Group 2 - with sports experience length from 6 to 10 years, Group 3 - with sports experience length from 11 to 15 years, BF% - body fat percentage, Visc F - visceral fat level, WC - waist circumference, SBP - systolic blood pressure, DBP - diastolic blood pressure.

* absence of normal distribution (significant at $p<0.05$)

Table 2 shows the basic statistics of the selected cardiovascular risk factors in physically active female PE students. The mean values of all the parameters are within the recommended ones, i.e. health-appropriate values, and deviation from the normal distribution of data was observed only when it comes to the level of visceral fats (K-S, Sig.= .003), although all participants have a level of Visc F that is in the range of normal values (Omron Healthcare, 2017).

Although the mean value of the body fat percentage is in the range of the recommended ones (Omron Healthcare, 2017), and more than half of the participants (n=30, i.e. 56.6%) have BF% corresponding to normal values for that age and sex, the percentage of participants with high BF% value is not negligible: in 14 female students (26.42%) a high percentage of body fat was found, and in 9 of them (16.98%) even higher values of this parameter (39.2%≤BF%≤43.9%).

Abdominal obesity assessed by the WC value is a significant predictor of cardiovascular diseases (Huxley et al., 2010) and of type 2 diabetes (Rexrode et al., 1998), while some authors argue that it is not yet sufficiently known whether waist circumference can predict abdominal fat and associated comorbid conditions in young people (Lee et al., 2006). When it comes to this parameter, the largest percentage of participants (90.38%, i.e. 47 of them) have a waist circumference that does not indicate a risk of health complications (Ross & Janssen, 2007); three of them (5.66%) have a waist circumference that indicates a slightly increased risk of health complications (80 cm ≤ WC ≤ 88 cm), while two female PE students (3.77%) have a significantly increased risk (WC is 92 cm, and 97.3 cm, respectively).

The relationship between blood pressure values and the risk of cardiovascular disease is continuous, consistent and independent of other factors. Thus, the higher the values of BP, the greater the chance of heart attack, stroke, kidney disease (NHLBI, 2004), which indicates the huge importance of monitoring this parameter. When it comes to blood pressure, the largest percentage of participants (67.92%, i.e. 36 of them) have normotension (90<SBP<120 mmHg and 60<DBP<80 mmHg); five participants (9.43%) have elevated blood pressure (120<SBP<129 mmHg and 60<DBP<80 mmHg); as many as nine (16.98%) have stage I hypertension (130<SBP<139 mmHg or 80<DBP<89 mmHg), of which the blood pressure of one participant is classified in this category at the expense of both the SBP and DBP value (her BP is 131/83 mmHg), and the remaining eight an elevated value of DBP (Börjesson, Kjeldsen, & Dahlöf, 2010; AHA, 2018). These data are not surprising, because in young adults diastolic pressure is a better predictor of cardiovascular disease than systolic (unlike older adults), but it is not uncommon for people aged 15 to 25 to have elevated systolic blood pressure and normal values of diastolic (O'Rourke, Vlachopoulos, & Graham, 2000). In addition, young adults with untreated diastolic hypertension have a better prognosis than those with elevated systolic and diastolic blood pressure (Fang et al., 1995). Stage II hypertension (SBP>140 mmHg or DBP>90 mmHg) was found in two participants (3.77%), and one had this stage of hypertension at the expense of both the SBP and DBP value (her BP is 143/92 mmHg). A very high body fat percentage (42.0%), increased BMI value (27.7 kg/m^2, which indicates preobesity) is found in that participant, but all the other parameters (WC, Visc F, RHR) are within the recommended values. When it comes to hypotension (SBP<90 mmHg and DBP<60 mmHg), it was recorded in only one participant (her BP is 90/60 mmHg), and it is around the limit values. Compared with the established results of blood pressure in physically active female university students, slightly higher average value of SBP (118.4±14.1 mmHg) was found in 2828 American non-athlete female university students (Pribis et al., 2010), while the average DBP value was similar (73.5±9.4 mmHg) to those recorded in this study. However, American non-athlete female university students have a lower body fat percentage (22.4±6.7 %) in comparison to our participants.

Table 3 Intercorrelation matrix of all of the examined variables

Variables	Age	Height	Weight	BMI	RMR	RHR	SPEXP	BF%	Visc F	WC	SBP	DBP
Age	1.00											
Height	.110	1.00										
Weight	-.070	.431**	1.00									
BMI	-.078	-.119	.811**	1.00								
RMR	-.032	.653**	.901**	.597**	1.00							
RHR	-.267	-.031	.082	.098	.142	1.00						
SPEXP	.091	-.052	-.095	-.066	-.044	-.043	1.00					
BF%	-.078	-.179	.663**	.846**	.333*	-.016	-.172	1.00				
Visc F	-.109	-.196	.632**	.900**	.451**	.115	-.063	.779**	1.00			
WC	.112	.095	.807**	.844**	.627**	.073	-.118	.733**	.688**	1.00		
SBP	.016	-.019	.263	.273*	.215	-.094	.127	.250	.167	.308*	1.00	
DBP	.068	.063	.284*	.247	.292*	.287*	.261	.228	.200	.304*	.571**	1.00

Legend: BMI - body mass index, RMR - resting metabolic rate, RHR - resting heart rate, SPEXP - length of sports experience, BF% - body fat percentage, Visc F - visceral fat level, WC - waist circumference, SBP - systolic blood pressure, DBP - diastolic blood pressure.
* significant at $p<0.05$, ** significant at $p<0.01$

Table 3 represents the intercorrelation matrix of all of the examined variables of physically active female PE students. A large number of positive, mostly moderate to strong, and statistically significant correlations ($p<0.001$) are established. The body fat percentage of female PE students is statistically significant and positively correlated with the body mass index, visceral fat, waist circumference, body mass, resting metabolic rate. In the case of visceral fat levels and waist circumference the situation is similar: both obesity parameters are statistically significant and positively correlated with body mass, the body mass index, resting metabolic rate, and also with body fat percentage. In addition, waist circumference and the visceral fat level have a strong and positive, statistically significant correlation, while only waist circumference has a statistically significant ($p<0.05$) and positive, but weak correlation with both blood pressure parameters. Besides the positive and statistically significant correlation of SBP with WC, this parameter has a weak positive, but statistically significant correlation ($p<0.05$) with BMI, but also a moderate positive, statistically significant correlation with DBP. Unlike SBP, DBP records weak positive and statistically significant correlations ($p<0.05$) with waist circumference, resting metabolic rate, resting heart rate as well as body mass. These established, statistically significant relationships of blood pressure with residual risk factors, mostly coincide with the results of a study conducted on a sample of 142 female university students from South Africa (Nkeh-Chungag, Mxhosa, & Mgoduka, 2015), aged 21.7±0.3 years, body height 159.7±0.6 cm, body mass 65.7±1.1 kg, body mass index 26.1±0.6 kg/m^2, waist circumference 77.9±0.9 cm, body fat percentage 43.1±3.0%, visceral fat level 5.1±0.3, systolic blood pressure 115.0±1.0 mmHg and diastolic blood pressure 72.0±1.0 mmHg. The following relationships with blood pressure were determined: BMI, WC, BF% and Visc F are in a statistically significant ($p<0.05$) correlation with SBP, while WC and BF% are in a statistically significant correlation with DBP.

When comparing female PE students from three different groups formed based on the length of their sports experience, no statistically significant differences in cardiovascular risk factors were established. This result can be explained by the possible fact that, regardless of the length of their sports experience, most of them are no longer active athletes and share the same level of physical activity (achieved through practical classes only). Also, there are authors who claim that independently of the physical activity carried out, it is sedentary behaviour that is related to cardiovascular risk factors (Young, Hivert, Alhassan, Camhi, Ferguson, Katzmarzyk et al., 2016), and all university students do have increased sedentary behaviour - their sitting time can exceed 9h a day (Castro, Bennie, Vergeer, Bosselut, & Biddle, 2020).

CONCLUSION

Given this global situation (obesity epidemic, hypokinesia, chronic diseases, most of which are cardiovascular), of which even young people are not spared, not even PE students, it is necessary to make some efforts to develop and identify techniques and markers that can be used to assess cardiovascular risks, which would enable triage of the population and the start of monitoring, and necessary therapy, as early as possible. So far attention has been paid to the health status of the elderly, but unfortunately it is necessary to direct it to younger populations too, and even to those who exercise regularly, have a healthy lifestyle, and may not show, at first glance, the presence of some risk factors. All of this is necessary because cardiovascular diseases in adults, but also many other diseases, are actually a "pediatric" problem. Thus, young people, who are in the at-risk group in terms of cardiovascular risk factors, most often remain in that group later in life, which indicates the need for early recognition and preventive action, i.e. work on the reduction and mitigation of cardiovascular risk factors. In this study, although weak positive, but statistically significant correlations were established (correlations of systolic blood pressure with body mass index and waist circumference, as well of diastolic blood pressure with body mass, resting metabolic rate, waist circumference and resting heart rate, but also with systolic blood pressure), and some participants have even been diagnosed with obesity, as well as with high percentage of body fat, and even with a risk value of waist circumference, it is unequivocal that the reduction of body mass at the expense of adipose tissue is necessary, as well as increase in the moderate physical activity level and regularity and decrease of sedentary behavior as much as possible, in order to reduce the risk of cardiovascular diseases in female PE students now as well as in older age.

Study limitations

This study has various limitations that should be considered. Firstly, it is a transversal study realized only on a sample of PE students. The global COVID-19 pandemic prevented the inclusion of students from other faculties, which was the original plan. The prevented comparison of PE students with other non-PE students would give a more realistic picture about the presence of cardiovascular risk factors among young adults as well as about the role of physical activity in the solution of this major public health problem. Another study limitation is the insufficiently addressed level and intensity of physical activity (hours per day, week, type of training, etc.), which would have been done properly if the comparison with other university students had not been originally planned and then prevented by the

pandemic (for comparison of student-athletes and student non-athletes the data collected would be quite sufficient). Finally, the lack of significance in some of the strata analyzed could be due to a lack of statistical power because of the low number of study participants in the subsamples and in the sample in total.

Acknowledgement: *The paper is a part of the research done within the project of the Ministry of Education, Science and Technological Development of the Republic of Serbia (No: 179024, Head researcher: Prof. S. Bubanj).*

REFERENCES

American Heart Association (2018). *Understanding blood pressure readings*. Retrieved on February 01, 2022 from https://www.heart.org/en/health-topics/high-blood-pressure/understanding-blood-pressure-readings

Alhalabi, L., Singleton, M.J., Oseni, A.O., Shah, A.J., Zhang, Z.M., & Soliman, E.Z. (2017). Relation of higher resting heart rate to risk of cardiovascular versus noncardiovascular death. *The American Journal of Cardiology, 119*(7), 1003-1007.

Bahrainy, S., Levy, W. C., Busey, J. M., Caldwell, J. H., & Stratton, J. R. (2016). Exercise training bradycardia is largely explained by reduced intrinsic heart rate. *International Journal of Cardiology, 222*, 213-216.

Bouchard, C., Blair, S.N., & Haskell, W.L. (2007). Why study physical activity and health? In C. Bouchard, S.N. Blair, & W.L. Haskell (Eds.), *Physical activity and health*, (pp. 3-19). Champaign, IL: Human Kinetics.

Börjesson, M., Kjeldsen, S., & Dahlöf, B. (2010). Hypertension. In M. Börjesson, M. Hellenius, E. Jansson, J. Karlsson, M. Leijon, A. Ståhle, C.J. Sundberg, & J. Taube (Eds.), *Physical activity in the prevention and treatment of diseases*, (pp. 410-425). Stockholm, SE: Swedish National Institute of Public Health.

Bjerregaard, P., Eika Jørgensen, M., & Borch-Johnsen, K. (2007). Cardiovascular risk amongst migrant and non-migrant Greenland Inuit in a gender perspective. *Scandinavian Journal of Public Health, 35*(4), 380-386.

Bray, S.R. (2007). Self-efficacy for coping with barriers helps students stay physically active during transition to first year university. *Research Quarterly for Exercise & Sport, 78*(2), 61-70.

Castro, O., Bennie, J., Vergeer, I., Bosselut, G., & Biddle, S.J. (2020). How sedentary are university students? A systematic review and meta-analysis. *Prevention Science, 21*(3), 332-343.

Ćurković, S., Andrijašević, M., & Caput-Jogunica, R. (2014). Physical activity behaviors among university students In D. Milanović, & G. Sporiš (Eds.), *Book of Proceedings of the 7th International Scientific Conference on Kinesiology "Fundamental and applied kinesiology - Steps forward*" (pp. 703-706). May 22-25, 2014, Opatija, HR: Faculty of Kinesiology of University of Zagreb.

Doyen, B., Matelot, D., & Carré, F. (2019). Asymptomatic bradycardia amongst endurance athletes. *The Physician & Sports Medicine, 47*(3), 249-252.

Fang, J., Madhavan, S., Cohen, H., & Alderman, M.H. (1995). Isolated diastolic hypertension: a favorable finding among young and middle-aged hypertensive subjects. *Hypertension, 26*(3), 377-382.

Hooper, L., Summerbell, C.D., Higgins, J.P.T., Thompson, R.L., Capps, N.E., Smith, G.D., Riemersma, R.A., & Ebrahim, S. (2001). Dietary fat intake and prevention of cardiovascular disease: systematic review. *BMJ, 322*(7289), 757-763.

Huxley, R., Mendis, S., Zheleznyakov, E., Reddy, S., & Chan, J. (2010). Body mass index, waist circumference and waist: hip ratio as predictors of cardiovascular risk- a review of the literature. *European Journal of Clinical Nutrition, 64*(1), 16-22.

Irazusta, A., Hoyos, I., Irazusta, J., Ruiz, F., Díaz, E., & Gil, J. (2007). Increased cardiovascular risk associated with poor nutritional habits in first-year university students. *Nutrition Research, 27*(7), 387-394.

Janssen, I. (2007). Physical activity, fitness, and cardiac, vascular, and pulmonary morbidities. In C. Bouchard, S.N. Blair**,** & W.L. Haskell (Eds.), *Physical activity and health*, (pp. 161-171). Champaign, IL: Human Kinetics.

Janssen, I., Boyce, W.F., Simpson, K., & Pickett, W. (2006). Influence of individual-and area-level measures of socioeconomic status on obesity, unhealthy eating, and physical inactivity in Canadian adolescents. *The American Journal of Clinical Nutrition, 83*(1), 139-145.

Kwan, M., & Faulkner, G. (2011). Perceptions and barriers to physical activity during the transition to university. *American Journal of Health Studies, 26*(2), 87-96.

Lee, S., Bacha, F., Gungor, N., & Arslanian, S.A. (2006). Waist circumference is an independent predictor of insulin resistance in black and white youths. *The Journal of Pediatrics, 148*(2), 188-194.

Mašina, T., Zečić, M., & Pavlović, D. (2014). Gender differences in some anthropometric and motor characteristics among students of Zagreb University School of medicine. In D. Milanović, & G. Sporiš (Eds.), *Book of Proceedings of the 7th International Scientific Conference on Kinesiology "Fundamental and applied kinesiology - Steps forward*" (pp. 722-725). May 22-25, 2014, Opatija, HR: Faculty of Kinesiology of University of Zagreb.

Miljoen, H., Ector, J., Garweg, C., Saenen, J., Huybrechts, W., Sarkozy, A., Willems, R., & Heidbuchel, H. (2019). Differential presentation of atrioventricular nodal re-entrant tachycardia in athletes and non-athletes. *EP Europace*, *21*(6), 944-949.

Moskovljević, L. (2013). *Faktori uspešnosti usvajanja programskih sadržaja ritmičke gimnastike kod osoba različitog pola [Success factors of Rhythmic Gymnastics syllabus acquisition in persons of different gender*. In Serbian*]*. Neobjavljena doktorska disertacija, Beograd, RS: Fakultet sporta i fizičkog vaspitanja Univerziteta u Beogradu.

National Heart, Lung, and Blood Institute (2004). *The seventh report of the Joint National Committee on Prevention, detection, evaluation, and treatment of high blood pressure*. Retrieved on February 2nd, 2022 from https://www.ncbi.nlm.nih.gov/books/NBK9630/pdf/Bookshelf_NBK9630.pdf

National Institute for Clinical Excellence (2006). *Clinical guideline 34: Hypertension Management of hypertension in adults in primary care*. Retrieved February 2nd, 2022 from https://www.nice.org.uk/guidance/CG34

Nkeh-Chungag, B.N., Mxhosa, T.H., & Mgoduka, P.N. (2015). Association of waist and hip circumferences with the presence of hypertension and pre-hypertension in young South African adults. *African Health Sciences*, *15*(3), 908-916.

Omron Healthcare (2017). *BF511 Body composition monitor: Instruction manual*. Retrieved February 20, 2019 from https://www.manualslib.com/manual/887289/Omron-Bf511.html

O'Rourke, M.F., Vlachopoulos, C., & Graham, R.M. (2000). Spurious systolic hypertension in youth. *Vascular Medicine*, *5*(3), 141-145.

Padwal, R., Straus, S.E., & McAlister, F.A. (2001). Cardiovascular risk factors and their effects on the decision to treat hypertension: evidence based review. *BMJ*, *322*(7292), 977-980.

Panunzio, M.F., Antoniciello, A., Pisano, A., & Dalton, S. (2007). Nutrition education intervention by teachers may promote fruit and vegetable consumption in Italian students. *Nutrition Research*, *27*(9), 524-528.

Popović, R., Aleksić-Veljković, A., Purenović-Ivanović, T., & Popović, A. (2020). Assessment of body composition in physical education female students of University of Niš. *Advances in Sciences & Humanities*, *6*(1), 36-51.

Prior, D.L., & La Gerche, A. (2012). The athlete's heart. *Heart*, *98*(12), 947-955.

Pribis, P., Burtnack, C.A., McKenzie, S.O., & Thayer, J. (2010). Trends in body fat, body mass index and physical fitness among male and female college students. *Nutrients*, *2*(10), 1075-1085.

Qian, J., Wang, B., Dawkins, N., Gray, A., & Pace, R.D. (2007). Reduction of risk factors for cardiovascular diseases in African Americans with a 12-week nutrition education program. *Nutrition Research*, *27*(5), 252-257.

Rexrode, K.M., Carey, V.J., Hennekens, C.H., Walters, E.E., Colditz, G.A., Stampfer, M.J., Willett, W.C., & Manson, J.E. (1998). Abdominal adiposity and coronary heart disease in women. *Jama*, *280*(21), 1843-1848.

Rogacheva, A., Laatikainen, T., Tossavainen, K., Vlasoff, T., Panteleev, V., & Vartiainen, E. (2007). Changes in cardiovascular risk factors among adolescents from 1995 to 2004 in the Republic of Karelia, Russia. *The European Journal of Public Health*, *17*(3), 257-262.

Ross, R., & Janssen, I. (2007). Physical activity, fitness and obesity. In C. Bouchard, S.N. Blair, & W.L. Haskell (Eds.), *Physical activity and health*, (pp. 173-189). Champaign, IL: Human Kinetics.

Rowland, T.W. (2007). Physical activity, fitness, and children. In C. Bouchard, S.N. Blair**,** & W.L. Haskell (Eds.), *Physical activity and health*, (pp. 259-270). Champaign, IL: Human Kinetics.

Selmanović, A., Čale-Mratović, M., & Ban, Đ. (2014). Analysis of the impact of health-related habits on the body composition of students in Dubrovnik. In D. Milanović, & G. Sporiš (Eds.), *Book of Proceedings of the 7th International Scientific Conference on Kinesiology "Fundamental and applied kinesiology - Steps forward*" (pp. 734-738). May 22-25, 2014, Opatija, HR: Faculty of Kinesiology of University of Zagreb.

Small, M., Bailey-Davis, L., Morgan, N., & Maggs, J. (2013). Changes in eating and physical activity behaviors across seven semesters of college: living on or off campus matters. *Health Education & Behavior*, *40*(4), 435-441.

Subramanian, S.V., Perkins, J.M., Özaltin, E., & Davey Smith, G. (2011). Weight of nations: a socioeconomic analysis of women in low-to middle-income countries. *The American Journal of Clinical Nutrition*, *93*(2), 413-421.

Stănescu, M., & Vasile, L. (2014). Using physical exercises to improve mental health. *Procedia- Social & Behavioral Sciences*, *149*, 921-926.

Stojanović, D., Višnjić, A., Mitrović, V., & Stojanović, M. (2009). Faktori rizika od nastanka oboljenja kardiovaskularnog sistema u studentskoj populaciji [Risk factors for the occurrence of cardiovascular system diseases in students. In Serbian]. *Vojnosanitetski Pregled*, *66*(6), 453-458.

Wan, Y., Heneghan, C., Stevens, R., McManus, R.J., Ward, A., Perera, R., Thompson, M., Tarassenko, L., & Mant, D. (2010). Determining which automatic digital blood pressure device performs adequately: a systematic review. *Journal of Human Hypertension*, *24*(7), 431-438.

Weiner, J.S., & Lourie, J.A. (1969). *Human biology, a guide to field methods. International Biological Programme*. Edinburgh, UK: Blackwell Scientific Publications.

Wildman, R.P., Gu, D., Reynolds, K., Duan, X., Wu, X., & He, J. (2005). Are waist circumference and body mass index independently associated with cardiovascular disease risk in Chinese adults? *The American Journal of Clinical Nutrition, 82*(6), 1195-1202.

World Health Organization (1948). *Constitution of the World Health Organization. Basic documents.* Geneva, CH: World Health Organization.

World Health Organization (1998). *Obesity: Preventing and managing the global epidemic* (WHO/NUT/NCD/98.1.1998). Geneva, CH: World Health Organization.

World Medical Association (2013). *World Medical Association Declaration of Helsinki: Ethical principles for medical research involving human subjects*. Retrieved February 18, 2019 from file:///C:/Users/PC/Downloads/wma-declaration-of-helsinki-ethical-principles-for-medical-research-involving-human-subjects.pdf

Young, D.R., Hivert, M.F., Alhassan, S., Camhi, S.M., Ferguson, J.F., Katzmarzyk, P.T., ... & Yong, C.M. (2016). Sedentary behavior and cardiovascular morbidity and mortality: a science advisory from the American Heart Association. *Circulation, 134*(13), e262-e279.

KARDIOVASKULARNI FAKTORI RIZIKA FIZIČKI AKTIVNIH STUDENTKINJA

Kardiovaskularne bolesti vodeći su uzrok smrtnosti u svetu, a nastaju kao rezultat delovanja mnogobrojnih faktora rizika (gojaznost, visok krvni pritisak, nedovoljna fizička aktivnost, hiperlipoproteinemija, neadekvatna ishrana i nezdrav stil života). S obzirom na to da većina ovih faktora rizika kod mladih odraslih ima tendenciju održavanja na istom nivou, pa čak i pogoršavanja sa godinama, posebno nakon druge, odnosno treće decenije života, to znači da mladi odrasli, ako se nalaze u rizičnoj grupi u pogledu kardiovaskularnih oboljenja, najčešće ostaju u toj grupi i u kasnijem životnom dobu. Problem ovog istraživanja jeste ispitivanje postojanja mogućih korelacija određenih kardiovaskularnih faktora rizika 53 fizički aktivnih studentkinja, uzrasta 19 do 25 godina, kao i da se ispitaju moguće razlike između onih sa različitom dužinom sportskog staža (u rasponu od 0 do 5, 6 do 10 i 11 do 15 godina). Utvrđeni su njihovi opšti pokazatelji (uzrast, telesna visina, telesna masa, indeks telesne mase- BMI, bazalni metabolizam- RMR, frekvenca srca u miru- RHR i dužina sportskog staža), kao i relacije odabranih kardiovaskularnih faktora rizika (procenat masnog tkiva- BF%, nivo visceralnih masti- Visc F, obim struka- WC, arterijski krvni pritisak- SBP i DBP). Podaci su analizirani (deskriptivna statistika, Kolmogorov-Smirnov test, Pearson-ov i Spearman-ov koeficijent korelacije, ANOVA) primenom SPSS 21.0. Rezultati analize ukazali su na izostanak statistički značajnih razlika u kardiovaskularnim faktorima rizika između studentkinja fakulteta sporta različite dužine sportskog staža, ali i na postojanje statistički značajnih ($p<0.001$), pozitivnih korelacija, uglavnom velike jačine, većine odabranih kardiovaskularnih faktora rizika. Kada je reč o parametrima krvnog pritiska, iako male pozitivne i statistički značajne ($p<0.05$), ustanovljene su korelacije SBP sa BMI ($r=.273$), SBP sa WC ($r=.308$), kao i DBP sa telesnom masom ($r=.284$), DBP sa RHR ($r=.287$), DBP sa RMR ($r=.292$), kao i DBP sa WC ($r=.304$),ali i sa SBP ($r=.571$, $p<0.001$), nedvosmisleno je da je neophodna redukcija telesne mase na račun masnog tkiva, ali i povećanje nivoa i redovnosti umerene fizičke aktivnosti, kako bi se umanjio rizik od kardiovaskularnih bolesti studentkinja sportistkinja sada, ali i u starijim godinama.

Ključne reči: *masno tkivo, krvni pritisak, kardiovaskularne bolesti, studentkinje sportistkinje*

FACTA UNIVERSITATIS
Series: **Physical Education and Sport**, Vol. 20, No 2, 2022, pp. 113 - 121
https://doi.org/10.22190/FUPES220410010L

Research article

INFLUENCE OF BODY COMPOSITION ON BASIC MOTOR ABILITIES IN HANDBALL PLAYERS

UDC 796.322.01:611.7

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Abstract. *The aim of this study was to investigate the influence of body composition on motor abilities in handball players. The sample involved 16 male handball players aged 15-20. Body composition variables included body mass (BM), the body mass index (BMI), percentage of body fat (PBF) and percentage of muscle mass (PMM). For speed assessment, the 20m sprint test was used. The T-test, Slalom test and Zig-Zag test were used to estimate agility, while the squat jump (SJ), counter movement jump (CMJ) and counter movement jump with arm swing (CMJa) were used to assess the muscle strength of the lower limbs. Linear regression analysis was used to determine the influence of body composition variables on basic motor abilities. Negative, statistically significant correlations were observed between BMI, PBF, sprint speed and agility ($r = 0,52 – 0,66$, $R^2 = 0,27 - 0,44$, $p < 0,05$). Muscle mass contributed to better performance on speed and agility tests ($-0,55 < r < -0,67$, $R^2 = 0,31 - 0,45$, $p < 0,05$). There were no significant relationships between BM and motor abilities, as well as between the muscle strength and body composition variables. These findings indicate that obesity contributes to slower linear and multidirectional movement, while muscle mass makes handball players faster. More research is needed in order to determine the influence of body composition on muscle strength, and the influence of body mass on specific handball movements.*

Key words: *morphological characteristics, strength, speed, agility*

Received April 10, 2022 / Accepted July 23, 2022
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1. INTRODUCTION

The game of handball, which has evolved from its first appearance at the Olympics in 1972 (Saavedra et al., 2018), became one of the most popular team sports on the planet (Sporiš, Vuleta, Vuleta Jr & Milanović, 2010). It represents a dynamic sport, which takes place through different tactical actions (Sporiš et al., 2010). Those tactical actions define handball as a complex ballgame, characterized by a high level of basic motor abilities such as strength, speed, agility and endurance (Mohamed et al., 2009). Furthermore, it is recognized by various defensive movements, and fast transition actions, which are carried out in order to score goals (Schwesig et al., 2016). For adequate positioning and the realization of tactics, players perform short, high intensity movements, both linear and with changes of direction (Karcher & Buchheit, 2014).

By observing and analyzing the above-mentioned competitive situations and movements, the anthropometric profile necessary for achieving elite level in handball has been defined (Katić, Čavala & Srhoj, 2007). However, the influence of body composition on motor abilities in handball players is not yet clearly established due to differences in the players' age, gender and competitive level, which make it difficult to generalize the results of previous research. Nikolaidis and Ingebrigsten (2013) studied the influence of body composition on motor abilities in male handball players of different age, where it was noted that the BMI has a negative influence on muscle strength and anaerobic abilities. The results of other studies support that claim, where higher values of the BMI were brought into connection with poor motor abilities in a sample of male handball players aged 12 to 18 (Molina-López et al., 2020; Visnapuu & Jürimäe, 2009). Similar results can be found when the effect of body fat on motor abilities was studied. Namely, Hammami (2018) found that a higher percentage of body fat contributes to slower changes of direction. The percentage of body fat has the same impact on muscle strength and aerobic endurance in young male and female players (Dellagrana et al., 2010). In a recent study, Molina-López (2020) also reported a negative influence of body fat on aerobic endurance.

Contrary to the consistency of the aforementioned results, the evidence varies when it comes to the effect of body mass on basic motor abilities in handball. Regardless of the numerous studies that confirm that the influence of body mass on motor abilities is statistically significant (Hammami et al., 2019; Marangoz & Var, 2018; Moncef, Said, Olfa & Dagbaji 2012; Moss, McWhannell, Michalsik & Twist, 2015; Saavedra et al., 2018) some studies reported contrary findings. Ciplak (2019) reported a non-significant relationship between body mass and muscle strength of the upper and lower limbs. In addition, non-significant relationships were noted in a study where the correlation between body mass, muscle strength and agility was investigated (Molina-López et al., 2020). The findings of the study, which examined the influence of body composition on the specific movements of handball players, also indicate that body mass does not significantly affect the velocity of the jump shot (Schwesig et al., 2016).

As Ziv and Lidor (2009) pointed out, experts involved in the training process, such as handball coaches, strength and conditioning coaches and physiotherapists, need to have insight into the physical and physiological aspects of the game in order to use practically applicable information when creating short-term and long-term training programs. Due to the diversity and variety of existing data, the generalization of the obtained results is not possible. Moreover, giving concrete guidelines for practical work becomes unachievable.

Therefore, the aim of this study was to determine the influence of body composition on basic motor abilities in adolescent male handball players.

2. METHODS

2.1. Participants

The sample consisted of 16 male handball players who voluntarily participated in this study. Players were aged from 15 to 20, with an average career length of 5.9 years. The mean values of the measured variables were: body height: 181.2 ± 7 cm; body mass: 83.5 ± 14 kg; body mass index: 25.5 ± 3.9 kg/m^2; percent of body fat: 17.8 ± 6.9%; percent of muscle mass: 40.6 ± 3.8%.

The benefits, risks and procedures involved in participation were explained to all players prior to testing. All players provided consent for participation in this study which was carried out in accordance with the Declaration of Helsinki. Permission was obtained from the handball club and parents/guardians as well, given that some participants were minors at the time when the study was conducted.

2.2. Measures

The examined variables in this research referred to the body composition and basic motor abilities of handball players. The sample of body composition variables and anthropometric characteristics were body height (BH), body mass (BM), the body mass index (BMI), percentage of body fat (PBF), and percentage of muscle mass (PMM). The motor abilities, tested in this study, included sprint speed, agility and muscle strength of the lower limbs.

2.3. Procedures

Body composition measurement

A cross-sectional study design was adopted where the players attended one testing session. Primarily, the players were instructed to maintain consistent dietary and sleeping patterns, to avoid alcohol consumption for 24 hours before testing and to consume adequate water prior to arrival. Measurements of body height were carried out with an anthropometer to the nearest 0.1 cm (anthropometer according to Martin). Body composition parameters were collected using an electronic scale (HBF-511B-E; Omron Healthcare) to the nearest 0.1 kg, while the participants were barefoot, wearing the clothes in which they practice (Đurašković, 2001).

Sprint testing

The 20m linear sprint has previously been used to measure linear speed in handball players (Ellis et al., 2000; Živković et al., 2019). The 20m linear sprint test involved players running with maximal effort in a straight line. Each player had one regular attempt, and for each trial, electronic timing gates (Witty, System, Microgate, Bolzano, Italy) were positioned on the start line, 5m from the start line, 10m from the start line and on the finish line. The photocell system was set at a height corresponding to the hip joint of the players, to ensure that only one segment of the body passes through the set gates (Yeadon, Kato & Kerwin, 1999). Players occupied a standing start position and were able to choose their preferred lead leg, which was positioned 50cm away from the starting line. Testing was conducted in an indoor stadium on a hardwood, non-slipping surface.

Agility testing

For the agility assessment, three tests were used: the T-test, Zig-Zag test and Slalom test (Mackenzie, 2005; Sporiš et al., 2010; Živković et al., 2019). Participants had one regular attempt, and for each trial, electronic timing gates (Witty, System, Microgate, Bolzano, Italy) were positioned on the start line and the finish line. The electronic timing gates were set according to the recommendations in previous research (Yeadon et al., 1999). Testing was conducted in an indoor stadium on a hardwood, non-slipping surface.

Muscle strength testing

Additionally, the muscle strength of the lower limbs was assessed with three different procedures. Each test is intended to assess the height of the vertical jump (Bosco, Luhtanen, & Komi, 1983). The tests used were: the squat jump (SJ), counter movement jump (CMJ), and counter movement jump with arm swing (CMJa). Participants had 3 regular attempts on each test, with a 30-second rest period between attempts, and 5-minute rest periods between the tests. The values of the highest jump were taken for statistical analysis. The measurement was conducted on the flat surface, using a system of photocells (Optojump, Microgate, Bolzano, Italy), which have shown exceptional validity and reliability when testing vertical jumps (Glatthorn et al., 2011).

2.4. Statistical analysis

All statistical analyses were performed in SPSS 20.0 (IBM Corporation). The results are presented as Mean ± SD. The normality of the data was confirmed by the Kolmogorov-Smirnov test. Simple linear regression was used to determine the relationship (r) and shared variance (R^2) between the body composition and basic motor abilities. All p-values less than 0.05 were considered significant for a 95% level of probability.

3. RESULTS

The basic descriptive statistics of the sample (n = 16) are presented in Table 1.

Table 1 The mean ± standard deviation values for a handball player's descriptive parameters and body composition parameters (n = 16).

Parameters	Mean ± SD
Age (years)	17.38 ± 1.26
Career length (years)	5.88 ± 1.86
Body height (cm)	181.16 ± 7.04
Body mass (kg)	83.53 ± 14.05
Body mass index (kg/m^2)	25.50 ± 3.87
Percent of body fat (%)	17.84 ± 6.92
Percent of muscle mass (%)	40.58 ± 3.85

For all outcome measures obtained, the mean value and standard deviation were calculated. The results are presented in Table 2.

Table 2 Outcome measures of male handball players (n = 16), presented as mean ± standard deviation.

Outcome measure	Mean ± SD
Sprint speed	
5m sprint (sec)	1.13 ± 0.09
10m sprint (sec)	1.87 ± 0.12
20m sprint (sec)	3.20 ± 0.17
Agility	
T-test (sec)	10.26 ± 0.75
Zig-Zag test (sec)	6.59 ± 0.42
Slalom test (sec)	8.06 ± 0.58
Muscle strength	
Squat jump (cm)	31.16 ± 3.95
Counter movement jump (cm)	33.99 ± 4.27
Counter movement jump with arm swing (cm)	41.31 ± 5.48

The correlations and shared variances between the body composition and motor abilities of handball players are presented in Table 3. The body mass index positively correlated with the time achieved on sprint and agility tests ($r = 0.52 – 0.61$, $R^2 = 0.27 – 0.37$, $p < 0.05$). Further, a significant correlation was established between the percent of body fat and scores obtained on sprint and agility tests ($r = 0.52 – 0.66$, $R^2 = 0.27 – 0.44$, $p < 0.05$). The percent of muscle mass contributed to lower values on sprint and agility tests, where the coefficient of determination ranged from 0.31 to 0.45 ($0.001 < p < 0.05$). No significant relationships were established between body mass and motor abilities. Moreover, a non-significant relationship was found between the body composition variables and muscle strength ($p > 0.05$).

Table 3 The relationships and the influence of the body composition on basic motor abilities in adolescent male handball players (n = 16).

		Speed			Agility			Muscle strength		
		Sprint 5m (s)	Sprint 10m (s)	Sprint 20m (s)	T test (s)	Zig-Zag test (s)	Slalom test (s)	SJ (cm)	CMJ (cm)	CMJa (cm)
BM	*r*	.443	.374	.436	.345	.304	.422	-.203	-.098	-.188
	R^2	.196	.139	.190	.119	.092	.178	.041	.009	.013
	p	.086	.153	.092	.191	.253	.104	.454	.718	.487
BMI	*r*	.591	.523	.611	.542	.547	.531	-.308	-.195	-.348
	R^2	.349	.273	.373	.293	.299	.281	.094	.038	.121
	p	**.016**	**.038**	**.012**	**.030**	**.028**	**.034**	.246	.468	.186
PBF	*r*	.627	.594	.660	.544	.519	.543	-.317	-.209	-.394
	R^2	.393	.352	.435	.295	.269	.294	.100	.043	.155
	p	**.009**	**.015**	**.005**	**.029**	**.039**	**.030**	.231	.437	.131
PMM	*r*	-.645	-.590	-.668	-.572	-.554	-.609	.420	.284	.464
	R^2	.416	.348	.446	.327	.306	.370	.176	.080	.215
	p	**.007**	**.016**	**.005**	**.021**	**.026**	**.012**	.106	.289	.070

BM – body mass; BMI – body mass index; PBF – percent of body fat; PMM – percent of muscle mass; SJ – squat jump; CMJ – counter movement jump; CMJa – counter movement jump with arm swing

4. DISCUSSION

This study aimed to assess the influence of the body composition on basic motor abilities in junior male handball players. The body mass index and the percent of body fat positively correlated with the time achieved on the speed and agility test, indicating that the influence of the mentioned variables is negative. The percent of muscle mass contributed to the better performance on the tests of linear and changes of direction speed. A non-significant relationship was found between body mass and motor abilities. Contrary to our expectations, body composition did not affect muscle strength.

Numerous studies have investigated the impact of body composition on physical performance in handball (Ciplak et al., 2019; Dellagrana et al., 2010; Hammami et al., 2018, Hammami et al., 2019; Kale & Akdoğan, 2020; Molina-López et al., 2020; Moss et al., 2015; Visnapuu & Jürimäe, 2009). The results of previous research indicate the negative impact of BMI and PBF on the movement velocity of handball players (Ciplak et al., 2019; Molina-López et al., 2020; Moss et al., 2015; Sporiš et al., 2010). Sporiš (2010) found a negative influence of PBF on sprint speed in professional players (r = -0.68, R^2 = 0.46, $p < 0.01$). Similar results can be found in the study of Ciplak (2019), where young female players with higher values of PBF were reported to move slower (R^2 = 0.28). In addition, more evidence can be found in the literature which confirms that body fat contributes to poorer results on the speed tests. In a recent study (Molina-López et al., 2020) the correlation between body fat and time scores on the sprint test was as high as 0.71. Further, it was reported that BMI negatively affected sprint speed (r = 0.41, R^2 = 0.17, $p < 0.001$) (Molina-López et al., 2020). The results of a study conducted on a sample of 120 female players of similar age support the mentioned data, with a positive relationship between the skin folds and the time score on the sprint test (Moss et al., 2015).

When it comes to the influence of body composition on the changes of direction of handball players, the results obtained by Hammami (2018, 2019) concur with those of this research. A positive correlation was found between PBF and the time achieved on the agility tests (r = 0.44, p = 0.04) (Hammami et al., 2018). Moreover, a negative relationship (r = -0.47, $p < 0.001$) between BM, BMI and agility was reported for a sample of male handball players aged 13 to 18 (Hammami et al., 2019). On the contrary, it was indicated that body mass had no significant influence on agility in senior handball players (Hammami et al., 2018). Nevertheless, sprint speed and muscle strength were not affected by body mass (Hammami et al., 2019). Notwithstanding the evidence that points to a conclusion that body mass has a significant impact on motor abilities (Hammami et al., 2019; Marangoz & Var, 2018; Moncef et al., 2012; Moss et al., 2015; Saavedra et al., 2018), opposing data can be found in the scientific literature. Namely, Ciplak (2019) assessed muscle strength with the counter movement jump and medicine ball throws, and a non-significant correlation was found between the obtained results and body mass ($p >$ 0.05). In the aforementioned study, it was pointed out that the relationship between body mass and physical performance was non-significant (Molina-López et al., 2020). The findings of a study which investigated the influence of body composition on specific handball movements also indicate that jump shot velocity is not affected by body mass (Schwesig et al., 2016).

Contrary to expectations, body composition did not significantly affect the muscle strength of handball players. Kale and Akdoğan (2020) reported a non-significant relationship between lean body mass and the jump height. Further, jump height was not influenced by

the body mass index and percentage of body fat in senior handball players (Moncef et al., 2012). The research conducted on a female sample, also showed that BMI has a non-significant impact on muscle strength (Ciplak et al., 2019; Saavedra et al., 2018). The discrepancy between the mentioned results leads to the conclusion that additional investigation is needed to determine the influence of body composition on basic motor abilities in handball. The findings of this study contain both expected outcomes and those opposed to our assumptions. Therefore, some limitations, which potentially influenced the results, should be emphasized. The present study was conducted only on male handball players aged from 15 to 20. Given the age range of the participants, it is likely that some players were in puberty, while others have already emerged from the second phase of accelerated growth. Furthermore, the impact of the position in the team should be taken into account, and therefore, position-specific examinations are needed in the future.

5. CONCLUSION

The findings in this study indicate that body composition variables affect motor abilities differently in a sample of junior male handball players. Body composition had no influence on motor abilities, while body mass was the only variable with a non-significant influence on sprint speed and agility. The body mass index and percentage of body fat had a negative influence on linear and multidirectional velocity. Notwithstanding that the muscle mass had a positive impact on the speed and agility, only a few studies examined the influence of the mentioned components on agility in handball players. Given that many activities in handball imply fast and sharp changes of direction, more research is needed in order to determine the influence of body composition on agility. Future research could examine the effect of muscle mass on the motor abilities of handball players after puberty.

REFERENCES

Bosco, C., Luhtanen, P., & Komi, P. V. (1983). A simple method for measurement of mechanical power in jumping. *European Journal of Applied Physiology and Occupational Physiology*, *50*(2), 273-282.

Ciplak, M. E., Eler, S., Joksimović, M., & Eler, N. (2019). The relationship between body composition and physical fitness performance in handball players. *International Journal of Applied Exercise Physiology*, 8(3.1), 347-353.

Dellagrana, R. A., Silva, M. P. D., Smolarek, A. D. C., Bozza, R., Stabelini Neto, A., & Campos, W. D. (2010). Body composition, sexual maturation and motor performance the young practitioners handball. *Motriz: Revista de Educação Física*, *16*(4), 880-888.

Đurašković, R. (2001). *Biologija razvoja čoveka sa medicinom sporta* (*Biology of human development with sports medicine*). Niš: S.I.I.C. In Serbian

Ellis, L., Gastin, P., Lawrence, S., Savage, B., Buckeridge, A., Stapff, A., et al. (2000). Protocols for the physiological assessment of team sport players. In C. Gore, *Physiological tests for elite athletes* (pp. 128-144). Champaign, Illinois: Human Kinetics.

Hammami, M., Hermassi, S., Gaamouri, N., Aloui, G., Comfort, P., Shephard, R. J., & Chelly, M. S. (2019). Field tests of performance and their relationship to age and anthropometric parameters in adolescent handball players. *Frontiers in physiology*, *10*, 1124.

Hammami, R., Sekulic, D., Selmi, M. A., Fadhloun, M., Spasic, M., Uljevic, O., & Chaouachi, A. (2018). Maturity status as a determinant of the relationships between conditioning qualities and preplanned agility in young handball athletes. *The Journal of Strength & Conditioning Research*, *32*(8), 2302-2313.

Glatthorn, J.F., Gouge, S., Nussbaumer, S., Stauffacher, S., Impellizzeri, F.M., & Maffiuletti, N.A. (2011). Validity and reliability of Optojump photoelectric cells for estimating vertical jump height. *The Journal of Strength & Conditioning Research*, 25(2), 556-560.

Kale, M., & Akdoğan, E. (2020). Relationships between body composition and anaerobic performance parameters in female handball players. *Physical education of students*, *24*(5), 265-270.
Karcher, C., & Buchheit, M. (2014). On-court demands of elite handball, with special reference to playing positions. *Sports medicine*, *44*(6), 797-814.
Katić, R., Čavala, M., & Srhoj, V. (2007). Biomotor structures in elite female handball players. *Collegium antropologicum*, *31*(3), 795-801.
Mackenzie, B. (2005). *Performance evaluation tests*. London: Electric World plc.
Marangoz, I., & Var, S. M. (2018). The Relationship among Somatotype Structures, Body Compositions and Estimated Oxygen Capacities of Elite Male Handball Players. *Asian Journal of Education and Training*, *4*(3), 216-219.
Mohamed, H., Vaeyens, R., Matthys, S., Multael, M., Lefevre, J., Lenoir, M., et al. (2009). Anthropometric and performance measures for the development of a talent detection and identification model in youth handball. *Journal of Sports Sciences*, *27*(3), 257-266.
Molina-López, J., Barea Zarzuela, I., Sáez-Padilla, J., Tornero-Quiñones, I., & Planells, E. (2020). Mediation effect of age category on the relationship between body composition and the physical fitness profile in youth handball players. *International journal of environmental research and public health*, *17*(7), 2350.
Moncef, C., Said, M., Olfa, N., & Dagbaji, G. (2012). Influence of morphological characteristics on physical and physiological performances of tunisian elite male handball players. *Asian journal of sports medicine*, *3*(2), 74.
Moss, S. L., McWhannell, N., Michalsik, L. B., & Twist, C. (2015). Anthropometric and physical performance characteristics of top-elite, elite and non-elite youth female team handball players. *Journal of sports sciences*, *33*(17), 1780-1789.
Nikolaidis, P. T., & Ingebrigtsen, J. (2013). The relationship between body mass index and physical fitness in adolescent and adult male team handball players. *Indian J Physiol Pharmacol*, *57*(4), 361-371.
Saavedra, J. M., Kristjánsdóttir, H., Einarsson, I. Þ., Guðmundsdóttir, M. L., Þorgeirsson, S., & Stefansson, A. (2018). Anthropometric characteristics, physical fitness, and throwing velocity in elite women's handball teams. *The Journal of Strength & Conditioning Research*, *32*(8), 2294-2301.
Schwesig, R., Hermassi, S., Fieseler, G., Irlenbusch, L., Noack, F., Delank, K. S., Shephard, R., & Chelly, M. S. (2016). Anthropometric and physical performance characteristics of professional handball players: influence of playing position. *The Journal of Sports Medicine and physical fitness*, *57*(11), 1471-1478.
Sporiš, G., Vuleta, D., Vuleta Jr, D., & Milanović, D. (2010). Fitness profiling in handball: physical and physiological characteristics of elite players. *Collegium antropologicum*, *34*(3), 1009-1014.
Visnapuu, M., & Jürimäe, T. (2009). Relations of anthropometric parameters with scores on basic and specific motor tasks in young handball players. *Perceptual and motor skills*, *108*(3), 670-676.
Yeadon, M.R., Kato, T., & Kerwin, D.G. (1999). Measuring running speed using photocells. *Journal of Sports Sciences*, *17*(3), 249-257.
Ziv, G. A. L., & Lidor, R. (2009). Physical characteristics, physiological attributes, and on-court performances of handball players: A review. *European Journal of Sport Science*, *9*(6), 375-386.
Živković, M., Stojiljković, N., Antić, V., Pavlović, L., Stanković, N., & Jorgić, B. (2019). The motor abilities of handball players of different biological maturation. *Facta Universitatis, Series: Physical Education and Sport*, 125-133.

UTICAJ TELESNOG SASTAVA NA BAZIČNE MOTORIČKE SPOSOBNOSTI RUKOMETAŠA

Cilj ovog istraživanja bio je da se ispita uticaj telesnog sastava na motoričke sposobnosti mladih rukometaša. Uzorak ispitanika činilo je 16 rukometaša, uzrasta od 15 do 20 godina. Merene varijable telesnog sastava činile su telesna masa, indeks telesne mase, procenat telesnih masti i procenat mišićne mase. Merenje motoričkih sposobnosti sprovedeno je testovima za procenu brzine kretanja, agilnosti i mišićne snage. Statistička analiza obuhvatila je deskriptivnu statistiku, korelacionu analizu i regresionu analizu, kako bi se utvrdilo da li postoji uticaj određenih varijabli telesnog sastava na motoričke sposobnosti. Na osnovu dobijenih rezultata, utvrđeno je da indeks telesne mase i procenat telesnih masti negativno utiču na brzinu pravolinijskog kretanja i brzinu promene pravca kretanja ($r = 0,52 – 0,66$, $R^2 = 0,27 - 0,44$, $p < 0,05$). Procenat mišićne mase doprineo je boljim performansama rukometaša na testovima za procenu brzine i agilnosti ($-0,55 < r < -0,67$, $R^2 = 0,31 - 0,45$, $p < 0,05$). Između telesne mase i motoričkih sposobnosti nije utvrđena

značajna povezanost, kao što ni jedna komponenta telesnog sastava nije značajno uticala na mišićnu snagu rukometaša ($p > 0,05$). Ovim istraživanjem utvrđeno je da gojaznost doprinosi sporijem kretanju, za razliku od mišićne mase koja čini rukometaše bržim, kako prilikom pravolinijskog, tako i prilikom nepravolinijskog kretanja. Uticaj telesnog sastava na ispoljavanje mišićne snage je potrebno dodatno ispitati, kao i uticaj telesne mase na specifične motoričke kretnje u rukometu.

Ključne reči: *telesna kompozicija, snaga, brzina, agilnost*

FACTA UNIVERSITATIS
Series: **Physical Education and Sport**, Vol. 20, No 2, 2022, pp. 123 - 131
https://doi.org/10.22190/FUPES220410011T

Research article

EMOTIONAL INTELLIGENCE IN ACROBATIC GYMNASTICS: HOW IMPORTANT IS THE ATHLETIC PROFILE?

UDC 796.894:159.955

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Abstract. *Emotional intelligence (EI) is considered to be an important parameter in the world of sports, as it affects the athletic performance and wellbeing of athletes. The purpose of this study was to examine EI in athletes of Acrobatic gymnastics (ACROGYM). Furthermore, potential differences in EI that may be associated with athletic profile (age, years of participation in ACROGYM, number of competitions, competition category) were investigated. In total, 95 acrobatic gymnasts, 9-18 years old (15.92 ± 3.17 years) participated voluntarily. The athletes' EI was assessed with the Emotional Quotient Inventory-Youth Version (EQ-i: YV), culturally adapted for the Greek population. According to the results, the ACROGYM athletes presented high levels of EI. However, the correlation analyses revealed that the association between the athletes' profile and scores on EI scales was not statistically significant (p >.05). The t-tests and the MANOVAs applied showed no statistically significant differences in the EI subscales associated with gymnasts' (a) participation in national competitions (p > .05); (b) frequency of training sessions per week (p > .05); (c) (not) being a member of a duet or a trio (p > .05); (d) position in the group (base, middle, top). It can be concluded that Greek acrobatic gymnasts present high levels of EI regardless of their age, their sport's experience or their level of performance. Moreover, neither their participation in a group nor their role in it seem to differentiate the dimensions of EI. Nevertheless, further research is needed in order to shed more light into EI in gymnastics.*

Key words: *ACROGYM, Emotional Quotient Inventory, mood, level of performance*

Received April 10, 2022 / Accepted July 22, 2022
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1. INTRODUCTION

Emotional intelligence (EI) is the ability of individuals to recognize and understand both their own emotions and the emotions of others, control them and to use the information derived from them to guide their behavior (Brody, 2004). Emotion management outcomes are highly related to EI (Bahrololoum, Hassani, Bandeli &Akbari, 2012; Lane, Thelwell & Devonport, 2009) as EI plays an important role in reducing aggressive behaviors (García-Sancho, Salguero, & Fernández-Berrocal, 2014), job performance (Fox & Spector, 2000), social life (Chan & Mallett, 2011; Goleman, 1995; Lane et al., 2010; Meyer & Fletcher, 2007; Mavroveli et al., 2009; Saarni, 1999; Schutte et al., 2001) and well-being (Cabello & Fernandez-Berrocal, 2015).

Regarding sport, there is a growing interest in EI. Numerous authors state that sports offer a significant context, in which several aspects of EI are being developed (Allen & Laborde, 2014; Arikan, 2020; Bar-On, 1997, 2006; Bukaliya & Rupande, 2015; Petrides, Gomez &Perez- Gonzalez, 2017); whereas, research shows that athletes present higher EI levels than non-athletes (Rani, 2019; Singh, Singh & David, 2020; Szabo & Urbán, 2014). Furthermore, since EI contributes to the reduction of negative emotions (Laborde, Dosseville & Allen, 2016; Mikolajczak, Menil &Luminet, 2007; Mikolajczak & Luminet, 2008; Walton, Keegan, Martin & Hallock, 2018), its importance for athletic performance is undoubtedly recognized (Akelaitis & Malinauskas, 2018; Ciarrochi, Forgas, & Mayer, 2001; Nielsen et al., 2013; Weinberg & Gould, 2010). Several researchers argue that it is important for athletes to recognize, understand, control, and manage their emotions (Crombie, Lombard & Noakes, 2009; Magrum, Waller, Campbell & Schempp, 2019), and be able to make better decisions (Campo et al., 2017; Laborde, Guillén & Mosley, 2016; Laborde, Guillén & Watson, 2017; Petrides et al., 2017). Indeed, athletes with higher EI have been found to control their emotions better in stressful situations (Laborde, Dosseville, Guillén, & Chávez, 2014a), respond better to repetitive periods of strenuous exercise (Lane & Wilson, 2011) and perceive problems in their sports as learning opportunities (Jahroni & Ghaleh, 2015).

Nevertheless, the existing research on potential EI differences among athletes from different sport types and/or with different athletic profiles is limited and provides contradictory data, so far. In some studies it has been found that athletes from different types of sport present similar EI levels (Bal, Singh, Sood & Kumar, 2011; Laborde et al., 2017); whereas, there are other studies showing significant differences between team- and individual sports in specific aspects of EI, such as psychological skill and motives (Kajbafnezhad et al., 2011; Sudheesh, 2020). Regarding the association of the athletic profile with EI, research is quite limited. There is some evidence supporting the superiority of elite athletes, compared to novices in some sports (canoe; track and field; football; taekwondo; tennis) (Arribas-Galarraga et al., 2019; Castro-Sánchez et al., 2018; Saies et al., 2014), but these findings cannot be generalized to other sports. Laborde, Dosseville, Guillén, and Chávez (2014b) found that the frequency and the duration of athletic involvement are more relevant to EI growth than years of participation. However, Laborde, Guillén and Watson (2014) found the opposite.

Acrobatic gymnastics (ACROGYM) is a gymnastics discipline in which the athletes cooperate to execute difficult gymnastics elements while being synchronized, and performing dance steps, acrobatic pyramids, jumps, etc. They present their gymnastic routines in duets or groups, in which each athlete has a different position/role, according

to their individual features and abilities. In more detail, duets are made up of a base and a top. Women's groups are comprised of a base, a middle, and a top partner and men's groups have a base, two middle and one top partner. Bases are generally older athletes that display strength and balance; tops are younger athletes and display flexibility and agility; middles are often required to show a combination of all attributes. ACROGYM is a highly demanding sport requiring among others, body control, balance, strength, courage, and trust between the members of group. It is obvious that EI is important in ACROGYM; however, to our knowledge studies addressing EI in gymnastics and in particular in acrobatics have not been published. Thus, the purpose of this study was to examine EI in athletes participating in ACROGYM and to investigate potential EI differences that may be associated with their athletic profile.

2. METHOD

2.1. Participants

In total, 95 acrobatic gymnasts, who were members of seven gymnastics clubs from different areas in Greece, volunteered to participate in this study. Among them, 91 were females and 4 males, and their age ranged between 9 and 18 years (M=15.92 ± 3.17 years).

2.2. Measures

The athletes' EI was assessed with the Emotional Quotient Inventory-Youth Version (EQ-i: YV, Bar-On & Parker, 2000), culturally adapted to the Greek population (David-Spanopoulou, 2020). The EQ-i: YV is a 60-item self-report tool that is based on the Bar-On Emotional Quotient Inventory (EQ-i, Bar-On, 1997) and aims at measuring EI in youth between 7 and 18 years old.

The EQ-i: YV consists of five scales that represent different EI dimensions: the intrapersonal dimension (including emotional self-awareness, assertiveness, self-regard, self-actualization, independence); interpersonal dimension (including empathy, social responsibility, interpersonal relationship); adaptability (including reality testing, flexibility, problem solving); stress management (including stress tolerance, and impulse control); and the general mood (including optimism and happiness). Each item is scored on a four-point Likert scale (1 = Very Seldom or Not True for Me, 4 = Very Often or True for Me). The scores of the items that constitute each scale are summed up and the scale total score is calculated. Moreover, a total EI quotient (EQ) is provided. High scores indicate a better level, while low scores indicate a lower level (Ferrándiz, Hernández, Bermejo, Ferrando & Sáinz, 2012).

The internal consistency of the Greek version of the EQ-i: YV is excellent, ranging from .87 to 0.90 (David-Spanopoulou, 2020). In the present study, the values of Cronbach's α for the EQ-i: YV revealed satisfactory reliability for the Interpersonal Dimension (α = .76), Adjustment (α = .80), General Mood (α = .82) and Positive Impression (α = .70). However, item 28 and items 3 and 39 were deleted for a satisfactory level of reliability to be achieved for the Intrapersonal dimension scale (α= .73) and the Anxiety scale (α = .72), respectively.

Apart from their EI, information about the athletes' age, as well as their athletic profile was gathered via a questionnaire that the athletes filled. Data regarding the participants'

athletic profile included years of participation in ACROGYM; the number of competitions, competition category, participation in national competitions, frequency of training sessions per week, participation in duets or trios, and position in the group (basis, middle, top).

2.3. Procedure

Data collection started in February and was completed in April 2021. Initially, an informative online meeting was held, during which the researcher group informed the coaches of the teams about the purpose and procedure of the research. Due to COronaVIrus Disease 19 pandemic [COVID-19, as defined by the World Health Organization (WHO) in February 2020], and the restrictions in Greece, communication with the coaches was conducted via e-mail or telephone. Then, the consent statement form and the EQ-i: YV was uploaded to an online platform (Google forms), and after the approval of the coaches and parents of the athletes, the questionnaires were administered to the athletes through social networks. The average time needed for the participants to fill in the questionnaires was 10min and the use of personal means with internet access facilitated the process of data collection in an environmentally friendly way.

2.4. Statistical analysis

First, the participants' descriptive data regarding their demographic characteristics, athletic profile and responses to the EQ-i: YV were calculated. Then, Cronbach's α was computed to check the internal consistency of the questionnaire. Then, correlations between the athletes' age, years of participation in the ACROGYM, number of competitions, and the ACROGYM competition category (A, B1, B2, C, D, E) with their scores on the EQ-i: YV were computed, using Pearson's r or Spearman's ρ correlation coefficient, depending on the type of variables. Cohen's (1988) cut-offs were used to estimate the strength of the statistically significant correlations.

The participants were classified into sub-groups according to whether (a) they had (or not) participated in national competitions, (b) they participated in fewer (or ≥) than three training sessions per week, (c) were members of duets or trios or participated in a team without executing routines in duets or trios. Potential differences between them in the components of EI were examined using independent samples t-tests and multivariate analyses of variance, respectively. Finally, gymnasts who were members of duets or trios (n= 78) were classified into three groups according to their position/role in the group (basis, middle, top). Differences between them in the components of EI were examined using multivariate analyses of variance. For the above analyses, the IBM SPSS 25.0 software package was used for all data analysis, while the level of statistical significance was set at 0.5.

3. RESULTS

The descriptive statistics of the gymnasts' profile are presented in Table 1, whereas their scores in the EQ-i: YV are presented in Table 2. Starting with the correlation coefficient indexes that were computed, Pearson's r revealed that the correlation between the athletes' age, the years they participated in AG, and the number of competitions they took part in with EI scales was not statistically significant, ($p>.05$). The correlation between the years of participation in AG and the adaptability was the only exception

found with a weak statistical significance (r= 27.3, p= .007). Spearman's ρ that was computed between the athletes' competition category and EI scales did not show a statistically significant correlation ($p > .05$).

Table 1 Descriptive statistics (M, SD, %) of the participants' characteristics

Age	15.92 ± 3.17
Years of participation in ACROGYM	8.09± 3.76
Number of competitions	3.11± 3.16
Competition category (%)	
A	6%
B1	18%
B2	10%
C	38%
D	18%
E	10%
Participation in national competitions (%)	63%
Training sessions per week (%)	
< 3	25%
≥ 3	75%
Members of duets (%)	22%
Members of trios (%)	60%
Not a member of a group (%)	18%

Moreover, according to the t-test and the MANOVAs, there were no statistically significant differences on the EI scales associated with (a) participation in national competitions ($p > .05$); (b) frequency of training sessions per week ($p > .05$); (c) being a member of a duet, a trio or not ($p > .05$). Similarly, in the subsample of participants who were members of groups, no statistically significant differences were detected due to the position (base, middle, top) of the athlete in the group.

Table 2 Means and standard deviations of acrobatic gymnasts on the EQ-i: YV subscales

		Intrapersonal Dimension	Interpersonal Dimension	Adaptability	Stress Management	General Mood
Total sample		11.62±2.94	41.84±3.38	31.59±3.98	22.79±5.03	43.83±5.29
National competitions	Non-participants	11.03±2.72	41.77±2.82	30.83±3.47	23.00±5.10	43.63±5.32
	Participants	11.97±3.04	41.88±3.70	32.03±4.22	22.67±5.03	43.95±5.31
Acrobatics groups	Duets	11.00±2.64	42.24±3.08	31.00±4.02	22.24±4.44	43.90±5.30
	Trios	11.95±3.19	42.02±3,67	32.33±4.00	22.35±5.05	43.60±4.72
	Non- participants	11.29±2.34	40.76±2.61	29.82±3.38	24.94±5.39	43.74±5.12
Position in group	Basis	12.09±3.13	42.28±3.51	32.05±4.07	22.65±4.78	43.75±5.46
	Middle	10.90±3.13	41.48±3.70	32.76±3.71	22.81±4.72	43.67±5.37
	Top	11.64±2.73	42.36±3.32	30.57±4.24	20.57±5.02	43.93±5.36

4. DISCUSSION

The purpose of this study was to examine EI in athletes participating in ACROGYM. Our main findings were that the acro gymnasts present high levels of EI; however, EI does not associate with any feature of their athletic profile.

Regarding the gymnasts' athletic profile, according to our results, no element (years of participation in ACROGYM, number of competitions, competition category) correlated with EI. Those findings are contrary to those of other studies, who report that elite athletes present higher levels of EI components (empathy, emotional recognition, emotional control and regulation) (Chakarvati & Lal, 2016; Crombie et al., 2009; Laborde, Brüll, Weber, & Anders, 2011; Laborde, You, Dosseville & Salinas,2012; Lane et al., 2009; Mikolajczak et al., 2007; Perlini & Halverson, 2006; Saies et al., 2014; Zizzi, Deaner, & Hirschhorn, 2003). Similarly, there was no association between the number of training sessions per week and the athletes' EI level. This is in agreement with Guillen and Laborde (2014), who found that practice frequency is not associated with EI, and argue that the key component is practice duration. Nevertheless, in the current study, data regarding practice duration were not gathered.

Since the requirements for teamwork increase in acrobatic routines in duets and trios, the potential EI differences of gymnasts who participate (or not) in duets or trios were examined. However, statistical analyses did not reveal any differences between the gymnasts. Nevertheless, previous researchers noted that team sport athletes are involved with their teammates, spending time training together (Kajbafnezhad et al., 2011); however, they present high emotional management (Castro-Sánchez et al., 2018) and higher rates of emotional self-regulation and sociability than individual sport athletes (Petrides, 2009).

Even though in this study no significant differences were detected among acrobatic athletes due to their athletic profile, the high levels of their EI should be taken into consideration. Similar values were observed in previous studies, which found that the ability of the athletes to use and control their motions and other components, social skills, self-awareness, empathy, emotional stability, altruistic behavior as well as adaptability and psychosocial function were higher in athletes than non-athletes (Rani, 2019; Rutkowska & Bergier, 2015; Singh et al., 2020; Szabo & Urbán, 2014).

Nevertheless, the fact that the scale of general mood, which reflects the participants' optimism and happiness, presented the lowest values should be noted. This finding can be attributed to the period in which this study was conducted, which was during the second lock-down due to the COVID-19 pandemic. In two studies conducted in 2020 it was revealed that the pandemic negatively affected the mood of handball players and the quality of sleep in soccer players. In both studies the findings were attributed to perceived fatigue's level, depression and stress that were caused by negative lifestyle changes (lower levels of physical exercise, higher consumption of alcohol, other abusive behaviours, etc.) (Mon-López, García-Aliaga, Bartolomé & Solana, 2020; Mon-López, de la Rubia Riaza, Hontoria Galán & Refoyo Roman, 2020).

To our knowledge, this is the first study shedding light into EI in acrobatic gymnasts. However, there are some limitations that should be considered when interpreting the results. To start with, as mentioned before, data collection was conducted during the COVID-19 lockdown, which means that the participants' routine was involuntarily altered. Moreover, among the participants there were only 4 males; thus, potential gender related differences could not be investigated.

5. CONCLUSIONS

Summarizing the aforementioned, Greek acrobatic gymnasts present high levels of EI regardless of their age, their experience in this sport, or their level. Moreover, neither their participation in a group nor their role in it seems to differentiate the dimensions of EI. However, ACRO gymnasts presented low scores on the scale of general mood, which may be due to the negative impact of the pandemic of COVID-19 on their lives. Although this study provides useful information about EI in acrobatic gymnasts, further research after the end of the pandemic will shed more light on EI, which is an important factor affecting not only the athletes' performance but also their well-being.

REFERENCES

Akelaitis A. V., & Malinauskas R. K. (2018). The expression of emotional skills among individual and team sports male athletes. *Pedagogics, Psychology, Medical-biological Problems of Physical Training and Sports, 22*(2), 62–67.

Allen, M. S., & Laborde, S. (2014). The role of personality in sport and physical activity. *Current Directions in Psychological Science*, *23*(6), 460-465.

Arikan, N. (2020). Effect of sport education model-based social-emotional learning program on emotional intelligence. *International Education Studies,13*(4), 41-53

Arribas-Galarraga, S., Cecchini, J. A., Luis-De-Cos, I., Saies, E., & Cos, L. D. (2019). Influence of emotional intelligence on sport performance in elite canoeist. *Journal of Human Sport and Exercise*, *15*(4), 772-782.

Bahrololoum, H., Hassani, A., Bandeli, M. R., & Akbari, A. (2012). The relationship between the emotional intelligence and mental skills in Iranian elite male volleyball players (case study Semnan province). *International Journal of Academic Research in Business and Social Sciences*, *2*(7), 123.

Bal, B. S., Singh, K., Sood, M., & Kumar, S. (2011). Emotional intelligence and sporting performance: A comparison between open-and closed-skill athletes. *Journal of Physical Education and Sport Management, 2*(5), 48-52.

Bar-On, R. (1997). *The Emotional Quotient İnventory (EQ-I): A test of emotional intelligence*. Toronto: Multi-Health Systems.

Bar-On, R. (2006). The Bar-On model of emotional-social intelligence (ESI). *Psicothema, 18*(1), 13-25.

Bar-On, R., & Parker, J. D. A. (2000).*The Bar-On Emotional Quotient Inventory:Youth Version™ (EQ-i: YV™): Technical manual.* Toronto, Canada: MultiHealth Systems.

Brody, N. (2004). What cognitive intelligence is and what emotional intelligence is not. *Psychological Inquiry*, *15*(3), 234-238.

Bukaliya, R., & Rupande, G. (2013). Mitigating the effects of dwindling resource base in open and distance learning through community service programmes. *Greener Journal of Educational Research, 3*(5), 206-216

Cabello, R., & Fernandez-Berrocal, P. (2015). Under which conditions can introverts achieve happiness? Mediation and moderation effects of the quality of social relationships and emotion regulation ability on happiness. *Peer Journal*, *3*, e1300. doi: 10.7717/peerj.1300

Campo, M., Sanchez, X., Ferrand, C., Rosnet, E., Friesen, A., & Lane, A. M. (2017). Interpersonal emotion regulation in team sport: Mechanisms and reasons to regulate teammates' emotions examined. *International Journal of Sport and Exercise Psychology*, *15*(4), 379-394.

Castro-Sánchez, M., Chacón-Cuberos, R., Zurita-Ortega, F., Puertas-Molero, P., Sánchez-Zafra, M., & Ramírez-Granizo, I. (2018). Emotional intelligence and motivation in athletes of different modalities. *Journal of Human Sport and Exercise*, *13*(Proc2), S162-S177.

Chakarvarti, D., &Lal, M. (2016). Emotional intelligence and its association with social physique anxiety and performance among sprinters. *Rupkatha Journal on Interdisciplinary Studies in Humanities, 8*(2), 71-78.

Chan, J. T., & Mallett, C. J. (2011). The value of emotional intelligence for high performance coaching. *International Journal of Sports Science & Coaching*, *6*(3), 315-328.

Ciarrochi, J., Forgas, J. P., & Mayer, J. D. (2001). *Emotional intelligence in everyday life: A scientific inquiry*. Philadelphia, PA: Psychology Press.

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences* (2nd ed.). Mahwah, NJ: Lawrence Erlbaum.

Crombie, D., Lombard, C., & Noakes, T. (2009). Emotional intelligence scores predict team sports performance in a national cricket competition. *International Journal of Sports Science & Coaching*, *4*(2), 209-224.

David-Spanopoulou, A. (2020). Prosarmogi stin Ellada tou erotimatologiou sinaisthimatikis noimosinis Bar-On: Ekdohi gia paidia kai efivous: axiopistia, sihnotites kai typikoi vathmoi, efarmoges stin ekpaidefsi, tin

erevna kai tin kliniki praxi. [Adaptation of the Bar-On emotional intelligence questionnaire: version for children and adolescents in Greece: reliability, frequencies and standard scores, implementation in education, research and clinical practice. *Erkyna, Review of Education-Research Issues, 21,* 55-78.

Ferrándiz, C., Hernández, D., Bermejo, R., Ferrando, M., & Sáinz, M. (2012). Social and emotional intelligence in childhood and adolescence: Spanish validation of a measurement instrument. *Journal of Psychodidactics, 17*(2), 309–338.

Fox, S., & Spector, P. E. (2000). Relations of emotional intelligence, practical intelligence, general intelligence, and trait affectivity with interview outcomes: It's not all just 'G'. *Journal of Organizational Behavior: The International Journal of Industrial, Occupational and Organizational Psychology and Behavior, 21*(2), 203-220.

García-Sancho, E., Salguero, J. M., & Fernández-Berrocal, P. (2014). Relationship between emotional intelligence and aggression: A systematic review. *Aggression and Violent Behavior, 19*(5), 584-591.

Goleman, D. (1995). *Emotional intelligence.* New York: Bantam Books.

Guillen, F., & Laborde, S. (2014). Higher-order structure of mental toughness and the analysis of latent mean differences between athletes from 34 disciplines and non-athletes. *Personality and Individual Differences, 60,* 30–35.

Jahroni, F. G., & Ghaleh, S. (2015). Predicting the mental skills through emotional intelligence in student sports Olympiad in 2014. *Journal of Applied Environmental and Biological Sciences, 5*(11S), 727-732.

Kajbafnezhad, H., Ahadi, H., Heidarie, A. R., Askari, P., & Enayati, M. (2011). Difference between team and individual sports with respect to psychological skills, overall emotional intelligence and athletic success motivation in Shiraz city athletes. *Journal of Physical Education and Sport*, *11*(3), 249.

Laborde, S., Brüll, A., Weber, J., & Anders, L. S. (2011). Trait emotional intelligence in sports: A protective role against stress through heart rate variability? *Personality and Individual Differences, 51(1),* 23–27.

Laborde, S., Dosseville, F., & Allen, M. S. (2016). Emotional intelligence in sport and exercise: A systematic review. *Scandinavian Journal of Medicine & Science in Sports, 26(8),* 862–874.

Laborde, S., Dosseville, F., Guillén, F., & Chávez, E. (2014). Validity of the Trait Emotional Intelligence Questionnaire in sports and its links with performance satisfaction. *Psychology of Sport and Exercise, 15*(5), 481-490.

Laborde, S., Guillén, F., & Mosley, E. (2016). Positive personality-trait-like individual differences in athletes from individual-and team sports and in nonathletes. *Psychology of Sport and Exercise, 26,* 9-13.

Laborde, S., Guillén, F., & Watson, M. (2017). Trait Emotional Intelligence Questionnaire Full-form and Short-form versions: Links with sport participation frequency and duration and type of sport practiced. *Personality and Individual Differences, 108,* 5-9.

Laborde, S., You, M., Dosseville, F., & Salinas, A. (2012). Culture, individual differences, and situation: Influence on coping in French and Chinese table tennis players. *European Journal of Sport Science, 12*(3), 255–261

Lane, A. M., & Wilson, M. (2011). Emotions and trait emotional intelligence among ultra-endurance runners. *Journal of Science and Medicine in Sport, 14*(4), 358-362.

Lane, A. M., Devonport, T. J., Soos, I., Karsai, I., Leibinger, E., & Hamar, P. (2010). Emotional intelligence and emotions associated with optimal and dysfunctional athletic performance. *Journal of Sports Science &Medicine, 9*(3), 388.

Lane, A., Thelwell, R., & Devonport, T. (2009). Emotional intelligence and mood states associated with optimal performance. *E-journal of Applied Psychology, 5*(1), 67-73.

Magrum, E. D., Waller, S., Campbell, S., & Schempp, P. G. (2019). Emotional intelligence in sport: A ten-year review (2008–2018). *International Journal of Coaching Science, 13*(2), 3–32.

Mavroveli, S., Petrides, K. V., Sangareau, Y., & Furnham, A. (2009). Exploring the relationships between trait emotional intelligence and objective socio-emotional outcomes in childhood. *British Journal of Educational Psychology, 79*(2), 259-272.

Meyer, B. B., & Fletcher, T. B. (2007). Emotional intelligence: A theoretical overview and implications for research and professional practice in sport psychology. *Journal of Applied Sport Psychology, 19*(1), 1-15.

Mikolajczak, M., & Luminet, O. (2008). Trait emotional intelligence and the cognitive appraisal of stressful events: An exploratory study. *Personality andIndividual Differences, 44*(7), 1445-1453.

Mikolajczak, M., Menil, C., & Luminet, O. (2007). Explaining the protective effect of trait emotional intelligence regarding occupational stress: Exploration of emotional labour processes. *Journal of Research in Personality, 41*(5), 1107-1117.

Mon-López, D., de la RubiaRiaza, A., HontoriaGalán, M., &Refoyo Roman, I. (2020). The impact of Covid-19 and the effect of psychological factors on training conditions of handball players. *International Journal of Environmental Research and Public Health, 17*(18), 6471.

Mon-López, D., García-Aliaga, A., Bartolomé, A. G., & Solana, D. M. (2020). How has COVID-19 modified training and mood in professional and non-professional football players?. *Physiology &Behavior, 227,* 113-148.

Nielsen, L., Meilstrup, C., Nelausen, M., Koushede, V., & Holstein, B. (2015). Promotion of social and emotional competence: Experiences from a mental health intervention applying a whole school approach. *Health Education, 115*, 339–356.

Perlini, A. H., & Halverson, T. R. (2006). Emotional intelligence in the National Hockey League. *Canadian Journal of Behavioural Science/Revue Canadienne des Sciences du Comportement*, *38*(2), 109-119

Petrides, K. V. (2009). *Technical manual for the Trait Emotional Intelligence Questionnaire (TEIQue).* London: London Psychometric Laboratory.

Petrides, K. V., Gómez, M. G., & Pérez-González, J. C. (2017). Pathways into psychopathology: Modeling the effects of trait emotional intelligence, mindfulness, and irrational beliefs in a clinical sample. *Clinical Psychology & Psychotherapy*, *24*(5), 1130-1141.

Rani, A. (2019). Relationship of social intelligence and emotional intelligence among sports and non-sports person. *International Journal of Physiology, Nutrition and Physical Education 2019, 4*(1), 1707-1710.

Rutkowska, K., & Bergier, J. (2015). Psychological gender and emotional intelligence in youth female soccer players. *Journal of Human Kinetics*, *47*(1), 285-291.

Saarni, C. (1999). *The development of emotional competence*. New York: Guilford Press.

Saies, E., Arribas-Galarrag, S., Cecchini, J. A., Luis-De-Cos, I., &Otaegi, O. (2014). Differences in goal orientation, self-determined motivation, emotional intelligence and sport satisfaction between expert and novice canoeing paddlers. *Cuadernos de Psicología del Deporte, 14*(3), 21-30.

Schutte, N. S., Malouff, J. M., Bobik, C., Coston, T. D., Greeson, C., Jedlicka, C., ...& Wendorf, G. (2001). Emotional intelligence and interpersonal relations. *The Journal of Social Psychology, 141*(4), 523-536.

Singh, T. N., Singh, T. P., & David, O. (2020). A comparative analysis of emotional intelligence between female athletes and non-athletes. *International Journal of Yogic, Human Movement and Sports Sciences, 5*(2), 31-33.

Sudheesh, J. J. (2020). Emotional intelligence of female intervarsity players: A comparative analysis. *The International Journal of Analytical and Experimental Modal Analysis, 12*(4), 520-525.

Szabo, A., & Urbán, F. (2014). Do combat sports develop emotional intelligence? *Kinesiology: International Journal of Fundamental and Applied Kinesiology*, *46*(1), 53-60.

Walton, C. C., Keegan, R. J., Martin, M., &Hallock, H. (2018). The potential role for cognitive training in sport: more research needed. *Frontiers in Psychology*, *9*, 1121.

Weinberg, R. S., & Gould, D. (2019). *Foundations of sport and exercise psychology*, *7E*. Human kinetics.

World Health Organization (2020). *Coronavirus Disease 2019 (COVID-19) Situation Report 83.* Geneva, Switzerland.

Zizzi, S., Deaner, H., & Hirschhorn, D. (2003). The relationship between emotional intelligence and performance among college basketball players. *Journal of Applied Sport Psychology*, *15*(3), 262-269.

EMOCIONALNA INTELIGENCIJA U AKROBATSKOJ GIMNASTICI: KOLIKO JE VAŽAN PROFIL SPORTISTE?

Emocionalna inteligencija (EI) smatra se važnim parametrom u sportskom svetu, s obzirom na to da utiče na sportske performanse i dobrobit sportista. Cilj ovog istraživanja bio je da se analizira EI sportista koji se takmiče u akrobatskoj gimnastici (ACROGYM). Potencijalne razlike u EI koje se mogu povezati sa profilom sportiste (godine starosti, godine bavljenja ACROGYM, broj takmičenja na kojima je sportista učestvovao, rang takmičenja) takođe su analizirane. Ukupno je 95 akrobatskih gimnastičara, starosti 9-18 godina (15.92 ± 3.17 years), dobrovoljno učestvovalo u istraživanju. Njihova EI analizirana je uz pomoć EQ-i: YV upitnika, koji je prilagođen populaciji grčkih sportista. Kod ACROGYM atletičara uočeni su visoki nivoi EI. Uprkos tome, korelaciona analiza je utvrdila da korelacije između profila sportista i vrednosti na EI nisu bile statistički značajne (p >.05). T-testom i MANOVA analizom nisu utvrđene statistički značajne razlike za EI podskale za (a) učešće na nacionalnim takmičenjima (p > .05); (b) broj treninga nedeljno (p > .05); (c) (ne)učestvovanje u dublu ili triu (p > .05); (d) mesto u timu prilikom ekipnog nastupa. Može se zaključiti da grčki akrobatski gimnastičari imaju visoke nivoe EI uprkos njihovim godinama starosti, iskustva u sportu, i sportskih performansi. Ni njihovo učešće u timskim nastupima ni njihova uloga u timu ne utiču na razlike u dimenzijama EI. Ipak, dalja istraživanja su neophodna kako bi se bolje razumela uloga EI u gimnastici.

Ključne reči: *ACROGYM, Emotional Quotient Inventory test emotivne inteligencije, raspoloženje, nivo sportskih performansi*

FACTA UNIVERSITATIS
Series: **Physical Education and Sport**, Vol. 20, No 2, 2022, pp. 133 - 141
https://doi.org/10.22190/FUPES220415012L

Research article

FUNCTIONAL TRAINING VS. PHYSICAL EDUCATION CLASSES: THE EFFECTS ON PHYSICAL PERFORMANCE IN PRIMARY SCHOOL GIRLS

UDC 796.015.57:371.214-053.5

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Abstract. *This study aimed to determine the effects of two training methods on the strength and mobility of trunk muscles in primary school girls. The sample of participants included 596 girls aged 11 to 15. The participants were randomly assigned to two groups: 1) an experimental group (n = 314) that performed a functional training (FT) program; 2) a control group (n = 282) that performed regular Physical Education (PE) classes. The experimental program was implemented during regular PE classes over a period of 16 weeks, where 3 training sessions were conducted per week, lasting 45 minutes each. The FitnessGram battery of tests was used to estimate the strength and mobility of trunk muscles at the initial and the final measurement. The following tests were used: Curl up, Incline push-ups, and dynamic and static Trunk lift tests. The results of the two-factor ANOVA showed significant ($p < 0.001$) improvements in each test for both groups. The magnitude of the effect size ranged from medium to large and differed between the methods in all tests except for abdominal muscle strength. These findings indicate that both training programs are beneficial for developing trunk muscle strength and mobility in primary school girls. Future research should consider investigating differences between the methods in primary school students.*

Key words: *functional training, physical education, elementary school, core muscles, students*

1. INTRODUCTION

As a curricular subject focused on physical development and health, physical education represents an integral part of the education system (Milanovic & Radisavljevic-Janic, 2018). The main goals of physical education (PE) include promoting health in primary and secondary education (Coledam et al., 2018). In this regard, the previous research has

Received April 15, 2022 / Accepted July 22, 2022
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demonstrated that PE classes increase daily physical activity (Pate, O'Neil & McIver, 2011) and moderate to vigorous activities (Chen, Kim, & Gao, 2014). Moreover, physical education interventions were associated with increases in fundamental motor skills regardless of the frequency or duration of PE classes (García-Hermoso et al., 2020).

In addition to the mentioned benefits of PE classes, the positive effects of functional training have been reported in the literature. Over the last decade, functional training has become a globally applicable training method, considered by many to be a better alternative than traditional resistance training for the development of muscle strength (Weiss et al., 2010). What is more, functional exercises are defined as the work performed against resistance to the intention that the generated force directly benefits the activities of daily living and sports-related movements (Kreamer et al., 2002). Moreover, functional exercises are designed to specifically improve activities in everyday life (Beckham & Harper, 2010) by stimulating the neuromuscular system through multi-joint and multi-planar movements (Boyle, 2004). In practical terms, functional training involves a host of ballistic movements, manifested through strength and agility exercises with training tools such as resistance bands, medicine balls, and unstable surfaces (Ives & Shelley, 2003).

Notwithstanding, the definitions and the utilization of functional training greatly vary in the existing literature. Furthermore, experimental research carried out in order to establish the benefits of functional training is specifically focused on improving functions in older adults and military personnel (Aragão-Santos, de Resende-Neto & Me, 2020; Guler, Tuncel, & Bianco, 2021; Haddock et al., 2016; Liu et al., 2014; O'Connor et al., 2017; Shaikh & Mondal, 2012). Contrary, limited data is available regarding the effects of functional training on fundamental motor skills in youth. Functional training was reported to be more effective than traditional training for improving movement quality and fitness performance in school-age girls (Liao, Li, & Wang, 2019). Further, after 16 weeks of an experimental program, Marković (2015) reported better improvements in muscle strength in primary school students who performed functional exercises compared to those who attended regular PE classes. In the latest study, Branco et al. (2021) investigated the effects of functional and sports training programs on overweight adolescent girls. However, the results have shown no significant differences between the methods since both physical activity models were effective in improving obesity-related health parameters (Branco et al., 2021).

With insufficient data regarding functional training and primary school students, opposite statements were made by the aforementioned authors. The claims differ when it comes to the research conducted on various populations. Despite the evidence in favor of functional exercise (Da Silva-Grigoletto et al., 2019; de Resende-Neto et al., 2021; Yildiz, Pinar, & Gelen, 2019), numerous authors doubt its superiority over traditional principles (Aragao-Santos et al., 2018; Bonney, Ferguson, & Smits, 2017; Branco et al., 2020; Mcweeny, Boule, Neto, & Kennedy, 2020).

Based on the above mentioned, it is evident that further research is needed in order to determine the impact of functional training on morphological characteristics and fundamental motor skills, especially in youth. Therefore, this study aimed to examine the effects of functional training and traditional PE classes on the strength and mobility of trunk muscles in elementary school girls.

2. METHODS

2.1. Study design

A design of two groups, a pretest-posttest, randomly controlled trial, was used in this study. In randomized order, participants were assigned to two groups: 1) an experimental

group (n = 314) which performed a functional training (FT) program; 2) a control group (n = 282) which performed regular PE classes. Randomization was done using Excel software. The experimental program lasted 16 weeks and was implemented during regular PE classes. Each week of the program consisted of 3 training sessions, lasting 45 minutes each. Before the beginning of the program, the initial measurement was carried out by qualified specialists. After the intervention, the same testers conducted the final measurement using the same order and procedure as during the initial measurement.

2.2. Participants

This study included 596 elementary school female students. All participants were students of the 5th to 8th grade, aged 11 to 15. Exclusion criteria were adopted to ensure the participants' physical status. Participants were excluded from the study if they were regularly involved in any sports-related programs 2 times or more per week. Further, if a student had any injury, surgery or functional limitation that would affect the health status and the experimental procedure, she would be prevented from participating. In addition, any student previously advised to avoid muscular strain by a health professional regarding any contraindications was excluded.

All participants and their parents/guardians were informed about the experimental procedures, and provided written informed consent prior to participation. The method was approved by the Ethics Committee of the Faculty of Sport and Physical Education with all procedures conducted in accordance with the Declaration of Helsinki.

2.3. Procedures

Measurement of anthropometric characteristics

Measurements of body height were carried out with an anthropometer to the nearest 0.1 cm (anthropometer according to Martin). Body composition parameters were collected using an electronic scale (HBF-511B-E; Omron Healthcare) to the nearest 0.1 kg while participants were barefoot, wearing the clothes they practice in (Đurašković, 2001). The anthropometric characteristics of the sample are presented in Table 1.

Table 1 Anthropometric characteristics of the Functional Training group (n = 314) and the Physical Education group (n = 282).

Sample characteristics	Grade			
	5th	6th	7th	8th
Functional Training group				
Body height (*cm*)	150.14 ± 8.57	157.30 ± 6.33	160.23 ± 6.35	166.70 ± 8.00
Body mass (*kg*)	41.07 ± 8.25	44.96 ± 6.97	51.72 ± 8.95	56.80 ± 10.11
Body mass index (kg/m^2)	18.14 ± 2.91	18.19 ± 2.87	20.07 ± 2.80	20.35 ± 2.59
N	64	89	101	60
Physical Education group				
Body height (*cm*)	154.02 ± 6.61	156.12 ± 6.19	161.57 ± 7.13	164.23 ± 8.04
Body mass (*kg*)	43.67 ± 9.27	43.03 ± 8.27	52.48 ± 9.22	53.61 ± 9.61
Body mass index (kg/m^2)	18.26 ± 2.75	17.58 ± 2.69	20.06 ± 3.11	19.76 ± 2.48
N	61	90	79	52

Muscle strength and mobility testing

To evaluate the strength and mobility of trunk muscles, the subtest from the FitnessGram battery of tests was used. The FitnessGram represents a multi-component standardized method which is a commonly used tool for assessing physical fitness in primary and secondary students. It is used to assess three general components of health-related physical fitness: *aerobic capacity*, *musculoskeletal fitness*, and *body composition*. The FitnessGram battery of tests, which has shown considerable validity (Morrow, Martin, & Jackson, 2010), encompasses musculoskeletal fitness, including muscle strength, muscular endurance, and flexibility (Meredith & Welk, 2010).

The tests, both initial and final, were conducted following the instructions provided in the Manual (Meredith & Welk, 2010). The method was previously described and used to assess muscle strength and mobility in primary school boys (Marković, 2015).

The participants performed the following tests:

1. Curl up test - abdominal muscles strength (AMS);
2. Trunk lift test (dynamic) - lower back muscles strength (LBMS);
3. Incline push-ups - upper body strength (UBS);
4. Trunk lift test (static) - thoracic spine mobility (TSM).

Functional training program

The intervention program was conducted over 16 weeks. Each week of the intervention program included three training sessions lasting 45 minutes. Training sessions consisted of three phases: *the warm-up phase*, *the main phase*, and *the cool-down phase.*

The purpose of the warm-up phase was to adequately and gradually prepare participants for the workload and intensity of the main phase. Therefore, at the beginning of every training session, all participants in the FT group underwent a 10 min warm-up consisting of moderate-intensity jogging, static and dynamic stretches, and shaping exercises. The main phase consisted of three to five functional exercises, predominantly focused on developing trunk muscle strength and mobility. The exercises were performed in three sets, with the training volume presented in seconds. Each set was followed by a 30 second period of rest. Completing the exercises in the main phase lasted approximately 30 minutes, where the exercises were performed both with and without training tools. The equipment used during the intervention period included pilates bands, power bands and medicine balls. An example of the main training phase design for one week is presented in Table 2. The primary goals of the

Table 2 The example of exercises performed in the main training phase during 1 week in primary school girls.

	Main phase 1	Main phase 2	Main phase 3
Exercise	Elbow plank Split squat with power band pull Glute bridge with a medicine ball Bodyweight single leg deadlift	Plank on a medicine ball Kneeling push-ups with a medicine ball Deadbug Trunk rotation with a powerband	Side elbow plank Split squat with overhead band pull Lunge with trunk rotation Deadlift with powerband
Sets (*n*)	3	3	3
Duration (*sec*)	30 - 45	30 - 45	20 - 60
Rest (*sec*)	30	30	30

cool-down phase were to reduce the heart rate and to lower the body temperature. The cool-down phase represented the last part of each training session, lasting approximately 5 minutes including low-intensity aerobic exercise with stretching and breathing exercises. The stretching exercises involved maintaining a given position for 10 to 15 seconds.

2.4. Statistical analysis

All statistical analyses were performed using the Statistical Package for the Social Sciences (v20.0, SPSS Inc., Chicago, IL, USA). The results are presented as Mean ± SD. The Kolmogorov-Smirnov test confirmed the normality of the data. The changes in strength and mobility of trunk muscles were compared over the training period for both groups using a two-factor (group × time) univariate analysis of variance (ANOVA). The magnitude of the effect size (ES), represented by the partial Eta squared (η_p^2), was interpreted as: *small* (< 0.01); *medium* (0.01 - 0.14); *large* (> 0.14) (Cohen, 1988). All *p*-values less than 0.05 were considered significant for a 95% probability level.

3. RESULTS

The results obtained on the initial and the final measurements are presented in Table 3. The effects of the Functional training program and Physical Education classes on the strength and mobility of the trunk muscles in primary school girls are presented in Table 4. The F value, statistical significance, and effect sizes were calculated for each test in both groups. A combined analysis of variance (ANOVA) showed that both training methods had a significant effect on muscle strength and mobility in adolescent girls. Both training methods had a *large* positive effect ($p > 0.001$) on abdominal muscle strength, since the partial Eta squared reached .234 and .151. Further, the impact of functional exercises on lower back muscle strength was *large*, whereas the impact of PE classes was found to be *medium*. The improvements in upper body strength were also *large* in the FT group, while a *medium* positive effect was obtained in the PE group. However, a more significant positive effect on thoracic spine mobility was achieved in the PE group compared to the FT group ($\eta_p^2 = .090$ vs. $\eta_p^2 = .190$).

Table 3 Outcome measures, presented as Mean ± SD, for each grade in the Functional Training (FT) group (n = 314) and the Physical Education (PE) group (n = 282).

Measure	5th		6th		7th		8th	
	Initial	Final	Initial	Final	Initial	Final	Initial	Final
FT group								
AMS (*n*)	13.58±2.86	18.83±2.93	17.75±4.16	22.72±4.50	20.93±3.39	25.84±3.76	21.47±3.30	27.15±3.13
LBMS (*n*)	17.84±3.32	24.06±3.87	33.98±4.45	40.18±4.91	34.31±9.18	40.45±8.82	34.05±5.79	40.53±6.24
UBS (*n*)	8.08±2.85	13.20±2.90	11.27±4.47	16.04±4.81	12.53±3.39	16.81±3.74	11.98±4.10	16.90±4.07
TSMOB (*cm*)	13.36±2.73	14.93±2.94	19.69±5.65	21.38±6.21	19.89±5.13	21.45±5.40	17.50±3.78	19.48±3.89
PE group								
AMS (*n*)	19.30±3.65	21.52±4.25	19.79±3.62	22.93±3.97	18.08±3.53	19.91±3.93	21.27±4.20	23.60±4.10
LBMS (*n*)	31.69±8.53	34.21±9.04	37.86±5.56	41.24±5.54	32.62±5.75	34.63±6.12	34.13±5.77	36.87±5.85
UBS (*n*)	13.08±4.08	15.25±4.24	14.22±4.37	16.44±4.63	12.32±3.71	13.82±3.53	13.50±2.95	14.85±3.16
TSMOB (*cm*)	23.07±1.54	23.99±1.52	24.32±3.81	25.34±4.33	19.80±3.24	20.41±3.35	16.68±3.64	17.53±3.68

FT - Functional training; PE - Physical Education; AMS - abdominal muscles strength; LBMS - lower back muscles strength; UBS - upper body strength; TSMOB - thoracic spine mobility

Table 4 The effects of training methods on strength and mobility of trunk muscles in primary school girls.

Measure	ANOVA (group × time)			
	F	*Sig.*	η_p^2	*Magnitude*
Functional Training group				
AMS	32.460	> 0.001	.234	large
LBMS	29.688	> 0.001	.219	large
UBS	18.362	> 0.001	.149	large
TSMOB	10.280	> 0.001	.090	medium
Physical Education group				
AMS	16.749	> 0.001	.151	large
LBMS	12.931	> 0.001	.122	medium
UBS	10.701	> 0.001	.103	medium
TSMOB	22.087	> 0.001	.190	large

AMS - abdominal muscles strength; LBMS - lower back muscles strength; UBS - upper body strength; TSMOB - thoracic spine mobility; F - F statistic; Sig. - significance; η_p^2 - partial Eta squared.

4. DISCUSSION

This study investigated the effects of two different training methods on the strength and mobility of trunk muscles in primary school girls. After 16 weeks of the experimental program, significant improvements were observed in both groups. The magnitude of the ES ranged from medium to large, indicating that functional and traditional exercises in PE classes contributed considerably to the development of trunk muscle strength and mobility. However, the impact of training methods mainly differed depending on the muscle groups.

Functional training is a form of physical exercise that is explained by neuronal complexity and higher demands of the central nervous system. The higher the central nervous system demands, the more functional movement is performed (Shaikh & Mondal, 2012). Therefore, the training method is based on complex exercises to prepare the body for everyday challenges, and sports performance (Feito, Heinrich, Butcher, & Poston, 2018). To our knowledge, there is a lack of research regarding functional training and trunk muscles although most complex exercises cannot be performed without activating those muscle groups.

Notwithstanding that the effects of functional training have been examined in various populations, different claims can be found in the existing literature. When the effects of sports training and functional training were investigated, both training methods effectively improved muscle strength and aerobic fitness in overweight boys and girls (Branco et al., 2021). Further, there was no statistically significant difference in maximal isometric strength of the trunk muscles between females who performed functional and traditional training (Da Silva-Grigoletto et al., 2019). Regarding the effects of resistance training, the results of some studies also indicate that functional training is not superior to traditional resistance training in adolescents and adults (Branco et al., 2020; Mcweeny et al., 2020). In addition, it was determined that there was no difference between the two interventions when the effects of functional training were examined in 14-year-old girls with Developmental Coordination Disorder (Bonney et al., 2017).

Contrary to the previous research, there are studies that highlight the advantages of the functional training method over traditional exercises used in PE classes. Namely, performing functional exercises improved movement quality and fitness performance in

primary school girls compared to traditional exercise (Liao et al., 2019). Marković (2015) found functional training to be more effective for the motor development of primary school students compared to PE classes. Further, functional training proved more effective than traditional physical fitness for the daily activities and quality of movement patterns in sedentary older women (de Resende-Neto et al., 2021). In addition to the impact on motor abilities, Bogdani and Pano (2021) pointed out that functional training had a more significant contribution to the reduction of body fat parameters. However, both traditional and functional training produced significant improvements in body composition.

Besides the fact that there is a lack of scientific data regarding functional training and trunk muscles in primary school students, the inconsistency of existing data prevents the generalization and formation of practical guidelines. However, several shortcomings of this study need to be pointed out. The sample consisted of girls who were not involved in any extracurricular physical activities; hence it could be expected that any form of physical activity would contribute to the development of muscle performance. Secondly, the impact of the training methods was investigated only on trunk muscles, although both training methods are known to involve multi-joint exercises, which contribute to the development of these muscle groups. Therefore, it is preferable to compare the effects of the training methods on upper and lower limb muscles. Further, future research should consider comparing the effects of functional and traditional training methods on different motor abilities, such as agility and aerobic endurance. Conclusively, sport-specific examinations are needed in the future, considering that the effects of training methods might differ in girls involved in different sports (e.g., volleyball, tennis), where such data might be useful for the coaching staff.

5. Conclusion

The findings in this study indicate that both training methods can be beneficial for the development of trunk muscle strength and mobility in school-age girls. It can be concluded that functional exercises also represent an adequate tool for improving the abilities of fundamental muscle groups. Therefore, physical education teachers could implement a functional training method in PE classes when the goal is to develop the strength and mobility of the trunk muscles in older female primary school students. To adopt functional training as the primary method in PE classes, additional research is needed.

References

Aragão-Santos, J. C., de Resende-Neto, A. G., & Me, D. S. G. (2020). Different types of functional training on the functionality and quality of life in postmenopausal women: a randomized and controlled trial. *The Journal of Sports Medicine and Physical Fitness, 60*(9), 1283-1290.

Aragao-Santos, J. C., De Resende-Neto, A. G., Nogueira, A. C., Feitosa-Neta, M. D. L., Brandao, L. H., Chaves, L. M., & Da Silva-Grigoletto, M. E. (2018). The effects of functional and traditional strength training on different strength parameters of elderly women: a randomized and controlled trial. *The Journal of sports medicine and physical fitness, 59*(3), 380-386.

Beckham, S. G., & Harper, M. (2010). Functional training: fad or here to stay?. *ACSM's Health & Fitness Journal, 14*(6), 24-30.

Bogdani, A., & Pano, G. (2021). Effects of traditional training compared to functional training in metabolic age and visceral fat in 18-30 old subjects. *Journal of Human Sport and Exercise, 16*(3), S1402-S1410.

Bonney, E., Ferguson, G., & Smits-Engelsman, B. (2017). The efficacy of two activity-based interventions in adolescents with developmental coordination disorder. *Research in Developmental Disabilities, 71*, 223-236.

Boyle, M. (2004). *Functional training for sports: superior conditioning for today's athlete.* Human Kinetics.

Branco, B. H. M., Carvalho, I. Z., de Oliveira, H. G., Fanhani, A. P., Dos Santos, M. C. M., de Oliveira, L. P., Boni, S. M., & Nelson Nardo, J. (2020). Effects of 2 types of resistance training models on obese adolescents' body composition, cardiometabolic risk, and physical fitness. *The Journal of Strength & Conditioning Research, 34*(9), 2672-2682.

Branco, B. H. M., Mariano, I. R., de Oliveira, L. P., Bertolini, S. M. M. G., de Oliveira, F. M., Araújo, C. G. A., & Adamo, K. (2021). Sports and Functional Training Improve a Subset of Obesity-Related Health Parameters in Adolescents: A Randomized Controlled Trial. *Frontiers in Psychology, 11*, 3885.

Chen, S., Kim, Y., & Gao, Z. (2014). The contributing role of physical education in youth's daily physical activity and sedentary behavior. *BMC Public Health, 14*(1), 1-7.

Coledam, D. H. C., Ferraiol, P. F., Greca, J. P. D. A., Teixeira, M., & Oliveira, A. R. D. (2018). Physical education classes and health outcomes in Brazilian students. *Revista Paulista de Pediatria, 36*, 192-198.

Da Silva-Grigoletto, M. E., Mesquita, M. M., Aragão-Santos, J. C., Santos, M. S., Resende-Neto, A. G., de Santana, J. M., & Behm, D. G. (2019). Functional training induces greater variety and magnitude of training improvements than traditional resistance training in elderly women. *Journal of Sports Science & Medicine, 18*(4), 789.

de Resende-Neto, A. G., da Silva Resende, M., Oliveira-Andrade, B. C., da Silva Chaves, L. M., Brandão, L. H. A., Nogueira, A. C., Mota, M. M., DeSantana, M. J., & Da Silva-Grigoletto, M. E. (2021). Functional training in comparison to traditional training on physical fitness and quality of movement in older women. *Sport Sciences for Health, 17*(1), 213-222.

Feito, Y., Heinrich, K. M., Butcher, S. J., & Poston, W. S. C. (2018). High-intensity functional training (HIFT): Definition and research implications for improved fitness. *Sports, 6*(3), 76.

García-Hermoso, A., Alonso-Martínez, A. M., Ramírez-Vélez, R., Pérez-Sousa, M. Á., Ramírez-Campillo, R., & Izquierdo, M. (2020). Association of physical education with improvement of health-related physical fitness outcomes and fundamental motor skills among youths: A systematic review and meta-analysis. *JAMA Pediatrics, 174*(6), 200-223.

Guler, O., Tuncel, O., & Bianco, A. (2021). Effects of Functional Strength Training on Functional Movement and Balance in Middle-Aged Adults. *Sustainability, 13*(3), 1074.

Haddock, C. K., Poston, W. S., Heinrich, K. M., Jahnke, S. A., & Jitnarin, N. (2016). The benefits of high-intensity functional training fitness programs for military personnel. *Military Medicine, 181*(11-12), e1508-e1514.

Ives, J. C., & Shelley, G. A. (2003). Psychophysics in functional strength and power training: Review and implementation framework. *The Journal of Strength & Conditioning Research, 17*(1), 177-186.

Kraemer, W. J., Adams, K., Cafarelli, E., Dudley, G. A., Dooly, C., Feigenbaum, M. S., Fleck, S. J., Franklin, B., Fry, A. C., Hoffman, J. R., Newton, R. U., Potteiger, J., Stone, M.H., Ratamess, N. A., & Triplett-McBride, T. (2002). American College of Sports Medicine position stand. Progression models in resistance training for healthy adults. *Medicine and Science in Sports and Exercise, 34*(2), 364-380.

Liao, T., Li, L., & Wang, Y. T. (2019). Effects of Functional Strength Training Program on Movement Quality and Fitness Performance Among Girls Aged 12–13 Years. *The Journal of Strength & Conditioning Research, 33*(6), 1534-1541.

Liu, C. J., Shiroy, D. M., Jones, L. Y., & Clark, D. O. (2014). Systematic review of functional training on muscle strength, physical functioning, and activities of daily living in older adults. *European Review of Aging and Physical activity, 11*(2), 95-106.

Marković, M. (2015). The use of functional training method in body muscle power development with the senior pupils of elementary school. *Godišnjak Fakulteta sporta i fizičkog vaspitanja, (21)*, 102-120.

Mcweeny, D. K., Boule, N. G., Neto, J. H. F., & Kennedy, M. D. (2020). Effect of high intensity functional training and traditional resistance training on aerobic, anaerobic, and musculoskeletal fitness improvement. *Journal of Physical Education and Sport, 20*(4), 1791-1802.

Meredith, M. D., & Welk, G. J. (2010). *Fitnessgram/Activitygram Test Administration Manual (4th ed.)*. Champaign, IL: Human Kinetics.

Milanović, I., & Radisavljević-Janić, S. (2018). Unapređivanje kvaliteta i efikasnosti nastave fizičkog vaspitanja u Republici Srbiji. *Unapređivanje kvaliteta i dostupnosti obrazovanja u Srbiji,* 279-292.

Morrow Jr, J. R., Martin, S. B., & Jackson, A. W. (2010). Reliability and validity of the FITNESSGRAM®: Quality of teacher-collected health-related fitness surveillance data. *Research Quarterly for Exercise and Sport, 81*(3), 24-30.

O'Connor, F. G., Deuster, P. A., Barrett, J., Kane, S. F., & Depenbrock, P. (2017). Is High-Intensity Functional Training (HIFT)/CrossFit Safe for Military Fitness Training? *Military Medicine, 182*(1-2), 1474-1475.

Pate, R. R., O'Neill, J. R., & McIver, K. L. (2011). Physical activity and health: Does physical education matter?. *Quest, 63*(1), 19-35.

Shaikh, A., & Mondal, S. (2012). Effect of functional training on physical fitness components on college male students-A pilot study. *Journal of Humanities and Social Science*, *1*(2), 01-05.

Weiss, T., Kreitinger, J., Wilde, H., Wiora, C., Steege, M., Dalleck, L., & Janot, J. (2010). Effect of functional resistance training on muscular fitness outcomes in young adults. *Journal of Exercise Science & Fitness*, *8*(2), 113-122.

Yildiz, S., Pinar, S., & Gelen, E. (2019). Effects of 8-week functional vs. traditional training on athletic performance and functional movement on prepubertal tennis players. *The Journal of Strength & Conditioning Research*, *33*(3), 651-661.

FUNKCIONALNI TRENAŽNI PROGRAM I ČASOVI FIZIČKOG VASPITANJA: ANALIZA UTICAJA NA FIZIČKE AKTIVNOSTI UČENICA STARIJIH RAZREDA OSNOVNE ŠKOLE

Cilj ovog istraživanja bio je da se utvrde efekti dva različita programa treninga na snagu i pokretljivosti mišića trupa kod devojčica starijeg školskog uzrasta. Uzorak ispitanika činilo je ukupno 596 devojčica, uzrasta od 11 do 15 godina. Uzorak ispitanika nasumično je podeljen u dve grupe: 1) eksperimentalna grupa (n = 314), koja je sprovodila funkcionalni trenažni (FT) program; 2) kontrolna grupa (n = 282) koja je sprovodila regularne časove fizičkog vaspitanja. Eksperimentalni program sproveden je tokom regularnih časova fizičkog vaspitanja, koji je trajao 16 nedelja. Svake nedelje realizovane su tri trenažne jedinice u trajanju od 45 minuta. Baterija testova FitnessGram korišćena je na inicijalnom i finalnom merenju za procenu snage i pokretljivosti mišića trupa. Korišćeni su testovi za procenu: repetativne snage trbušne muskulature, repetativne snage leđne muskulature, repetativne snage grudnog i ramenog pojasa i pokretljivosti donjeg dela leđne muskulature. Rezultati dvofaktorske analize varijanse pokazali su značajan ($p < 0.001$) napredak na svim testovima kod obe grupe. Veličina efekta treninga bila je u rasponu od srednjeg do velikog i razlikovala se između protokola na svim testovima, osim na testu za procenu snage trbušne muskulature. Rezultati ovog istraživanja upućuju da su oba trenažna metoda korisna za razvoj snage i pokretljivosti mišića trupa kod devojčica osnovnog školskog uzrasta. Budućim istraživanjima bi trebalo ispitati razlike između metoda treninga kod učenika osnovnih škola.

Ključne reči: *funkcionalni trening, fizičko vaspitanje, osnovna škola, fundamentalni mišići, učenici*

FACTA UNIVERSITATIS
Series: **Physical Education and Sport**, Vol. 20, No 2, 2022, pp. 143 - 151
https://doi.org/10.22190/FUPES220622013J

Research article

THE COMMUNICATION APPROACH AND ATTITUDES OF STUDENTS REGARDING THE EFFECTS OF SPORTS ACTIVITIES ON HEALTH

UDC 796.035:35.082.2-057.87

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Abstract. *The student population is one of the most sensitive populations today, whereby it is necessary to consider the relationship between health and physical activity in order to improve students' quality of life. In addition to physical inactivity, health status is adversely affected by constant technological innovations and excessive socializing, consumption of alcohol, tobacco and narcotics. The aim of this study was to determine the differences between the communication approach and attitudes of first- and fourth-year students of the Faculty of Sports and Physical Education on the impact of sports on health and improvement of mental hygiene. Using a 60-item questionnaire, the study included 70 healthy respondents of both genders (Mean ± SD: 20.86±1.76 years). The respondents were divided into two subsamples, i.e. a group of first-year students (IG; n=34; F=15, M=19) and a group of fourth-year students (IVG; n=36; F=18, M=18). All obtained data are presented by descriptive parameters. The reliability of the survey in terms of internal compliance was tested by Cronbach's Alpha coefficient. The manifest space of attitudes was processed by the scaling technique. The Mann-Whitney U Test was used to determine differences in attitudes between first- and fourth-year students. For statistical significance of the differences in results between groups, the $p<0.05$ level of significance was used. The data were processed in the SPSS statistical package. The results of the study unequivocally confirmed the existence of a positive attitude among the student population about the impact of sports on health and improvement of mental hygiene, as well as that there are no statistically significant differences in most of the variables included in the testing (eight out of ten domains), i.e. that there is no great difference in the attitudes of first- and fourth-year students on the importance of sports for their psychophysical health.*

Key words: *physical activities, recreation, healthy lifestyle, exercise*

Received June 22, 2020 / Accepted September 22, 2022
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INTRODUCTION

Communication is a basic human need and activity, continuous throughout space and permanent in time, directed towards the outside world and towards the inner being. In order to understand other people and for them to understand us, it is necessary to establish an appropriate communication system, to start an intellectual process in which one mind influences another (Banjanin, 2003). Each communication model implies and emphasizes the importance of feedback as an integral component of this process. Equally distributed communication between sender and receiver is an ideal model of two-way symmetric communication (Wilcox, Cameron, Ault, & Agee, 2006).

Apart from the basic existential needs, which stimulate instinctive behaviors in humans, most other stimuli come from the world of information, as the initiator of action, which gives action meaning and purpose. Information is a complex concept that implies at least three dimensions: new knowledge, the form by which this new knowledge is shaped to be transferred to other subjects of the communication process and purposefulness, that is, the activity dimension of the message (Tomić, 2003). The choice thus begins to depend on perceptions, previous experiences and attitudes, with which the motives for action are projected and implemented through consciousness. Another mediator of the information function is attitude. It represents a relatively stable mental organization of perceptions, knowledge, emotions and will. In other words, attitudes are considered to be a solid basis for human behavior. They act as a psycho-motor force on the human being to do something physically, or spiritually, or not. When the message reaches the existing attitude, it simultaneously introduces the reason for the future reaction (Jelenković & Jelenković, 2016). Attitude formation is a progressive process that sublimates thinking and feeling and completes it with intention and behavior (Banjanin, 2003). Attitude is formed in interpersonal communication and "develops either through direct experience or learning from others through socialization, and manifests through verbal expressions, emotions, visible actions, posture or behavior." (Banjanin, 2003, 118).

Drastic reduction of movement and a deficit of physical activities, as characteristics of all social groups, are the main features of the modern way of life, which results in impaired general health, even among the younger population (Nešić, Lolić, Srdić, & Meholjić-Fetahović, 2011). The increase in the number of people with certain health problems in adulthood is often attributed to poor life habits and lifestyle in youth (Chan & Woo, 2010). Consequently, much attention has recently been paid to proper diet and physical activity as important factors in prevention and maintaining health at all ages (Macanović et al., 2013). One of the most sensitive populations today, where it is necessary to consider the relationship between health and physical activity in order to improve the quality of life, is the student population (Čokorilo & Mikalački, 2014), whose health is vital to the wider community (Guthrie et al., 1998; Holt & Powell, 2017) and which represents the largest capital and investment for the future of a society (Ilić Živojinović, 2014). Frequent disorders of psycho-physical health of the student population caused by numerous negative environmental factors and psycho-social stressors (Chew-Graham, Rogers & Yassin, 2003), as well as the complexity of the transition period from high school to more intensive university obligations, lead to a sedentary lifestyle (Nešić, Srdić & Fratić, 2013). Sedentary lifestyle is present in a large number of students, and obesity occurs (Budakov, et al., 2012), poor eating habits (Singh, Siahpush, Hiatt, & Timsina, 2011) and the occurrence of stress (Nešić, Perić, Srdić & Muhi, 2019). In addition

to physical inactivity, health status is adversely affected by constant technological innovations and excessive time spent on social networks (Krivokapić & Popović, 2011), alcohol consumption (Matović & Pavlović, 2019), tobacco (Cvetković, Nenadović, Stojanović-Tasić, & Milošević, 2015), and narcotics (Jugović, 2004). Due to the reduction in the number of hours of practical classes, as well as the reduction of students' interest in extracurricular or recreational activities in general, a trend of reduction in aerobic fitness was observed even among students of the Faculty of Sports and Physical Education, for whom exercise should be the essence of interest (Prebeg, Mihajlović & Mitić, 2012). Although students show a great tendency towards bad life habits, they recognize the importance and need for regular physical exercise, but also expect external support from the university to do so (Nešić & Kovačević, 2011). In support of a positive attitude and awareness of the impact of physical activity and sports on their lives, mental health and study outcomes (Kordić & Babić, 2011), there is a claim that students who engage in physical activity more often rate their health excellent or very good, compared to students who do not engage in physical activity (Čokorilo & Mikalački, 2014).

The aim of this study was to determine the differences in the communication approach and attitudes of first- and fourth-year students of the Faculty of Sports and Physical Education, on the impact of sports on health and improvement of mental hygiene.

METHODS

Sample of participants

In this cross-sectional study, the sample of respondents consisted of first- and fourth-year students of the Faculty of Sport and Physical Education, University of Niš. The sample included 70 healthy respondents of both genders, i.e. 37 male and 33 female respondents, chronological age ranging from 19 to 25 years (Mean ± SD: 20.86 ± 1.76 years). The inclusion criteria for the respondents were: that they are students of the Faculty of Sports and Physical Education of the University of Niš; that they do not participate in organized sports activities outside the faculty and are not professional athletes. The exclusion criteria for the respondents were: students who had not passed their Sociology and Psychology of sports courses, and students who participated in previous psychosociological research at the faculty. Respondents who satisfied the criteria for participation in the study were divided into two sub-samples, i.e. the group of first-year students (IG; n = 34; F = 15, M = 19), the age range 19 to 22 years (Mean ± SD: 19.21 ± 0.64 years) and the group of fourth-year students (IVG; n = 36; F = 18, M = 18), ages ranging from 22 to 25 years (Mean ± SD: 22.42 ± 0.73 years). All of the respondents voluntarily agreed to participate in the study/survey.

Measures

To collect data on the attitudes of first- and fourth-year students of the Faculty of Sport and Physical Education in Niš on the impact of sports on health and improvement of mental hygiene, the survey method was used, and a specially designed closed-type questionnaire was used as the basic measuring instrument. The 60-item questionnaire collected information on: gender, age and year of the study, variables for examining the students' subjective attitudes about the importance of sports for health and improving

mental hygiene of the student population, and variables related to student involvement in sports activities. A five-point Likert-type scale was used in the questionnaire to collect data, with answers from completely negative to completely positive attitudes (1 = completely incorrect; 2 = mostly incorrect; 3 = not sure; 4 = mostly correct; 5 = completely correct). To examine students' involvement in sports, a five-point scale was used, consisting of the following statements: 1 = never; 2 = very rarely; 3 = sometimes; 4 = most frequently; 5 = regularly. All questions were classified into ten different domains depending on their specific area: 1) sport and health (D1); 2) sport as socializing and entertainment (D2); 3) sport and behavioral learning (D3); 4) manipulation of sports (D4); 5) sport and attitude towards other people (D5); 6) sport and violence (D6); 7) sports and money (D7); 8) sport and work activity (D8); 9) sport and education (D9); 10) sport and mental hygiene (D10). In order for the respondents not to cognitively assume the domains being researched, the order of the indicators was mixed.

The results obtained were analyzed, presented in tabular form and a discussion was conducted based on the determined attitudes of the respondents.

A cross-sectional model was applied in this study. Before the beginning of the survey, the respondents were verbally given information about the procedure of filling out the questionnaire and were acquainted with the purpose of conducting the research. The respondents were given the questionnaire which they filled out on the spot by an anonymous procedure.

Statistical data analysis

All data are presented using parameters of descriptive statistics (medium value - mean, standard deviation - SD, minimum score - min and maximum score - max). The reliability of the survey in terms of internal compliance was tested by Cronbach's Alpha coefficient (La Cruz, Gutiérrez, Gómez, & Torres, 2017). The manifest space of attitudes is processed by the scaling technique. The Mann-Whitney U Test was used to determine differences in attitudes between first- and fourth-year students. To determine any statistical significance of the differences between groups, a significance level of $p < 0.05$ was used. The data were processed in the SPSS statistical package (IBM Corp. Released 2010. IBM SPSS Statistics for Windows, Version 19.0. Armonk, NY: IBM Corp.).

RESULTS

The reliability of the measurement scale of the applied survey in this study was verified by Cronbach's alpha coefficient (Table 1). The value of Cronbach's alpha coefficient (0.812) indicates that the survey used in this study has good reliability and an internal consistency of the whole scale.

Table 1 Verification of the measurement scale - Cronbach's alpha coefficient

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.812	0.827	60

Legend: Cronbach's Alpha - Cronbach's alpha coefficient; N of Items - number of indicators.

Numerical and percentage values of the size of the total sample, as well as individually for each year of study in relation to the gender of the respondents, are presented in Table 2.

Table 2 Number and percentage of the total sample of respondents by gender

Year of study of the respondents	Total number of respondents	Number and percentage (%) of female respondents	Number and percentage (%) of male respondents
I year	34	15 (44.12%)	19 (55.88%)
IV year	36	18 (50.00%)	18 (50.00%)
Total	70	33 (47.14%)	37 (52.86%)

Observing the tabulated numerical values of the arithmetic means of expressed attitudes for both groups (Table 3), fourth-year students have more pronounced positive attitudes compared to first-year students in most of the surveyed domains, such as "sport and health" (IVGD1 = 4.44> IGD1 = 4.28), "sport as socializing and entertainment" (IVGD2 = 4.34> IGD2 = 4.18), "sport and behavioral learning" (IVGD3 = 4.54> IGD3 = 4.38), "sport manipulation" (IVGD4 = 3.93> IGD4 = 3.88) , “sport and attitudes towards other people” (IVGD5 = 4.43> IGD5 = 4.25), “sport and work activity” (IVGD8 = 3.99> IGD8 = 3.83), “sport and education” (IVGD9 = 4.44> IGD9 = 4.14), and "sport and mental hygiene" (IVGD10 = 4.44> IGD10 = 4.26).

Table 3 Values of arithmetic means of the examined domains for both groups of students

Domain	1	2	3	4	5	6	7	8	9	10	Sum
Mean (I year)	4.28	4.18	4.38	3.88	4.25	2.94	4.06	3.83	4.14	4.26	4.02
Mean (IV year)	4.44	4.34	4.54	3.93	4.43	2.86	3.85	3.99	4.44	4.44	4.13

Legend: Mean - arithmetic mean; Domain - research area, SUM - total mean value of all domains by sub-samples; D1 - domain of sports and health; D2 - domain sport as socializing and entertainment; D3 - domain of sports and learning behavior; D4 - domain of sports manipulation; D5 - domain sport and attitude towards other people; D6 - domain of sports and violence; D7 - domain sports and money; D8 - domain sport and work activity; D9 - domain sports and education; D10 - domain of sports and mental hygiene.

Analyzing the results by domains, fourth-year students have moderately positive attitudes for the domains "sports manipulation" (D4 = 3.93), "sports and money" (D7 = 3.85) and "sports and work activity" (D8 = 3.99). Students in the final year of study have more pronounced positive attitudes about the domains "sport and health" (D1 = 4.44), "sport as socializing and entertainment" (D2 = 4.34), "sport and learning behavior" (D3 = 4.54), "sport and attitudes towards other people” (D5 = 4.43), “sport and education” (D9 = 4.44), and “sport and mental hygiene” (D10 = 4.44). When it comes to first-year students, they express moderately positive attitudes towards the domains "sport manipulation" (D4 = 3.88) and "sport and work activity" (D8 = 3.83), while they have more positive attitudes towards the domains "sport and health" D1 = 4.28), “sport as socializing and entertainment” (D2 = 4.18), “sport and learning behavior” (D3 = 4.38), “sport and attitudes towards other people” (D5 = 4.25), “sport and money” D7 = 4.06), "sport and education" (D9 = 4.14), and "sport and mental hygiene" (D10 = 4.26).

Using the Mann-Whitney U Test and using statistical significance at the level of $p < 0.05$, differences were determined in attitudes between groups of first- and fourth-year students in ten different domains (Table 4).

Table 4 Results of the Mann-Whitney U Test

	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10
Mann-Whitney U	490.50	487.00	508.50	589.00	503.00	555.00	441.50	492.00	413.50	470.00
Wilcoxon W	1085.50	1082.00	1103.50	1184.00	1098.00	1221.00	1107.50	1087.00	1008.50	1065.00
Z	-1.44	-1.48	-1.23	-0.27	-1.33	-0.68	-2.02	-1.43	-2.40	-1.68
Asymp. Sig. (2-tailed)	0.15	0.14	0.22	0.79	0.18	0.50	**0.04**	0.15	**0.02**	0.09

Legend: Asymp. Sig. (2-tailed) - Statistical significance of differences (p); Z - value of approximation; D1 - domain of sports and health; D2 - domain sport as socializing and entertainment; D3 - domain of sports and learning behavior; D4 - domain of sports manipulation; D5 - domain sport and attitude towards other people; D6 - domain of sports and violence; D7 - domain sports and money; D8 - domain sport and work activity; D9 - domain sports and education; D10 - domain of sports and mental hygiene.

The Mann-Whitney U Test results showed that a statistically significant difference exists only in domains D7 and D9, while in most domains (D1, D2, D3, D4, D5, D6, D8, D10) no statistically significant difference in attitudes between first- and fourth-year students was detected. The attitudes of students are similar regarding the influence of sports on different domains of life, which is shown by the values of the median in Table 5.

Table 5 Median values of student attitudes of both groups and total by domain

Year of study		D1	D2	D3	D4	D5	D6	D7	D8	D9	D10
I year	N	34	34	34	34	34	34	34	34	34	34
	Median	4.35	4.29	4.40	3.83	4.33	3.00	4.20	3.83	4.17	4.27
IV year	N	36	36	36	36	36	36	36	36	36	36
	Median	4.50	4.29	4.60	4.00	4.33	3.00	3.80	4.00	4.33	4.45
Total	N	70	70	70	70	70	70	70	70	70	70
	Median	4.40	4.29	4.60	4.00	4.33	3.00	4.00	4.00	4.33	4.45

Legend: N - number of respondents; Median - the value of the median; D1 - domain of sports and health; D2 - domain of sport as socializing and entertainment; D3 - domain of sports and learning behavior; D4 - domain of sports manipulation; D5 - domain of sport and attitude towards other people; D6 - domain of sports and violence; D7 - domain of sports and money; D8 - domain of sport and work activity; D9 - domain of sports and education; D10 - domain of sports and mental hygiene.

DISCUSSION

In accordance with the aim of the study, based on the analysis of the presented results, it can be concluded that there is no difference in the numerically expressed attitudes of first- and fourth-year students at this faculty. In general, fourth-year students have a slightly more positive attitude about the impact of sports on the health and improvement of mental hygiene of the student population than first-year students, when looking at the sum of arithmetic mean values (IVGSUM = 4.13> IGSUM = 4.02). A positive attitude of students about the impact of sports is expressed in most domains (3> D1, D2, D3, D4, D5, D7, D8, D9, D10), i.e. in nine domains, and a negative attitude only in the domain of the impact and connection of sports activities with the occurrence of violence and the display of violent behavior in athletes (D6), which was more pronounced in fourth-year students (IG = 2.94; IVG = 2.86). There was a minimal difference in the attitudes of the students in most of the surveyed domains, and the Mann-Whitney U Test showed that in

most domains this difference is not statistically significant. Using the Mann-Whitney U test, a statistically significant difference was determined in the attitudes of students at the $p<0.05$ level in the domains "sport and money" (D7; $p = 0.04$) and "sport and education" (D9; $p = 0, 02$). Observing these two domains separately, the statistically significant difference in students' attitudes can be caused by the influence of the teaching program at the Faculty of Sports and Physical Education in Niš. Based on a detailed analysis of the results, it can be concluded that first- and fourth-year students generally have a very positive attitude about the impact of sports on the general health of the human body (IVGD1 = 4.44; IGD1 = 4.28). This attitude is in accordance with the claims of the authors of previous studies (Kordić & Babić, 2011; Čokorilo, & Mikalački, 2014), who claim that students highly value sports activities and are aware of the importance of sports on their lives, mental health and study practices. The results (IVGD10 = 4.44; IGD10 = 4.26) confirm the claims that students are aware of the need to increase their level of physical activity (Janković et al., 2017), and that activity is a significant factor in students' mental stability (Nešić, et. al., 2019). Also, the attitudes of students in this research support the claims of authors of previous research that systematically enabling more intensive participation in sports of the student population can positively affect their socialization (Hadžikadunić, Softić, Novaković, Nurković, & Đedović, 2015), and raise their awareness about healthy lifestyles and the beneficial effects of sport on psycho-physical health (Nešić, et al., 2019; Detanac, Detanac, Ćeranić, Đokić, & Milić, 2014; Stankov, Jovanović, & Starčević, 2017). It is said that it is never too late to adopt healthy living habits, and that a person is young as long as they can adopt healthy habits. Therefore, we must take advantage of the fact that by acquiring healthy lifestyle habits at a young age, we create the conditions for a better quality and happier life in the future (Jelenković & Jelenković, 2014). The results of the research indicate that there is a statistically significant difference in attitudes about the connection between sports and the material status of athletes, i.e. a more positive attitude of first-year students compared to fourth-year students on the impact of sports on individual economic status and potential financial gain. Also, it is necessary to point out the statistically significant difference and more positive attitudes of fourth-year students compared to first-year students on the effects of physical activities and sports in the educational process and the expressed wish to increase their number of practical classes, which may be the result of their educational background in areas of sports and participation in sports activities at the university. On the other hand, it can be concluded that any educational cycle is not possible at all without different forms of communication, which can be seen in practice.

CONCLUSION

Finally, the results of this study unequivocally confirmed the existence of a positive attitude among the student population about the impact of sports on health and the improvement of mental hygiene. It is necessary to point out the statistically significant difference and more positive attitudes of fourth-year students compared to first-year students about the effects of physical activities and sports in the education process itself and the expressed desire to increase the number of hours of practical classes, which may be the result of the students' educational background in the field of sports and participation in sports activities at the university. A detailed analysis of the results showed that there are no

statistically significant differences in most of the variables covered by testing (eight out of ten domains), i.e. that there is no significant difference in the attitudes of first- and fourth-year students regarding the importance of sports for their psycho-physical health. Also, all of the respondents agree or have adopted a unified position that sport is a form of verbal and non-verbal communication through which messages are sent and received. Therefore, we can conclude that first- and fourth-year students of the Faculty of Sports and Physical Education are aware of the role of sports in society and the positive impact of regular, planned and professionally led physical activities on their lives, socialization, mental and physical health and study. Based on the results and limitations of this cross-sectional, but also the conclusions of previous studies, recommendations for further research are reflected in increasing the sample of respondents, and including students from other faculties in the Republic of Serbia.

REFERENCES

Banjanin, K. M. (2003). *Communication dynamics-intercultural business context.* Belgrade: Megatrend University of Applied Sciences.

Budakov, N., Bokan, D., Rakic, D., & Bokan, D. (2012). Body mass index and physical activity of students of the University of Novi Sad. *South Eastern Europe Health Sciences Journal, 2*(1), 8-14.

Chan, R. S., & Woo, J. (2010). Prevention of overweight and obesity: how effective is the current public health approach. *International journal of environmental research and public health, 7*(3), 765-783.

Chew-Graham, C. A., Rogers, A., & Yassin, N. (2003). 'I wouldn't want it on my CV or their records': medical students' experiences of help - seeking for mental health problems. *Medical education, 37*(10), 873-880.

Cvetković, J., Nenadović, M., Stojanović-Tasić, M., & Milošević, N. (2015). Tobacco use among the student population in northern Kosovo. *Biomedical Research, 6*(1), 46-51.

Čokorilo, N., & Mikalački, M. (2014). Physical activity and students 'attitudes towards their own health. In: I. Parčina (Ed.), *Proceedings 10th International Scientific Conference „Challenges in contemporary sport management"* (pp. 59-66). Belgrade: Faculty of Sport Management, Alfa University.

Detanac, D., Detanac, B., Ćeranić, M., Đokić, P., & Milić, V. (2014). Alcohol consumption, smoking and physical activity among students of the State University of Novi Pazar. *Praxis medica, 43*(3), 41-47.

Guthrie, E., Black, D., Bagalkote, H., Shaw, C., Campbell, M., & Creed, F. (1998). Psychological stress and burnout in medical students: a five-year prospective longitudinal study. *Journal of the Royal Society of Medicine, 91*(5), 237-243.

Hadžikadunić, A., Softić, F., Novaković, R., Nurković, H., & Đedović, D. (2015). The impact of sport on the social behavior of children and youth. *Sports Logos, 13*(24), 4-16.

Holt, M., & Powell, S. (2017). Healthy Universities: a guiding framework for universities to examine the distinctive health needs of its own student population. Perspectives in public health, 137(1), 53-58.

Ilić Živojinović, J.B. (2014). *Analysis of the connection between socio - environmental factors and academic stress with students' mental health*. Doctoral dissertation. Belgrade: Faculty of Medicine.

Janković, G., Stanojević, Ž., Mazić, S., Topalović, N., Đurđević, D., & Isakovic, A. (2017). Physical activity and dietary habits among second year students of the School of Medicine, University of Belgrade. *Facta Universitatis: Series Physical Education and Sport, 15*(2), 239-248.

Jelenković, P., & Jelenković, Lj. (2014). The importance of lobbying and marketing in adopting healthy living habits. *Ecologica, 21*(76), 684-688.

Jelenković, P., Jelenković, Lj. (2016). *Communication and profession choice*. Niš: Media Reform Center Niš.

Jugović, A. (2004). Risky behaviors of youth in Serbia. In S. Mihailović (Ed.), *Young people lost in transition* (pp. 177-203). Belgrade: Center for the Study of Alternatives.

Kordić, B., & Babić, L. (2011). The attitudes of Belgrade University students towards sport. *Teaching and Education, 60*(4), 673-687.

Krivokapić, D., & Popović, S. (2011). The impact of recreational activities on mental health. In A. Biberović (Ed.), *Proceedings of the IV International Symposium "Sport and Health"* (pp. 10-13). Tuzla: Faculty of Physical Education and Sport, University of Tuzla.

La Cruz, A., Gutiérrez, A., Gómez, G. B., & Torres, V. J. R. (2017). Validation of an instrument to evaluate intra-laboratory psychosocial factors in a sample of Venezuelan workers. *Salud de los Trabajadores, 25*(2), 110-130.

Macanović, G., Marković, D., Ferati, A., Arsić, J., Jocić, I., & Arsic, K. (2013). Physical activity of students. *PONS Medical Journal, 10*(4), 137-141.

Madić, D., Nikolić, M. and Stojiljković, D. (2015). Measurement technique. In M. Bratić (Ed.), *Measuring instruments in sports, physical education and recreation* (pp. 33-36). Niš: Faculty of Sports and Physical Education, University of Niš.

Matović, M., & Pavlović, V. Ž. (2019). Alcohol use among young people in dormitories. In B. Knežić & I. Stevanović (Eds.), *Proceedings of the Institute for Criminological and Sociological Research* (pp. 39-50). Belgrade: Institute for Criminological and Sociological Research.

Nešić, M., & Kovačević, J. (2011). Life habits of Student population as a factor in orientation to the University Sports. *Acta kinesiologica, 5*(2), 89-95.

Nešić, M., Lolić, V., Srdić, V., & Meholjić-Fetahović, A. (2011). Body mass index as a factor in determining sports and recreational activities at the university. *Sports Science and Health, 1*(1), 37-46. 21

Nešić, M., Perić, D., Srdić, V., & Muhi, B. (2019). The level of student stress in relation to some lifestyle indicators. In O. Bajrić, & Đ. Nicin (Eds.). *9th International Conference "Sport Science and Health"* (pp. 48-57). Banja Luka: Pan-European Aperion University of Banja Luka.

Nešić, M., Srdić, V., & Fratrić, F. (2013). Attitudes and motivational determinants of female students as a factor of choice about university sport. *Sports Science & Health, 3*(2), 103-116.

Prebeg, G., Mihajlović, N., & Mitić, D. (2012). Aerobic fitness trend of students of the Faculty of Sport and Physical Education at the University of Belgrade. Exercise and Quality of Life, 4(2), 41-47.

Singh, G. K., Siahpush, M., Hiatt, R. A., & Timsina, L. R. (2011). Dramatic increases in obesity and overweight prevalence and body mass index among ethnic-immigrant and social class groups in the United States, 1976–2008. *Journal of community health, 36*(1), 94-110.

Stankov, L., Jovanović, M., & Starčević, N. (2017). The importance of recreational sports activities from the perspective of students - future pre-school teachers. In S. Mandarić, L. Moskovljević, M. Marković, & M. Ćosić (Eds.). *International Scientific Conference „Effects of applying physical activity on anthropological status of children, adolescents and adults"* (pp. 78-84). Belgrade: Faculty of Sport and Physical Education of University of Belgrade.

Tomic, Z. (2003). *Komunikologija*. Beograd: Čigoja štampa.

Wilcox, L. D., Cameron, T. G., Ault, H. F., Agee, K.W. (2006). *Public Relations: Strategies and Tactics*. Belgrade: Center for Publishing of the Faculty of Economics in Belgrade.

KOMUNIKOLOŠKI PRISTUP I STAVOVI STUDENATA O UTICAJU SPORTA NA ZDRAVLJE

Kao jedna od najosetljivijih populacija današnjice, kod koje je neohodno sagledavanje odnosa zdravlja i fizičke aktivnosti u cilju unapređenja kvaliteta života, označava se populacija studenata. Pored fizičke neaktivnosti, na zdravstveni status nepovoljno utiču i stalne tehnološke inovacije i prekomerni boravak na društvenim, konzumiranje alkohola, duvana i narkotika. Cilj ovog istraživanja bio je utvrđivanje razlika u komunikacijskom pristupu i stavovima studenata I i IV godine studija Fakulteta sporta i fizičkog vaspitanja o uticaju sporta na zdravlje i unapređenje mentalne higijene. Korišćenjem anketnog lista od 60 pitanja, istraživanje je obuhvatilo 70-oro zdravih ispitanika oba pola (Mean±SD: 20.86±1.76 years). Ispitanici su podeljeni na dva subuzorka, odnosno na grupu studenata prve godine (IG; n=34; Ž=15, M=19) i grupu studenata četvrte godine studija (IVG; n=36; Ž=18, M=18). Svi dobijeni podaci predstavljeni su parametrima deskriptivnivne. Pouzdanost ankete u smislu unutrašnje saglasnosti proveren je Cronbach's Alpha koeficijentom. Manifestni prostor stavova obrađen je tehnikom skaliranja. Za utvrđivanje razlika u stavovima između studenata prve i četvrte godine korišćen je Mann-Whitney U Test. Za statističku značajnost razlika u rezultatima između grupa, korišćen je nivo značajnosti od p<0.05. Podaci su bili obrađeni u statističkom paketu SPSS. Rezultati istraživanja nedvosmisleno su potvrdili postojanje pozitivnog stava kod studentske populacije o uticaju sporta na zdravlje i unapređenje mentalne higijene, kao i da ne postoje statistički značajne razlike u većini testiranjem obuhvaćenih varijabli (osam od deset domena), odnosno da ne postoji velika razlika u stavovima studenata prve i četvrte godine studija o značaju sporta za njihovo psihofizičko zdravlje.

Ključne reči: *fizička aktivnost, rekreacija, zdravi životni stil, vežbanje*

CIP - Каталогизација у публикацији
Народна библиотека Србије, Београд

796/799

FACTA Universitatis. Series, Physical Education and Sport / University of Niš ; editor-in-chief Zoran Milanović. - [Štampano izd.]. - Vol. 1, no. 7 (2000)- . - Niš : University of Niš, 2000- (Niš : Atlantis). - 24 cm

Tri puta godišnje. - Je nastavak: Facta Universitatis. = ISSN 0354-4745. - Drugo izdanje na drugom medijumu: Facta Universitatis. Series: Physical Education and Sport (Online) = ISSN 2406-0496
ISSN 1451-740X = Facta Universitatis. Series: Physical Education and Sport
COBISS.SR-ID 113549324