ORIGINAL ARTICLE

The relations between body mass index, motor skills, and physical self-concept in determining physical activities of junior karatekas

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Abstract

The aim of this research was to examine the contribution of body mass index (BMI), motor skills and physical self-concept in explaining the physical activity (PA) of adolescent karatekas (N=148). The average age of participants was 16,56 years (± 1,14). The following measuring instruments were used: Body Mass Index (BMI), Eurofit Physical Fitness Test Battery, Physical Self-Description Questionnaire (PSDQ), and Physical Activity Questionnaire for Adolescents (PAQ-A). The Cronbach's alpha coefficient was used to determine the internal consistency of the questionnaires. The results of the hierarchical analysis showed that the predictor variables explained 18,5% of the total variance of the criterion PA of junior karatekas. With their positive direction, the independent variables of the physical self-concept strength ($\beta = 0.049$; $p < 0.01$), flexibility ($\beta = 0.037$; $p < 0.01$) and self-respect ($\beta = 0.019$; $p < 0.05$) showed the maximum statistically significant contribution to predicting the variability of the participants' PA, which means that junior karatekas who manifest the higher level of perception on those variables exhibit the higher level of PA. This study confirmed that the applied instruments are valid and suitable to predict PA among adolescent athletes in Serbia.

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Keywords karatekas • adolescence • eurofit battery • PSDQ • PAQ-A.

Introduction

The World Health Organization (WHO, 2010) believes that increasing the level of PA (physical activity) is the most relevant determinant for improving the health of the population.

The optimal dosage of PA, prompted by skeletal muscles and energy spending has a positive effect on health, maintenance and improvement of bio-psycho-social components, and prevention of various diseases (Kljajević, Stanković, Đorđević, Trkulja-Petković, Jovanović & Sporiš, 2022). The study (Katsanis, Hatyopoulos, Barkoukis, Afroditi, Chatyelli & Paraschos, 2021) has confirmed that physical inactivity causes the incr ease in body mass and can lead to obesity. The authors (Kapsis, Tsoukos, Psarraki, Douda, Smilios & Bogdanis, 2022) believe that an intensive one-hour physical exercise each day is necessary for good health and active lifestyle.

The authors (Marsh & Redmayne, 1994) established a hypothetical multidimensional hierarchical model – PSDQ, as self-perception which is influenced by individual experiences and the assessment by other people, and which includes emotions such as self-acceptance, self-respect, and competence. Self-concept is based on this construct, and it includes academic and non-academic self-concept. The component non-academic self-concept, or physical self-concept, includes perception of one's physical skills and

body constitution. So, the nature of this measuring instrument includes nine characteristic elements of self-concept (such as health, motor coordination, PA, BMI, athletic competence, physical appearance, strength, flexibility, and endurance) and two general elements (general physical self-concept and self-respect).

The study (Palenzuela-Luis, Duarte-Clíments, Gómez-Salgado, Rodríguez-Gómez & Sánchez-Gómez 2022) points out that the multidimensional structure of the physical self-concept includes many variables, such as physical characteristics – health, BMI, physical appearance and general body shape on the one hand, and flexibility, endurance and strength on the other. Research (Jorga, Mastrappas & Damigos, 2018; Wong, Chung & Leung, 2022) has found the relationship between physical self-concept and self-perception of one's body.

Based on the results of the previous studies and the fact that this topic has not been sufficiently explored in the Serbian population, the aim of this transversal research was to examine the relations and direction of the determinants of motor skills based on Eurofit battery and physical self-concept (as determinants) in predicting the part of variance of PA in junior karatekas. In accordance with the aforementioned research findings, it is expected that the influence of predictor variables (as presumed cause) in evaluating the criteria of junior karatekas' PA (as a consequence) is statistically significant, and the higher predictive intensity of motor variables (strength and flexibility) is also expected, as well as the significance of the dimensions self-respect of physical self-concept in explaining the variance of PA of karatekas in the period of early adolescence. Since the previous studies did not provide the full insight into the relations of the aforementioned variables (within the population of adolescent karatekas), testing these hypotheses can have influence on further empirical research, as well as for sports practice in Serbia

Method

Participants and procedure

Using the method of transverse cross-section, 148 junior karatekas were included in this research. The average age of the participants was 16.56 years (SD = 1.14). The convenience sampling included karatekas from Kolubara district: KC "Shodan" (Valjevo), KC "014 Valjevo" (Valjevo), and KC "Kizame" (Valjevo). All participants had minimum two years of training, at least three times a week. The research was conducted in 2022, during the month of April.

The authors of this research conducted the testing, with the supervision of a psychologist. The participants gave informed consent, with the approval from parents and club managers. The participants first had to fill in the questionnaire. Their anthropometric measures were taken and general physical condition was tested before their practice in the school gym. The instructions were explained to the participants and the subject of the research was presented; the importance of answering truthfully was emphasized, and they were told that they could quit at any time without consequences and that the data would solely be used for scientific purposes. Participation in this research was voluntary and anonymous. The testing lasted 45 minutes.

Measuring instruments

BMI was used as an indicator of the level of nutritional status and is based on the international classification which measures the anthropometric measurements body height and body mass. This was calculated by dividing body mass (in kilograms) by the body height in meters (squared). The formula is $BMI = BM/BH^2$ (Bubanja, Jovanović & Vuković, 2019).

The participants' measures were taken as is recommended by The International Biological Program (IBP). Body mass was measured using the standard decimal scale with the accuracy of 0,1kg, while height was measured using the Martin anthropometer with the precision of 0,1 cm and the "Frankfort horizontal plane" head position.

Standardized EUROFIT Battery (Adams, Klissouras, Ravazzolo, Renson & Tuxworth, 1988) was used to examine the general PA, which meant that the following four tests were measured: seated forward bend (SFB), 30 s lying forward bend (LFB30), standing long jump (SLJ), and 20m progressive overload sprinting (POS).

Physical Self-Description Questionnaire (Marsh, Redmayne, 1994)

The physical self-concept consists of 70 claims on a six-point Likert scale (1 – completely untrue, 2 – mostly untrue, 3 – somewhat untrue, 4 – somewhat true, 5 – mostly true, 6 – completely true) separated into 11 subscales, where nine include specific dimensions of physical self-concept: strength (3 items), obesity (3 items), PA (4 items), endurance (3

items), athletic competence (3 items), motor coordination (5 items), health (8 items), physical appearance (3 items) and flexibility (3 items); and two general components: general physical self-concept (3 items) and self-respect (5 items). The reliability coefficients (Cronbach's alpha) vary from $\alpha = 0.72$ for self-respect to $\alpha = 0.93$ for athletic competence, which is in accordance with the study recommendation (McNeish, 2017).

Physical Activity Questionnaire for Adolescents – PAQ-A (Kowalski, Crocker & Kowalski, 2004)

PAs during the school year, excluding holidays. With item one (PA during leisure), the participants assess the level of agreement with the given statement and give average assessment of the time they spent on PA during the previous week, using the scale that ranges from 1 ("no") to 5 ("7 times or more"). Claims 2 to 7 include time (gym classes, time around lunch, right after school, in the evening, during the weekend). On the claim number 8 the participants assess the mean value of all days, where the scale ranges from 1 ("no activity") to 5 ("very often"). The last 9th claim is used for checking if the participant was unable, for various reasons, to take part in a regular PA. The final score is calculated based on the first eight claims scored from 1 to 5, where 1 indicates low level of PA, and 5 means high level of PA. The reliability analysis revealed satisfactory reliability coefficient ($\alpha = 0.78$).

Statistical analysis

The Cronbach's alpha coefficient was used to measure the reliability of this research. The measuring included the value of the coefficient $\alpha > 0.70$ (McNeish, 2018). Apart from the descriptive statistic indicators, the data processing was based on calculating the Pearson correlation coefficient (to determine the correlation between the variables), while the forward stepwise method was used for the self-assessment of the predictor criterion variable of PA after removing the influence of the added predictor variables. The software used for statistical analysis was BM SPSS, version 21.

Results

Taking the insight into the result distribution of the all variables used in Table 1, it can be seen that they do not deviate significantly from the normal Gaussian distribution, which means that their skewness and kurtosis index is within the standard range (Gravetter & Wallnau, 2014). Therefore, further data analysis uses parametric statistical procedures.

Table 1. The descriptive parameters of the used variables (n = 148)

Variable	Mean	SD	SK	KU	Alfa
BMI (kg/m²)	19.96	2.98	0.58	0.28	
Standing long jump (0,1 cm)	177.12	27.08	0.27	0.46	
Seated forward bend (0,1 cm)	16.01	7.15	0.30	0.77	
30s lying forward bend (n/30s)	26.11	5.32	0.41	0.23	
20m progressive overload sprinting (0,1 s)	379.34	128.17	0.25	0.42	
Health	5.03	0.90	0.16	0.47	0.82
Motor coordination	4.39	0.98	0.18	0.73	0.79
Physical activity	3.96	1.56	0.47	0.66	0.86
Body mass	4.97	0.92	0.50	0.57	0.90
Athletic competence	5.04	0.89	0.24	0.82	0.93
General physical self-concept	4.93	0.97	0.35	0.44	0.91
Physical appearance	5.06	0.95	0.26	0.68	0.79
Strength	4.69	0.90	0.33	0.75	0.85
Flexibility	3.88	1.17	0.23	0.29	0.92
Endurance	4.28	1.35	0.40	0.77	0.88
Self-respect	4.87	1.01	0.19	0.58	0.72
Physical Activity Questionnaire for Adolescents	2.92	0.77	0.26	0.83	0.77

Annotation: Mean – arithmetic mean; SD – standard deviation; SK – skewness; KU – kurtosis; Alfa – Cronbach's alpha coefficient; Value of the standard error of mean (SE) for skewness is 0.18, and for kurtosis is 0.20

Table 2 examines the predictive value of 16 independent variables (BMI, standing long jump, seated forward bend, 30s lying forward bend, 20m progressive overload sprinting, health, motor coordination, PA, body mass, athletic competence, general physical self-concept, physical appearance, strength, flexibility, endurance, and self-respect) in explaining the criterion variability – the level of participants' PA.

Table 2. The results of the hierarchical linear regression analysis for predicting the PA as a criterion variable (n = 148)

Predictors	B (SE)
1. step	
BMI	0.10
ΔR^2	
R^2	0.079**
2. step	
Standing long jump	0.11
Seated forward bend	0.03
30s lying forward bend	0.05
20m progressive overload sprint	-0.09
ΔR^2	0.012
R^2	0.115
3. step	
Physical activity	0.054** (0.01)
Body mass	0.01
Health	0.07
Motor coordination	0.05
Physical activity	0.524** (0.01)
Body mass	0.01
Athletic competence	0.08
General physical self-concept	0.06
Physical appearance	0.11
Strength	0.049** (0.01)
Flexibility	0.037** (0.01)
Endurance	0.02
ΔR^2	0.034*
R^2	0.144
4. step	
Self-respect	0.026** (0.01)
ΔR^2	0.019
R^2	0.185

Annotation: (β) – values of the beta coefficient for the steps mentioned in the table above; ΔR^2 = contribution of the individual groups of predictors to the unexplained variance; R^2 = total contribution to the unexplained variance.; SE = standard error. * $p < 0.05$; ** $p < 0.01$.

BMI ($\beta = 0.10$) is introduced as a predictor in the first step of the regression equation which predicted 7,9% of the variance level of PA. The four predictor variables of the general fitness EUROFIT battery (standing long jump ($\beta = 0.11$), seated forward bend ($\beta = 0.03$), 30s lying forward bend ($\beta = -0.05$), and 20m progressive overload sprinting ($\beta = -0.09$)) that were introduced in the second step did not have statistically significant partial influence on the criterion variance assessment of participants' PA. The third step introduced 12 dimensions of the physical self-concept and the measures for the assessment of PA which further explained 3,4% of the total variance of the criterion variable. It should also be noted that the independent variables strength ($\beta = 0.49$; $p < 0.01$) and flexibility ($\beta = 0.37$; $p < 0.01$) gave the maximum contribution in explaining the variance of participants' PA. Taking a look into the statistical significance of the standardized regression coefficients of the individual predictors, one can come to a conclusion that junior karatekas who have better motor skills are more successful in regulating their PA. The final fourth step of the regression model introduced the dimension of physical self-concept self-respect. Even with only 1,9% of the variance participation, but with its positive beta coefficient, it has independent contribution in predicting the criterion of PA ($\beta = 0.26$; $p < 0.05$), which means that the participants who manifest higher perception on this dimension express a higher level of PA.

The final regression equation shows that the given groups of independent variables account for 18,5% of the criterion variability. That shows that the determinants BMI, motor skills, and physical self-concept are significant in predicting the PA of junior karatekas.

Discussion

The research studies so far have revealed uneven findings regarding the relations between BMI, motor skills, and physical self-concept in determining PA, motor skills and physical self-concept (Ciumărnean, Milaciu, Negrean, Orășan, Vesa & Vlaicu, 2022; Kutyrina, Filkina, Kocherova, Rudenko, Malyshkina & Vorobyeva 2022; Tharwat, Trousselard, Fromage, Belrose, Balès, Duffaud, 2022; Викторовна, 2018), so the aim of this research was to examine to which extent the given predictor variables explain PA of junior karatekas.

In their research, the authors (Pérez-Mármol, Chacón-Cuberos, García-Mármol & Castro-Sánchez,

2021) established the causality between the multidimensional structure of the construct physical self-concept and PA, where shaping the physical self-concept is based on earlier experiences in various PAs. That implies that positive experiences in PA cause a positive view of one's own self-concept, which can increase one's persistence in engaging in PA. The study (Woll et al., 2021) has determined that there is an interaction between mental health and motor skills such as flexibility, strength, motor coordination, endurance, and PA. In addition, it has been determined that PA in adolescence improves physical self-concept, self-respect, and athletic competence (Gualdi-Russo, Rinaldo, Toselli & Zaccagni, 2021). That means that adolescents who perceive themselves as self-respecting and athletically competent will have more success in practicing PA, and vice versa.

This empirical research, with 3.4% of the explained variance of the criterion variable, revealed that the most significant determinants of the variability of PA are the dimensions of physical self-concept, with strength and flexibility as the dimensions with the most influence. The maximum significance of the standardized regression coefficients of the given partial predictors shows that junior karatekas who achieve better results in these motor skills are more efficient in managing their own PA. In addition, the variable of physical self-concept self-respect, even with its minimal variance proportion of 1,9%, indicates that it has independent influence in explaining the criterion of PA. That shows that adolescent karatekas who show more self-awareness on that variable on PADQ realize a higher level of PA on PAQ-A. Taking a look into the final regression equation, one can see that the tested group of independent variables predicted 18,5% of criterion variability, which means that the independent variables BMI, motor skills on the Eurofit battery, and physical self-concept are statistically significant in predicting the PA of junior karatekas, which is in accordance with other studies (Courtney, Moss, Butki, & Li, 2019; Kalajas-Tilga, Koka, Hein, Tilga & Raudsepp, 2020; Lippke, Dahmen, Gao, Guza & Nigg, 2021; Jekauc et al., 2017; Zapatero & Agustin, 2020; Яковлев & Яковлев, 2018).

During the analysis of the matrix of the hierarchical regression analysis, it is important to say that predictor variables BMI, and general body shape from the Eurofit battery (standing long jump, seated forward bend, 30s lying forward bend, and 20 m progressive overload sprinting), with a moderate percentage of the variance in the first and second step of the regression analysis, did not show a significant independent contribution to predicting the criterion variance of PA. The obtained results are in accordance with the research results, which is also in accordance with other studies (Castro-Sánchez, Zurita-Ortega, García-Marmol & Chacón-Cuberos, 2019; Gultom, Defi & Sungkar, 2019; Lang, Brand, Colledge, Ludyga, Pühse, & Gerber, 2019). The obtained results also confirm the starting hypothesis that motor variables (strength and flexibility) and physical self-concept (dimensions of self-respect) have a statistically significant influence in predicting the level of PA in adolescent karatekas.

The conducted correlational research has certain methodological limitations, which potentially limit the generalization of the results, such as: a) relatively small pertinent sample, b) self-assessment method, which enables socially desirable responding, and c) transversal method that tests the participants within a certain time frame, which prevents identifying the cause-effect connection between the examined variables.

This research is significant for sport practice. The obtained results revealed the fundamental predictor variable for self-perception of physical self-concept – self-respect, which is the most important for general physical shape, or the results of the Eurofit battery, and the training of karatekas of that age. In addition, the obtained results represent the basis for creating a training program that emphasizes the following components: motor skills evaluation (flexibility, endurance, strength of abdominal muscles, explosive strength of lower extremity, functional variables of cardiovascular endurance, and intensifying the self-assessment of physical self-concept, which is in accordance with the research (Bou-Sospedra, Adelantado-Renau, Reyes Beltran-Valls & Moliner-Urdiales, 2022; Jarnig, Jaunig, Kerbl & van Poppel, 2022; Palacios-Cartagena, 2022).

Instead of the cross-sectional view, future studies should apply the longitudinal design in order to include more karatekas of various age, and both sexes, using the longer time frame, while also including other variables, such as personality traits, motivation and social relations, and the battery with more motor skills tests which theoretically can add to the understanding of the connection between BMI, motor skills, the measured construct of physical self-concept, and the criterion variable of PA of adolescent karatekas. Future theoretical and practical implications should also include modern training processes directed at the variables which motivate

participants' positive self-assessment of physical self-concept and further their interest in PA. Besides, coaches should enable daily feedback between them and karatekas, and generate optimal moods that encourage peer interaction.

Finally, despite the aforementioned limitations of this research, the obtained results can encourage other authors to conduct more detailed empirical studies on these interesting, relatively unexplored, and complex cause-effect interactions between BMI, motor skills, and physical self-concept in predicting the PA of junior karatekas.

Conclusion

The analysis of the reliability coefficient (Cronbach's alpha) revealed that the applied questionnaires PSDQ and PAQ-A have high internal consistency and can be used on Serbian adolescent karatekas. Reviewing the results of this empirical research leads to a conclusion that self-awareness of physical self-concept, with 18,5% of the explained variability, is a dominant determinant in predicting junior karatekas' PA. Maximum statistical significance in explaining the criterion variance is shown by partial positive predictors self-respect, strength and flexibility, which suggests that during adolescence karatekas that manifest higher level of self-awareness on those independent variables express higher level of PA. The obtained results of the hierarchical regression analysis can be used as a suggestion to coaches on which partial determinants (BMI, motor skills, and physical self-concept) have relevant contribution in assessing the level of PA of adolescent karatekas.

References

Adams, C., Klissouras, V., Ravazzolo, M., Renson, R., & Tuxworth, W. (1988). EUROFIT: *European test of physical fitness*. Rome: Council of Europe, Committee for the development of sport (CDSS).

Barnekow-Bergkvist, M., Hedberg, G., Janlert, U., & Jansson, E. (1998). Prediction of physical fitness and physical activity level in adulthood by physical performance and physical activity in adolescence-An 18-year follow-up study. *Scandinavian journal of medicine & science in sports, 8*(5), 299–308.

Bou-Sospedra, C., Adelantado-Renau, M., Reyes Beltran-Valls, M., & Moliner-Urdiales, D. (2022). Independent and combined influence of physical fitness components on self-esteem in adolescents: DADOS study. *Ann Hum Biol Actions, 14*,1–7.

Bubanja, D., Jovanović, Y., & Vuković, M. (2019). Criterion validity of metabolic and anthropometric predictors in diabetic foot syndrome. Vojnosanit Pregled, 76(4), 359–364.

Caspersen, C. J., Powell, K. E., & Christenson, G. M. (1985). Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. *Public health reports, 100*(2), 126–131.

Castro-Sánchez, M., Zurita-Ortega, F., García-Marmol, E., & Chacón-Cuberos, R (2019). Motivational Climate in Sport Is Associated with Life Stress Levels, Academic Performance and Physical Activity Engagement of Adolescents. *Int. J. Environ. Res. Public Health* 2019, *16*(7), 1198–1209.

Ciumărnean, L., Milaciu, M. V., Negrean, V., Orășan, O. H., Vesa, S. C., ... & Vlaicu, S.I. (2022). Cardiovascular Risk Factors and Physical Activity for the Prevention of Cardiovascular Diseases in the Elderly. *International Journal of Environmental Research and Public Health. 19*(1), 207–214.

Cleland, V., Dwyer, T., & Venn, A. (2012). Which domains of childhood physical activity predict physical activity in adulthood? A 20- year prospective tracking study. *Br J Sports Med, 46*(8), 595–602.

Courtney, J. B., Moss, H. E., Butki, B. D., & Li, K. (2019). Parent support, perceptions, and child attributes affect child activity. *American Journal of Health Behavior, 43*(2), 311–325.

Gualdi-Russo, E., Rinaldo, N., Toselli, S. & Zaccagni, L. (2021). Associations of Physical Activity and Sedentary Behaviour Assessed by Accelerometer with Body Composition among Children and Adolescents: A Scoping Review. *Sustainability 13*(1), 335–344.

Gultom, C., Defi, I. R., & Sungkar, E., (2019). Association between Self-Reported Questionnaire-determined Physical Activity Level with the Cardiorespiratory Fitness in Adolescent. *Indonesian Journal of Physical Medicine & Rehabilitation, 8*, 2–8.

Gravetter, F., & Wallnau, L. (2014). "Essentials of statistics for the behavioral sciences", (8th ed.). Belmont, CA: Wadsworth.

Jarnig, G., Jaunig, J., Kerbl, R., R. A., .& van Poppel, M. N. M. (2022). A Novel Monitoring System (AUT FIT) for Anthropometrics and Physical Fitness in Primary School Children in Austria: A Cross-Sectional Pilot Study. *Sports*, *10*(1), 4– 12.

Jekauc, D., Wagner, M. O., Herrmann, C., Hegazy, K., & Woll, A. (2017). Does physical self-concept mediate the relationship between motor abilities and physical activity in adolescents and young adults? *PLOS One*, *12*(1), 1–10.

Jorga, I., Mastrappas, S., & Damigos, D. (2018). Identifying contributing factors to progress in karate-do using the fuzzy cognitive mapping approach. *Ido Movement for Culture. Journal of Martial Arts Anthropology, 18*(1), 15–22.

Kalajas-Tilga, H., Koka, A., Hein, V., Tilga, H., & Raudsepp, L. (2020). Motivational processes in physical education and objectively measured physical

activity among adolescents. *Journal of Sport and Health Science, 9*(5), 462–471.

Kapsis, D. P., Tsoukos, A., Psarraki, M. P., Douda, H.T., Smilios, I., & Bogdanis, G. C. (2022). Changes in Body Composition and Strength after 12 Weeks of High-Intensity Functional Training with Two Different Loads in Physically Active Men and Women: A Randomized Controlled Study. *Sports*, 1*0*(1), 7 –15.

Katsanis, G., Hatyopoulos, D., Barkoukis, V., Afroditi Cl., Chatyelli, C., & Paraschos, I. (2021) Effect of a school-based resistance training program using a suspension training system on strength parameters in adolescents. *J Phys Educ Sport 21*(5), 2607–2621.

Kljajević, V., Stanković, M., Đorđević, D., Trkulja-Petković, D., Jovanović, R., ... & Sporiš, G. (2022). Physical Activity and Physical Fitness among University Students—A Systematic Review. *International Journal of Environmental Research and Public Health. 19*(1), 158–169.

Kowalski, K. C., Crocker, P. R. & Kowalski, N. P. (1997). Convergent validity of the physical activity questionnaire for adolescents. *Pediatric Exercise Science, 9*, 342–352.

Kutyrina, I. M., Filkina, O. M., Kocherova, O.Y., Rudenko, T. E, Malyshkina A.I., & Vorobyeva E.A., (2022). The awareness and attitude of adolescents concerning healthy lifestyle. *Problems of Social Hygiene, Public Health and History of Medicine, 30*(1), 33–38.

Lang, C., Brand, S., Colledge, F., Ludyga, S., Pühse, U., & Gerber, M. (2019). Adolescents' personal beliefs about sufficient physical activity are more closely related to sleep and psychological functioning than self-reported physical activity: a prospective study. *J. Sport Health Sci.* 8, 280–288.

Lazarević, D., Radisavljević, S., & Milanović, I. (2008). Relacije fizičkog self-koncepta i fizičkog vežbanja učenika osnovne škole. *Zbornik Instituta za pedagoška istraživanja, 40*(2), 306–326.

Leppänen, M. H., Lehtimäki, A.V., & Roos, E. & Viljakainen, H. (2022). Viljakainen, H. Body Mass Index, Physical Activity, and Body Image in Adolescents. *Children 9*, 202 –210.

Lippke, S., Dahmen, A., Gao, L., Guza,E., & Nigg, C. R. (2021).To What Extent is Internet Activity Predictive of Psychological Well-Being? *Psychology Research and Behavior Management, 14*, 207–219.

Marsh, H. W. & Redmayne, R. S. (1994). A multidimensional physical self-concept and its relations to multiple components of physical fitness. *Journal of Sport and Exercise Psychology*, *16*, 43–55.

McNeish, D. (2018). Thanks, coefficient alpha, we'll take it from here. *Psychological Methods, 23*(3), 412–433.

Gravetter, F. & Wallnau, L. (2014). *Essentials of statistics for the behavioral sciences* (8th ed.). Wadsworth.

Palacios-Cartagena, R., Parraca, J.A., Mendoza-Muñoz, M., Pastor-Cisneros, R., Muñoz-Bermejo, L., & Adsuar, J. C. (2022). Level of Physical Activity and Its Relationship to Self-Perceived Physical Fitness in Peruvian Adolescents. *Int. J. Environ. Res. Public Health, 19*, 1182–2193.

Palenzuela-Luis, N., Duarte-Clíments, G., Gómez-Salgado, J., Rodríguez-Gómez, J. Á., & Sánchez-Gómez, M. B. 2022). Questionnaires Assessing Adolescents' Self-Concept, Self-Perception, Physical Activity and Lifestyle: A Systematic Review. *Children, 9*, 91–100.

Pérez-Mármol, M., Chacón-Cuberos, R., García-Mármol, E., & Castro-Sánchez, M. (2021). Relationships among Physical Self-Concept, Physical Activity and Mediterranean Diet in Adolescents from the Province of Granada. *Children, 8*, 901–912.

Srianto, W., & Siswantoyo, S. (2022). Biomotor Analysis of Speed and Flexibility in the Karate Talented Athletes Coaching in the Special Region of Yogyakarta. *Advances in Health Sciences Research, 43*, 153 – 156.

Tenjović, L. (2002). *Statistika u psihologiji*-priručnik. Beograd: Centar za primenjenu psihologiju Društva psihologa Srbije.

Tharwat, D., Trousselard, M., Fromage, D., Belrose, C., Balès, M., … Duffaud, A. M. (2022). Acceptance Mindfulness-Trait as a Protective Factor for Post-Natal Depression: A Preliminary Research. *International Journal of Environmental Research and Public Health*. 19(3),1545–1556.

Tubić, T., Đorđić, V., & Poček, S. (2012). Dimenzije self-koncepta i bavljenje sportom u ranoj adolescenciji. *Psihologija, 45*(2), 209–225.

Викторовна, И. (2018). Современные проблемы формирования здорового образа жизни у студенческой молодежи. У: Пантюк (Ред.), *Международной научно-практической интернет-конференции* (с. 277–288), Минск, Беларусь / БГУ, Фак. социокультурных коммуникаций, Каф. экологии человека

Zapatero, A., & Agustin, J. (2020). Analysis of the characteristics and physical-motor achievements of the classes based on physical activity: a systematic review. *Revista Iberoamericana De Ciencias De La Actividad Fisica y El Deporte, 9*(2), 1–15.

Woll, A., Klos, L., Burchartz, A., Hanssen-Doose, A., Niessner, C., ... & Schmidt, S. (2021). Cohort Profile Update: The Motorik-Modul (MoMo) Longitudinal Study—physical fitness and physical activity as determinants of health development in German children and adolescents. *International Journal of Epidemiology, 50*(2), 393–394.

Wong, M. Y., Chung, P. K., & Leung, K. M. Y. (2022). Psychometric properties of Chinese translated body compassion scale (BCS) among Hong Kong adolescents. *Journal of Exercise Science & Fitness 20* (1), 54–61.

World Health Organization. (2010). *Global recommendations on Physical Activity for health.* Geneva: WHO, Organization.

Яковлев, А. Н., & Яковлев, М. А. (2018). Воспрятие будущего вюношеском возрасте в процесе занятий фискультурно-спортивной деятельностью.

Физическое воспитание и спотивная тренировка, *4*(26), 103–109.

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