DOI 10.26773/smj.250211

SportMont

ORIGINAL SCIENTIFIC PAPER

EUROFIT Reference Values of 7-11 Aged Children in Urban Areas of Kosovo: Relations between Age and Gender

Bahri Gjinovci[1], Besnik Morina[1], Goran Sporiš[2], Valon Nikqi[1], Onur Akman[3], Damir Jurko[4], Arta Osmani[1], Maki Grle[5], Ivana Grle[5], Jerko Prlić[6], Robert Çitozi[7]

[1]University of Pristina "Hasan Pristina", Faculty of Physical Education and Sport, Pristina, Republic of Kosovo, [2]University of Zagreb, Faculty of Kinesiology, Department of General and Applied Kinesiology, Zagreb, Croatia, [3]University of Bayburt, Faculty of Sport Science, Bayburt, Türkiye, [4]University in Split, Faculty of Kinesiology, Split, Croatia, [5]University Clinical Hospital Mostar, Department of Physical Medicine and Rehabilitation, Mostar, Bosnia and Herzegovina, [6]University Clinical Hospital Mostar, Department of Orthopedics, Mostar, Bosnia and Herzegovina, [7]Sports University of Tirana, Faculty of Physical Activity and Recreation, Tirana, Albania

Abstract

This study establishes EUROFIT reference values for physical fitness and anthropometric measurements in children aged 7-11 years in urban Kosovo. Analyzing data from 500 participants, the study examines age- and sex-based variations in motor abilities and morphological traits. Data was collected over three months, from April through June 2023, in a typical school setting during regular physical education class times. This environment was typically utilized by students to reduce performance variability caused by external conditions. Results reveal age-related increases in height, weight, and strength measures, consistent with growth trends during childhood. Boys showed higher performance in strength and power tests, while girls exhibited greater flexibility. The EUROFIT battery proved effective for assessing physical fitness across age groups. This research fills a data gap in Kosovo, providing valuable reference values for educators, coaches, and policymakers aiming to promote children's health and physical activity.

Keywords: *physical fitness, EUROFIT, motor abilities, children*

Introduction

Physical fitness, recognized as a fundamental component of overall quality of life, has gained increased public attention in recent years. With the sedentary lifestyle becoming more prevalent, especially during COVID-19 lockdowns, health issues associated with reduced physical activity have become a pressing concern Gemelli Against COVID-19 Post-Acute Care Study Group (2020). Studies demonstrate that sedentary behavior is linked to increased risks of all-cause and cardiovascular mortality, independent of physical activity levels, highlighting the need for active lifestyles across all age groups (Ekelund et al., 2016; Karimé et al., 2017). Children, in particular, are susceptible to physical inactivity, and the relationship between motor competence and health status strengthens significantly from childhood through adolescence (Batez et al., 2021; Robinson et al., 2015).

Physical fitness is vital to physical health and influences children's psychological and cognitive growth Sauka et al., (2011). Studies consistently show that children who participate regularly in physical activity often demonstrate more substantial academic outcomes and improved social skills, reinforcing fitness as an integral part of overall child development (Avornyo et al., 2024; Robinson et al., 2015). In light of this, schools and sports organizations are central to cultivating physical fitness through the guidance of trained profes-

Correspondence:

V. Nikqi
University of Pristina "Hasan Prishtina", Faculty of Physical Education and Sport, Str. "George Bush" 31, 10000 Prishtinë, Republic of Kosovo
E-mail: valon.nikqi@uni-pr.edu

sionals who can apply structured programs tailored to young participants. Standardized fitness assessments offer a practical way to monitor these developments effectively, supporting reliable, large-scale evaluations with minimal equipment needs (Asmussen et al., 1983).

One of the most widely accepted assessment tools for school-aged children's fitness is the EUROFIT test protocol. Frequently utilized in developed countries, EUROFIT serves as a measure of children's health, aids in directing them toward suitable sports, and enables comparative analysis of physical and motor traits across nations (Berisha et al., 2017). Recent reviews have confirmed EUROFIT's dependability as a testing framework, demonstrating its consistent application across diverse populations (Gulías et al., 2014). Published normative datasets derived from EUROFIT are valuable references for educators, coaches, and researchers alike, including datasets for Spanish children aged 6–12, Latvian children aged 6–17, and Macedonian children aged 6–14. Notably, an updated European dataset now includes over 5 million results from 34 countries, offering a comprehensive resource for international comparison (Gontarev et al., 2018; Ortega et al., 2023; Sauka et al., 2011; Tomkinson et al., 2018). In Kosovo, however, normative data are limited, with only one available dataset for adolescents aged 11–17 (Berisha et al., 2017). There is a notable gap in reference values for younger children in late childhood and pre-pubertal stages, creating a need to establish benchmarks for children aged 7–11 in urban Kosovo. Thus, this study aims to publish reference values for 7–11-year-old children in urban Kosovo and examine potential differences in motor abilities and morphological traits based on age and sex groups. These data will contribute to a broader understanding of child health and fitness in Kosovo, offering valuable insights for educators, coaches, and policymakers working to promote active lifestyles and improve youth health outcomes.

Materials and Methods

Respondents were formally invited to participate in the study through official communication channels, and informed consent was obtained in writing from parents as part of the ethical protocol. This study was formally approved by the University of Prishtina "Hasan Prishtina" with protocol number 677, dated 24.03.2023. All procedures strictly conformed to ethical standards stipulated in the Declaration of Helsinki.

Participants

The study population comprised 500 primary school students from urban areas, representing a broad cross-section of demographics. The participants were further categorized by age (7, 8, 9, 10, and 11 years) and sex (male/female) to make the comparison valid, making in total 10 different subgroups. Simple random sampling was used to select students from various primary schools so that the sample could be representative of the target population and free from possible biases. This enabled the making of solid comparisons between categories for both age and sex.

Study Design

Data was collected over three months, from April through June 2023, in a typical school setting during regular physical education class times. Students typically utilized this environment to minimize performance fluctuations caused by external conditions. All measurement protocols were performed by kinesiology and medical professionals who had received previous training to unify techniques in anthropometrical and motor tests. Such procedural uniformity was intended to ensure a higher degree of reliability and validity of the measurements taken.

Anthropometric Characteristics

Anthropometric measurements were taken according to International Biological Program (IBP) standards, which provide guidelines for measuring human body dimensions. While the IBP contains a wide range of measurements, the current study considered only the following seven anthropometric variables, which were considered most relevant for this population: body height, sitting trunk length, open arm span, and skinfold measurements at triceps, abdominal, and subscapular sites, plus body weight. Body height, trunk length, and arm span were measured using a Martin Anthropometer with an accuracy of ±0.01 cm; skinfold thickness was determined with the Accu-Measure Body Fat Caliper, while body weight was measured on the TANITA diagnostic scale, model BC 418. Each of these measurements reveals one morphological characteristic that can determine physical fitness and motor performance.

Physical Fitness and Motor Skill Evaluation

Physical fitness and motor abilities were measured by using the EUROFIT battery, which is an extensive testing protocol designed by the Council of Europe and has been widely validated to measure school-age children's physical fitness (Al-Shammari et al., 2024). The EUROFIT battery contains a test battery assessing different dimensions of physical fitness such as static balance, agility, flexibility, explosive, repetitive strength, and cardiovascular endurance.

Statistical Analysis

Statistical analyses were performed with Statistica 14 (TIBCO Software Inc. Palo Alto, CA, United States) and Microsoft Excel for Mac OS Version 16.43. To summarize participant characteristics, we calculated means and standard deviations (SDs) for each characteristic within groups. Next, one-way ANOVA was performed to determine if there were any significant group differences. Subsequent post hoc analyses (Tukey HSD) were performed to assess differences among the groups, allowing a fine-tuning of comparing physical fitness variables according to age and sex. The significance was set at $p<0.05$.

Results

Table 1 displays male and female participants' anthropometric and motor performance data. Mean values for body weight, height, sitting trunk length, and arm length show minimal differences between male and female participants in this age group. The Sit-and-Reach test means for females is slightly higher than that of males, reflecting a difference in flexibility. Males have higher mean scores in tests assessing strength and power, including the Standing Broad Jump, Sit-Ups in 30 seconds, Bent Arm Hang, and 10 x 5 Shuttle Run.

Table 1. Descriptive characteristics of participants, separated and compared by sex

Variables	Male				Female			
	Mean	SD	Min	Max	Mean	SD	Min	Max
Weight	32.26	11.71	16.00	119.00	32.18	10.61	16.00	75.00
Height	136.47	9.69	115.00	161.00	136.43	10.90	108.00	164.00
The length of the sitting trunk	73.39	4.80	61.00	86.00	74.14	5.60	60.00	90.00
Arms length open	132.94	10.29	108.00	161.00	132.08	14.12	12.80	159.00
The triceps skinfold	9.35	4.16	4.00	22.00	10.00	3.99	3.00	22.00
Abdominal Skinfold	9.60	7.96	2.00	45.00	9.22	5.99	2.00	37.00
Subscapular skinfold	6.35	3.94	2.00	26.00	6.75	3.64	3.00	25.00
Flamingo Balance	9.06	7.24	0.00	30.00	9.13	6.39	0.00	27.00
PlateTopping	15.99[a]	3.64	10.01	30.00	15.18	2.91	10.30	24.20
Sit-and-Reach	32.98	8.06	0.00	52.00	36.85[b]	9.57	13.00	57.00
Standing Broad Jump	115.52[a]	25.31	39.00	177.00	103.44	20.02	55.00	165.00
Sit-Ups in 30sc	13.79[a]	4.62	0.00	22.00	10.72	4.65	0.00	22.00
Bent Arm Hang	13.62[a]	15.00	0.00	97.00	9.69	10.62	0.00	60.00
10 x 5 Shuttle Run	20.35[a]	1.82	13.60	27.00	21.23	1.76	10.30	28.72
20m Beep test	3.31[a]	1.29	1.50	13.40	2.81	0.75	1.40	5.40

Legend: [a]-mean result in males is significantly higher ($p<0.01$), b-mean result in females is significantly higher ($p<0.01$).

Table 2 presents data on age-related differences in anthropometric and motor performance characteristics. As age increases, there is a progressive rise in weight, height, sitting trunk length, and arm span, consistent with growth patterns in childhood. Skinfold measurements also increase with age, particularly at age 11. The Flamingo Balance test results show

Table 2. Descriptive characteristics including girls and boys in sex-independent variables, compared according to age

Variables	Age 7		Age 8		Age 9		Age 10		Age 11	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Weight	26.04	10.71	28.30	8.15	34.28[a]	9.80	29.57	7.24	43.03[a]	10.80
Height	124.54[a]	5.92	130.63[a]	6.20	137.45[a]	6.70	141.09[a]	5.83	148.54[a]	5.90
The length of the sitting trunk	68.35[a]	3.25	70.96[a]	3.32	74.05[a]	3.76	76.20[a]	3.74	79.26[a]	3.70
Arms length open	120.24[a]	12.87	125.97[a]	6.81	132.81[a]	7.09	137.31[a]	6.79	146.22[a]	7.20
The triceps skinfold	9.07	3.53	8.69	3.36	9.64	4.32	9.41	3.67	11.55[a]	4.83
Abdominal Skinfold	7.33	4.25	6.86	5.13	9.52	7.65	10.97[b]	7.78	12.38[b]	7.99
Subscapular skinfold	5.86	2.46	5.83	3.73	6.43	3.65	7.26	4.33	7.37[d]	4.30
Flamingo Balance	11.28	8.00	9.47	7.54	8.46[c]	6.55	8.56[c]	5.61	7.70[a]	5.61

Legend: [a]-mean result is significantly higher than in younger groups ($p<0.01$), [b]-mean result is significantly higher than in younger groups excluding surrounding age groups ($p<0.01$), [c]-mean result is significantly higher than in youngest group ($p<0.01$), [d]- mean result is significantly higher than in youngest two groups ($p<0.01$).

Table 3. Descriptive characteristics for males in sex-dependent variables, compared according to age groups.

Variables	Age 7		Age 8		Age 9		Age 10		Age 11	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
PlateTopping	20.01[a]	3.34	18.07[a]	2.53	14.72	1.84	13.89	2.36	13.32	2.64
Sit-and-Reach	36.10	5.93	35.74	6.95	33.90	7.93	28.24[b]	8.27	30.94[c]	8.35
Standing Broad Jump	102.78	20.03	100.72	19.72	113.62[a]	28.53	136.62[d]	21.95	123.84[e]	15.89
Sit-Ups in 30sc	14.48	3.33	12.96	3.65	12.78	5.33	14.12	5.02	14.60	5.23
Bent Arm Hang	8.11	8.06	15.29	15.87	11.57	12.47	18.06[f]	16.78	15.06	18.15
10 x 5 Shuttle Run	21.38[g]	1.26	21.6[a]	1.68	20.37[a]	1.89	19.31	1.20	19.09	1.39
20m Beep test	3.08	1.69	2.86	0.95	3.27	1.19	3.90[f]	1.10	3.43	1.21

Legend: [a]-mean result is significantly higher than in older groups ($p<0.01$), [b]- mean result is significantly lower than in younger groups ($p<0.01$), [c]- mean result is significantly lower than in youngest two groups ($p<0.01$), [d]- mean result is significantly higher than in all other groups ($p<0.01$), [e]- mean result is significantly higher than in youngest two groups ($p<0.01$), [f]-mean result is significantly higher than in youngest group ($p<0.01$), [g]- mean result is significantly higher than in 3 oldest groups ($p<0.01$).

a slight decrease as age advances. In motor performance tests, older children generally achieve better results across most fitness assessments, such as the Standing Broad Jump and 10 x 5 Shuttle Run.

Table 3 details the performance results of male participants across age-specific variables. Plate Tapping scores show relatively minor changes with age, while flexibility, measured by the Sit-and-Reach test, declines slightly as age increases. The Standing Broad Jump results show a notable increase at age 10. Performance in the Bent Arms Hang and 20m Beep Test rises steadily with age.

Table 4 outlines the age-specific anthropometric and motor performance data for female participants. Like males, Plate Tapping scores show minor variation with age, while flexibility slightly decreases, as the Sit-and-Reach test indicates. Standing Broad Jump results increase with age, reaching a peak at age 10. Performance in the Bent Arm Hang, 20m Beep Test, and other strength and endurance measures also improve with age.

Table 4. Descriptive characteristics for females in sex-dependent variables, compared according to age groups.

Variables	Age 7		Age 8		Age 9		Age 10		Age 11	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
PlateTopping	17.22[h]	3.10	17.02[h]	2.55	15.48[a]	2.24	13.13	1.70	13.05	1.51
Sit-and-Reach	43.20[a]	9.53	37.02[b]	6.79	39.40[a]	7.72	30.88[b]	10.85	33.74	7.55
Standing Broad Jump	88.24[h]	15.20	93.18[h]	17.75	110.48[f]	15.61	121.08[d]	18.35	104.20	14.08
Sit-Ups in 30sc	10.82	2.80	12.30	5.95	10.78	3.79	8.52[c]	5.05	11.16[e]	4.36
Bent Arm Hang	6.75	8.93	13.49[g]	12.21	10.27	12.93	8.22	7.20	9.72	9.99
10 x 5 Shuttle Run	22.57[d]	1.41	21.47[a]	1.70	21.41[a]	1.19	20.76	2.20	19.94	0.86
20m Beep test	2.77	0.79	2.99	0.86	2.64	0.61	2.70	0.67	2.92	0.79

Legend: [a]-mean result is significantly higher than in older groups (p<0.01), [b]- mean result is significantly lower than in younger groups (p<0.01), [c]- mean result is significantly lower than in youngest two groups (p<0.01), [d]- mean result is significantly higher than in all other groups (p<0.01), [e]-mean result is significantly higher than in surrounding group(s) (p<0.01), [f]- mean result is significantly higher than in youngest two groups (p<0.01), [g]-mean result is significantly higher than in youngest group (p<0.01), [h]- mean result is significantly lower than in 3 oldest groups (p<0.01), #- mean result is significantly higher than in oldest group (p<0.01).

Discussion

This study revealed the referent values for the 10 different age- and sex-stratified groups of children in urban areas of Kosovo. Lack of sex-dependent difference occurred in anthropometric variables and the balance- possibly constrained by morphologic traits. Skeletal longitudinality and body fat increase along with age, while the balance seems to be disturbed by the overall body growth. Also, the Plate tapping results tend to decrease, possibly due to skeletal/body growth. Anyhow, the 10 x 5 Shuttle Run test has an improving trend across all subgroups following the age (growth & maturation). The present study provides comprehensive reference values for physical fitness and anthropometric measurements among 7- to 11-year-old children in urban Kosovo, filling a significant gap in available normative data. The results reveal important insights into how fitness parameters vary by age and sex, providing a valuable tool for educators, coaches, and healthcare providers working with children. The findings outline expected growth patterns with age, including consistent increases in height, weight, sitting trunk length, and arm span, all aligning with typical childhood development, where physical and skeletal maturity progressively accelerates (Al-Shammari et al., 2024). Extensive studies underscore that regular physical activity is essential for long-term health, reducing mortality risks associated with sedentary lifestyles (Ekelund et al., 2016).

Similarly, age-related increases in skinfold measurements, particularly around age 11, correspond with physiological changes characteristic of the prepubescent stage (Al-Shammari et al., 2024; Yu 2022). Motor test improvements, such as those observed in the Standing Broad Jump and 10 x 5 Shuttle Run, highlight a positive relationship between age and motor skills, reflecting the development of strength and coordination that occurs as children grow (Batez et al., 2021; Robinson et al., 2015). Research consistently shows that motor competence supports both physical and psychological health, reinforcing healthy developmental patterns (Robinson et al., 2015).

Notable sex-based differences are evident in strength and power tests, where males generally perform better in measures like the Standing Broad Jump, Sit-Ups, Bent Arm Hang, and 10 x 5 Shuttle Run. These variations are likely due to early hormonal effects, as even prepubescent boys often demonstrate higher muscle mass and strength levels compared to girls of the same age (Asmussen et al., 1983; Avornyo et al., 2024; Berisha et al., 2017). Studies indicate that hormonal variations, such as testosterone levels, contribute to these observed differences in muscular strength between sexes (Ekelund et al., 2016). The consistent trends in sex-related fitness differences observed in this study echo findings from EUROFIT datasets in other regions, including studies on Spanish, Latvian, and Macedonian children, reinforcing the validity of these observations (Grgic, 2023; Gulías et al., 2014; Sauka et al., 2011).

Conversely, females showed higher flexibility scores in the Sit-and-Reach test, which aligns with other studies reporting that girls generally have greater flexibility due to lower muscle stiffness, particularly in the hamstrings and calf muscles (Asmussen et al., 1983; Yu et al., 2022). Flexibility differences between sexes are well-documented, suggesting that females may naturally possess more excellent elasticity in connective tissues, which supports a more fantastic range of motion and flexibility (Grgic, 2023). The Flamingo Balance test results showed a slight decrease with age, potentially reflecting changes in body proportions that can impact balance control. As children grow taller, their center of gravity shifts, which may momentarily disrupt balance performance (Cameron, 2021; Zemková, Mohr, & Malý, 2024).

Additionally, both male and female participants displayed similar balance scores, suggesting that balance, as a motor skill, might be less influenced by sex and more by body morphology (Gontarev et al., 2018). These findings support that balance skills develop differently from strength- and flexibility-related skills, potentially stabilizing or decreasing during rapid growth phases (Tomkinson et al., 2018). The EUROFIT test battery's reliability in measuring such attributes has been validated across populations, highlighting its adaptability and consistency in capturing physical fitness metrics (Gulías et al., 2014).

Although the present study provides essential reference data, several limitations should be acknowledged. The sample is restricted to urban areas, which may not fully capture the fitness profiles of children from rural or suburban backgrounds, where lifestyle factors can vary significantly. Rural children, for example, may engage in different types of physical activities or experience varied nutritional factors that could influence fitness outcomes (Tomkinson et al., 2018). Future research should consider including rural populations to enable more comprehensive regional comparisons and examine potential socioeconomic factors that may play a role in physical fitness and motor skills development.

Additionally, the study does not account for potential seasonal variations in physical fitness, as all data collection occurred from April to June. Research indicates that children's physical activity levels can fluctuate seasonally, with higher activity in warmer months, which could affect the generalizability of findings to other times of the year (Ortega et al., 2023). Longitudinal data collection spanning different seasons could offer a more dynamic view of children's physical fitness, potentially informing adaptive physical education programs tailored to seasonal changes.

The study underscores the utility of the EUROFIT battery in assessing and tracking physical fitness among children. Widely recognized for its reliability and applicability across various populations, the EUROFIT protocol has been instrumental in setting benchmarks for health and fitness levels in school-aged children (Adam et al., 1988; Ortega et al., 2023). Establishing normative data, as done in this study, contributes to the global body of knowledge on child fitness and provides critical data to inform health promotion and intervention strategies in schools and communities. These reference values could serve as an essential tool for practitioners seeking to identify at-risk children or monitor the efficacy of physical education programs, reinforcing the importance of regular fitness assessments in educational settings (Adam et al., 1988). Moreover, as seen in large-scale studies, understanding the benefits of physical activity supports the role of structured programs in school environments to cultivate lifelong health and fitness habits (Ekelund et al., 2016).

Conclusions

This study revealed the referent values for the 10 different age- and sex-stratified groups of children in urban areas of Kosovo. A lack of sex-dependent difference occurred in anthropometric variables and the balance-possibly constrained by morphologic traits. Skeletal longitudinality and body fat increase along with age, while the balance seems to be disturbed by the overall body growth. Also, the Plate tapping results tend to decrease, possibly due to skeletal/body growth. Anyhow, the 10 x 5 Shuttle Run test has an improving trend across all subgroups following the age (growth & maturation). Sex differences do occur in strength-involving tests, where boys score better results. 10-year-old boys had the best results on the Broad jump, Bent arm hangs, and 20m Beep tests, thankfully to the optimal ratio between body mass and (ballistic and static) muscle strength. There is a continuous decrease in flexibility among boys as they grow. Furthermore, girls do have greater levels of flexibility due to chronically lower muscle stiffness. The lowest flexibility scores among girls were found in the group of 10-year-olds, as well as the highest Standing broad jump scores- ballistic strength. Results of this study are limited to the specific population, and results should be used with caution when compared to other populations. Living conditions may to a certain extent influence motor ability levels in children, and future studies may include populations from other, especially Balkan countries, and rural areas, to determine possible differences and reasons that lie behind them.

Acknowledgments
There are no acknowledgments.

Conflict of interest
The authors declare that there is no conflict of interest.

Received: 03 December 2024 | **Accepted:** 27 January 2025 | **Published:** 01 February 2025

References

Adam, C., Klissouras, V., Ravazzolo, M., Renson, R., Tuxworth, W. Kemper, H., …. Van Lierde, A. (1988). *Eurofit: European test of physical fitness.* Rome: Council of Europe, Committee for the development of Sport. https://openlibrary.org/books/OL1966631M/Eurofit

Al-Shammari, M. A., Elbilgahy, A. A., Attia, B. M., & Elfeshawy, R. (2024). Assessing the accuracy and reliability of linear growth measurement techniques in children: A comprehensive investigation. *International Journal of Advanced Community Medicine, 7*(3), 142–51. https://www.comedjournal.com/archives/2024.v7.i3.b.336

Asmussen, E., Klissouras, V., Tuxworth, B., Lofi, A., & Leger, L. (1983). Sport testing physical eurofit. In *F. Karaesk (Ed.), TESTING PHYSICAL FITNESS EUROFIT Experimental Battery (pp. 1-83).* Strasbourg Council of Europe.

Avornyo, E. A., & Wolf, S. (2024). Relative Contributions of Mothers, Fathers, and Other Caregivers' Cognitive and Socioemotional Stimulation on Ghanaian Children's School Readiness. *Early Education and Development*, 1–17. https://doi.org/10.1080/10409289.2024.2425591

Batez, M., Milošević, Ž., Mikulić, I., Sporiš, G., Mačak, D., & Trajković, N. (2021). Relationship between Motor Competence, Physical Fitness, and Academic Achievement in Young School-Aged Children. *BioMed Research International*, *2021*, 6631365. https://onlinelibrary.wiley.com/doi/10.1155/2021/6631365

Berisha, M., & Cilli, M. (2017). Comparison of Eurofit Test Results of 11-17-Year- Old Male and Female Students in Kosovo. *European Scientific Journal, ESJ*, *13*(31), 138. https://doi.org/10.19044/esj.2017.v13n31p138

Cameron N. (2021). *The measurement of human growth.* In: Elsevier eBooks; p. 317–45.

Ekelund, U., Steene-Johannessen, J., Brown, W. J., Fagerland, M. W., Owen, N., Powell, K. E., … Lancet Physical Activity Series 2 Executive Committe, & Lancet Sedentary Behaviour Working Group (2016). Does physical activity attenuate, or even eliminate, the detrimental association of sitting time with mortality? A harmonised meta-analysis of data from more than 1 million men and women. *Lancet (London, England)*, *388*(10051), 1302–1310. https://doi.org/10.1016/S0140-6736(16)30370-1

Gemelli Against COVID-19 Post-Acute Care Study Group (2020). Post-COVID-19 global health strategies: the need for an interdisciplinary approach. *Aging Clinical and Experimental Research*, *32*(8), 1613–1620. https://doi.org/10.1007/s40520-020-01616-x

Gontarev, S., Kalac, R., Velickovska, L. A., & Zivkovic, V. (2018). Physical fitness reference standards in Macedonian children and adolescents: the MAKFIT study. Estándares de referencia de aptitud física en niños y adolescentes de Macedonia: el estudio MAKFIT. *Nutricion*

hospitalaria, *35*(6), 1275–1286. https://doi.org/10.20960/nh.1881

Grgic, J. (2023). Test-retest reliability of the EUROFIT test battery: a review. *Sport Sciences for Health, 19*, 381-388. https://link.springer.com/article/10.1007/s11332-022-00936-x

Gulías-González, R., Sánchez-López, M., Olivas-Bravo, Á., Solera-Martínez, M., & Martínez-Vizcaíno, V. (2014). Physical fitness in Spanish schoolchildren aged 6-12 years: reference values of the battery EUROFIT and associated cardiovascular risk. *The Journal of School Health*, *84*(10), 625–635. https://doi.org/10.1111/josh.12192

González, K., Fuentes, J., & Márquez, J. L. (2017). Physical Inactivity, Sedentary Behavior and Chronic Diseases. *Korean Journal of Family Medicine*, *38*(3), 111–115. https://doi.org/10.4082/kjfm.2017.38.3.111

Ortega, F. B., Leskošek, B., Blagus, R., Gil-Cosano, J. J., Mäestu, J., Tomkinson, G. R., … FitBack, HELENA and IDEFICS consortia (2023). European fitness landscape for children and adolescents: updated reference values, fitness maps and country rankings based on nearly 8 million test results from 34 countries gathered by the FitBack network. *British Journal of Sports Medicine*, *57*(5), 299–310. https://doi.org/10.1136/bjsports-2022-106176

Robinson, L. E., Stodden, D. F., Barnett, L. M., Lopes, V. P., Logan, S. W., Rodrigues, L. P., & D'Hondt, E. (2015). Motor Competence and its Effect on Positive Developmental Trajectories of Health. *Sports Medicine (Auckland, N.Z.)*, *45*(9), 1273–1284. https://doi.org/10.1007/s40279-015-0351-6

Sauka, M., Priedite, I. S., Artjuhova, L., Larins, V., Selga, G., Dahlström, O., & Timpka, T. (2011). Physical fitness in northern European youth: reference values from the Latvian Physical Health in Youth Study. *Scandinavian Journal of Public Health*, *39*(1), 35–43. https://doi.org/10.1177/1403494810380298

Tomkinson, G. R., Carver, K. D., Atkinson, F., Daniell, N. D., Lewis, L. K., Fitzgerald, J. S., … Ortega, F. B. (2018). European normative values for physical fitness in children and adolescents aged 9-17 years: results from 2 779 165 Eurofit performances representing 30 countries. *British Journal of Sports Medicine*, *52*(22), 1445–14563. https://doi.org/10.1136/bjsports-2017-098253

Yu, S., Lin, L., Liang, H., Lin, M., Deng, W., Zhan, X., … & Liu, C. (2022). Gender difference in effects of proprioceptive neuromuscular facilitation stretching on flexibility and stiffness of hamstring muscle. *Frontiers in Physiology*, *13*, 918176. https://doi.org/10.3389/fphys.2022.918176

Zemková, E., Mohr, M., & Malý, T. (2024). Editorial: A physiologically-based approach to study different types of locomotion in association with core performance. *Frontiers in Physiology*, *15*, 1505881. https://doi.org/10.3389/fphys.2024.1505881