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Impact Of Covid-19 Lockdown On Physical Fitness In Hungarian Schoolchildren: Evidence From A National Cohort Study

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The COVID-19 pandemic has profoundly impacted daily life, raising particular concerns about children's physical activity and fitness levels. During the second semester of the 2019-2020 school year and throughout the 2020-2021 academic year, schools in Hungary were closed for approximately half of the total instructional time. As a result, educational institutions shifted to remote learning, while physical education classes and organized sports activities were suspended.

PURPOSE: This cohort-based analysis aimed to compare the health-related physical fitness levels of Hungarian students in primary grades 5-8 before and one year after the COVID-19 pandemic.

METHODS: The analysis included 285,465 students assessed during the pre-pandemic (2018/2019) and post-pandemic (2021/2022) academic years. Physical fitness components analysed included body mass index (BMI), body fat percentage (BF%), cardiorespiratory fitness (CF), musculoskeletal fitness, and flexibility, measured using the Hungarian National Youth Fitness Test (NETFIT®). Fitness scores were classified according to NETFIT® criterion-referenced health standards. Generalized linear mixed-effects models were applied to quantify differences between time periods, modeling the odds of students achieving results within the healthy fitness zone.

RESULTS: According to multivariate analyses, the proportion of students performing outside the healthy fitness zone for BMI, BF%, CF, push-ups, standing long jump, and flexibility increased significantly in the post-pandemic school year compared with the pre-pandemic period. (OR_BMI = 1.22; OR_BF% = 1.16; OR_PACER = 1.65; OR_FLEXIBILITY = 1.06; OR_PUSH-UP = 1.19). In contrast, after the closures, students were less likely to fall outside the healthy fitness zone for handgrip strength, and standing long jump (OR_handgrip = 0.92; OR_jump = 0.93).

CONCLUSIONS: The effects of lockdown on adolescents' musculoskeletal systems remain unclear. Overall, unlike body composition and cardiovascular fitness, musculoskeletal responses to lockdown suggest selective adaptations. These results underscore the importance of implementing targeted interventions to promote physical activity and fitness recovery in youth populations following prolonged periods of school closure.

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The Association Of Strength And Body Composition In Children Ages 5 To 11 Years

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BACKGROUND: Prior reports have determined that fat-free mass (FFM) is positively associated with muscle strength. Furthermore, DXA scanning can provide total body and regional soft tissue analyses and the ability to create and analyze uniquely created regions of interest (ROI) including the quadriceps (QUADS) and hamstrings (HAMS). While this association has been demonstrated in adults, the association between mineral-free lean (MFL) mass measures and muscle strength in young children has not been fully elucidated. The purpose of this study was to determine the association between strength and total body and regional soft tissue measures in young children. **METHODS:** Total body DXA scans from 32 children 5-11 years (8.0 ± 1.6) of age were acquired with the subjects lying on their left and right sides with the leg of interest extended and the contralateral leg bent removing it from the analyses field of view. Unique regions of interest were created for analyses of MFL masses using custom analyses software. Muscle strength testing was performed using a RAMPing protocol at 90° knee flexion consisting of two warm-up contractions at 50% and 75% perceived effort followed by three maximal voluntary isometric contractions (MVIC) of knee flexion and extension using an isokinetic dynamometer (Biodex System 4). Correlational analyses and explained variance were used to determine the associations between strength and body composition. **RESULTS:** Peak knee extension torque (72.6 ± 35.9 N·m) explained 70.6% of the variance in total body MFL mass (20.3 ± 6.1 kg), 77.5% of the variance in total thigh MFL mass (2.2 ± 0.9 kg), and 66.3% of the variance in QUADS MFL mass (0.8 ± 0.3 kg) while peak knee flexion torque (27.4 ± 14.0 N·m) explained 59.8% of the variance in total body MFL mass, 62.7% of the variance in total thigh MFL mass, and 65.4% of the variance in HAMS MFL mass (0.8 ± 0.3 kg). **CONCLUSIONS:** Total body and total thigh MFL mass, including QUADS and HAMS MFL mass measures demonstrated a strong association to peak knee extension and flexion torque, confirmed by the significant explained variance. This study was supported in part by the University of Kentucky Pediatric Exercise Physiology Laboratory Endowment.

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Limb Symmetry Index Fails To Predict Athletic Performance In Youth Athletes

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Limb symmetry index (LSI) is a ratio of muscle function between opposing limbs. For quadriceps strength, a common LSI cut-off for athletes to return to sport is $\leq 10\%$. **PURPOSE:** To assess quadriceps LSI on various performance metrics in youth athletes. **METHODS:** We assessed 22 youth athletes (9 female, 13 male) in a battery of physical tests. Countermovement jump (CMJ) height and CMJ peak take-off force were measured with Vald ForceDecks force plates; we used the standardized VALD CMJ protocol consisting of 3 jumps. Athletes then performed a 40-yard dash and 5-10-5 agility shuttle adhering to Vald protocols; times were captured with the Vald SmartSpeed pulsed laser. We also measured quadriceps strength and torque using a Vald Dynamo dynamometer. Quadriceps torque was used to calculate LSI ratio. Independent-samples t-tests compared subjects above and below 10% LSI in CMJ, 40-yard dash, and 5-10-5 shuttle performances; Mann-Whitney U tests assessed non-parametric distributions. Linear regression measured the effect of LSI percentage on performance. **RESULTS:** Athletes were 15.8 ± 8.1 yr, 13 had an LSI $> 10\%$, and 9 were $< 10\%$. Subjects with an LSI $< 10\%$ had a quadriceps strength of 41.0 ± 15.5 kg, torque of 2.5 ± 0.8 Nm, CMJ height of 26.7 ± 8.1 cm, CMJ peak take-off force of 23.5 ± 2.3 N, 40-yard dash of 5.9 ± 0.5 sec, and 5-10-5 agility shuttle of 5.2 ± 0.3 sec. Subjects with an LSI $> 10\%$ had a quadriceps strength of 35.6 ± 16.0 kg, torque of 2.3 ± 0.7 Nm, CMJ height of 29.2 ± 6.2 cm, CMJ peak take-off force of 21.8 ± 2.3 N, 40-yard dash of 6.0 ± 0.5 sec, and 5-10-5 agility shuttle of 5.4 ± 0.4 sec. Independent-samples t-tests found no differences between groups in quadriceps torque ($p = 0.653$), CMJ height ($p = 0.426$), or 40-yard

dash ($p = 0.507$). A weak trend was observed in CMJ peak take-off force; subjects with LSI $<10\%$ were 7.5% higher ($p = 0.089$). Quadriceps strength and 5-10-5 agility shuttle did not meet parametric assumptions; Mann-Whitney U tests were insignificant ($p = 0.794$ and $p = 0.324$, respectively). Linear regression found the exact LSI percentage to be a significant predictor of CMJ peak take-off force ($p = 0.045$; 95% CI of β : -0.002, -0.172). **CONCLUSION:** Better understanding of return-to-sport metrics may be valuable to coaches and athletic personnel. Using an LSI cut-off score of $>10\%$ may not be as informative as raw percentage deviations.

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ASSOCIATION BETWEEN METs AND PERCEIVED EXERTION DURING TREADMILL WALKING/RUNNING AMONG 6-12 YEAR OLDS: A PRELIMINARY STUDY

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PURPOSE: Individuals' rating of perceived exertion (RPE) during physical activity is often captured by the Borg scale and has been indicated as a predictive measure of metabolic equivalent of task (MET) in young adults. This study explores the relationship between RPE and METs among youth ages 6-17 years during treadmill walking/running.

METHODS: Participants completed a 5-minute seated rest followed by incremental 5-minute treadmill bouts (0.5-6.0mph), with oxygen uptake (VO₂) measured by indirect calorimetry. Participants' self-reported RPE was measured using the Borg scale ranging 6-20 during the last 30 seconds of each bout. Youth METs were calculated as VO₂ divided by the measured VO₂ during seated rest. A linear mixed effects model with random intercepts and slopes for participants as well as a spline component was used to assess the association between RPE and METs, along with a corresponding 95% confidence interval.

RESULTS: One hundred and seven participants (mean $\pm$ SD age 12.0 $\pm$ 3.1 years, 50.5% female, BMI 20.6 $\pm$ 5.6 kg/m², bodyfat 22.3 $\pm$ 10.3%) completed 696 treadmill bouts. A significant nonlinear association was found between RPE and METs ($p < 0.0001$). MET values increased with higher RPE. For example, at RPE=6, the expected MET was 1.71 (95% CI 1.52-1.89), and at RPE=15, the expected MET was 5.85 (95% CI 5.18-6.52). **CONCLUSIONS:** A nonlinear association was observed between RPE and METs indicating that perceived exertion increases in parallel with objectively measured metabolic intensity. These results support the validity of RPE as a practical indicator of physiological workload. Future research should examine different RPE scales, such as the OMNI Scale, to further assess perceived exertion in youth and evaluate potential differences across scales.

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Receiver Operating Characteristics Analysis Of Phase Angle To Identify Muscular-related Deficits In Children And Adolescents

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Although sarcopenia is associated with aging, emerging evidence suggests that early manifestations of low muscle quality and function can occur in youth. While the bioelectrical impedance (BIA)-derived phase angle (PhA) is a recognized marker of health and nutritional status, its ability to detect early signs of low muscular-related indices in youth remains uncertain. **PURPOSE:** To investigate the sensitivity and specificity of PhA as a single marker of low lean soft tissue (LST) and low muscular function indices in youth. **METHODS:** The cross-sectional cohort investigation included 613 on-time maturing participants (10-18y; 51% females). Receiver operating characteristic (ROC) curve analyses were conducted using PhA, assessed with a 50 kHz BIA device, as a screening tool of i) low LST and appendicular LST (ALST), derived from dual-energy X-ray absorptiometry and adjusted to height (LST-I and ALST-I; <19 th percentile); ii) low muscular function was evaluated using handgrip strength (HGS) and standing broad jump (SBJ) tests (<20 th percentile); iii) combined low LST or ALST with low HGS or SBJ. **RESULTS:** For both LST-I and ALST-I, PhA showed good accuracy in females [area under the curve (AUC): 0.74-0.85; cutoff: 5.13°; sensitivity: 0.72; specificity: 0.74-0.92] and fair accuracy in males (AUC: 0.65-0.73; cutoffs: 5.22-5.69°; sensitivity: 0.51-0.75; specificity: 0.64-0.79). Regarding the muscular function domain, PhA performance was moderate in females for both HGS and SBJ (AUC: 0.70-0.78; cutoffs: 5.02-5.34°; sensitivity: 0.52-0.74; specificity: 0.85-0.86) and low in males, but only for SBJ (AUC: 0.66; cutoffs: 5.26°; sensitivity: 0.73; specificity = 0.58). When combining LST-related and muscular function risks, PhA retained good discriminative ability in females (AUC: 0.85; cutoff: 5.12°; sensitivity: 0.72; specificity: 0.92) and fair accuracy in males (AUC: 0.69; cutoff: 5.94°; sensitivity: 0.40; specificity: 0.93). **CONCLUSION:** PhA emerged as a useful single marker to identify early signs of sarcopenia in youth, being particularly effective in females, especially when multiple risk factors coexisted. Moreover, PhA appeared to better reflect deficits in LST than impairments in muscular function, suggesting that its discriminative capacity may be predominantly structural rather than functional.

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A Nutrition Education Program Focusing On Feelings Of Hunger And Fullnessfor Pre-school Age Children

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Background: Infants are born with the ability to self-regulate their energy intake by recognizing internal cues of hunger and fullness based on physiological needs. However, in the present obesogenic environment, children face significant challenges in response to their internal sensations of hunger and fullness. Nutrition education may help children improve their eating self-regulation. **Purpose:** We evaluated how children perceive and report their own hunger and fullness cues, as well as their food intake, after following a nutrition education program designed by the United States Department of Agriculture's (USDA's) Team Nutrition Resource. **Methods:** We conducted this study during snack time among children, 4 to 5 years of age, who attended a childcare center in Blacksburg, VA. Food intake and hunger/fullness ratings were collected at three time points: baseline (week 0), post-intervention (week 3), and follow-up (week 7). During week 2, the nutrition