The Impact of the Pandemic COVID 19 on Adolescent's Sports Performance in Czech Republic

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Original Article

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Abstract:

Background: During the COVID-19 pandemic, free movement, leisure activities and sports, both competitive and elite, were restricted by measures against the spread of the infection. The study aimed to evaluate the impact of the restric-

tions on the performance of Czech adolescent competitive athletes.

Methods: The sample of the retrospective study comprised 125 participants (41 girls, 84 boys). The initial examination, the mean age of the entire sample was 15.5 ± 1.2 (median 16.0) years; 16.0 ± 1.2 in girls and 15.5 ± 1.2 in boys, respectively. All participants were examined during regular preventive sports health checks from September to November 2019 and a year later. The examination consisted of a complete medical history and physical examination, anthropometric measurements (height, weight and body mass index [BMI] calculations) and maximal exercise testing on a leg cycle ergometer, ECG and blood pressure recordings. The response variables in regression models were power output (W/kg) and MET.

Results: In the entire sample, as well as in the boy and girl subgroups, body height, weight, BMI, BMI percentile and power output were significantly increased in 2020 compared to 2019, yet with a statistically significant reduction in both power output per kilogram of body weight and metabolic equivalent (MET). In 2020, the relative power output dropped by 0.13 W/kg and MET by 0.6. There was no statistically significant predictor of changes in relative power output and MET identified in regression models, including no significant impact of the sport type. There were no significant differences in results between genders.

Conclusions: Performance and anthropometric parameters, specifically power output per kilogram of body weight and MET, worsened in the sample of adolescent male and female athletes.

Introduction

During just a few months, the COVID-19 pandemic has caused a global public health crisis with psychological, social and health consequences. In 2020, the global coronavirus disease (COVID-19) pandemic, caused by severe acute respiratory syndrome coronavirus 2, produced major changes to social behavior including restrictions on free movement, leisure activities and sports, both competitive and elite. Compared with adult COVID-19 patients, the number of pediatric patients was lower with milder symptoms and better prognosis.[1,2,3]

On 11 March 2020 after the virus infected more than 381,000 people in 195 countries, the World Health Organization declared COVID-19 to be a global pandemic.[4] On the same day, preventive measures to contain the spread of the disease including restrictions on free movement, leisure activities and sports, both competitive and elite were adopted. Coronavirus disease has been shown to have direct and indirect effects on human health and social life like social isolation; loss or risk of loss of income and livelihood; economic unrest; increased alcohol and drug use; intimate partners and family violence; reduced physical activity; intellectual stimulation.[5]

With schools and sports grounds being closed, children's leisure activities were significantly limited until 24 May 2020 when the ban was lifted. With regard to the worsening epidemiological situation, the measures were reintroduced; once again, schools, indoor and, later, outdoor sports grounds were closed. Thus, leisure, high competitive and school sports activities of Czech children were limited in 2020. Subsequently, a detraining effect may be expected, associated with reduced physical condition and specific performance[6] as well as other negative metabolic and morphological and functional changes.[7]

Physical activity is a basic biological mani-

festation and need in human life. Globally, progressive technological development, urbanization, car-oriented urban and rural design have reduced common mobility habits and options. The overall amount of physical activity, in particular its habitual component decreases even though the genetic makeup of individuals, and thus their need for movement, remain unchanged. Hypokinetic disease and sedentary lifestyle are increasingly encountered in childhood. Physical activity is one of the most important sources of personal, social and economic development that contributes significantly to the quality of life.[8,9]

Physical inactivity is described as one of the biggest public health problems of the 21st century.[10-12] It is defined as an activity that does not consume sufficient muscle energy.[13] Physical inactivity is one of the main risk factors for noncommunicable diseases, ranking 14th in the world and 11th in high-income countries.[14]

The aim of this study was to evaluate the influence of the lockdown due to the COVID-19 and preventive restrictions on performance of Czech adolescent competitive athletes, by comparing anthropometric and performance parameters measured in 2019 and 2020.

Materials and methods

Study design and sample

A retrospective, non-interventional, non-randomized, non-blinded, uncontrolled study was performed. The sample comprised 125 children and adolescents (41 girls, 84 boys). Outdoor athletes prevailed over the indoor ones (73.6% vs. 26.4%). Participants involved in team and individual sports were present equally in the study sample (48.8% vs. 51.2%). The mean age at initial examination was 15.5 years (median 16, SD 1.2). All participants were examined during regular preventive sports health checks conforming to the Czech legislation (Decree No. 391/2013 Coll.) between September and November 2019. Only athletes examined a year later, in 2020, who did not interrupt their training due to illness or injury between the two health checks were enrolled. The examination consisted of a complete medical history and physical examination, anthropometric measurements (height, weight and body mass index [BMI] calculations) and maximal exercise testing on a leg cycle ergometer (Ergoselect 100P, Ergoline, Bitz, Germany). ECG recordings were made with BTL-08 LC ECG (BTL Industries Ltd., UK). The studied parameters were maximum power output (Wmax, or W per kg of body weight) and metabolic equivalent (MET).

The study was approved by the Ethics Committee of the Faculty of Medicine, University of Ostrava (No. 18/2021). All participants (or their parents) signed informed consent forms.

Statistical analysis

Data were analyzed using IBM SPSS Statistics version 22 (Armonk, NY: IBM Corp.). Numerical variables were assessed with descriptive statistical methods (mean, median, SD). To determine statistical significance of differences between the 2 years, genders and subgroups, the chi-square test and the Wilcoxon test were used. Forward stepwise logistic regression and linear regression were applied to evaluate predictors for changes in power output per kilogram of body weight and changes in MET, as response variables, and the other numerical variables. The level of statistical significance was set at 5%.

Results

Sample characteristics

Basic characteristics of the entire sample are shown in Table 1. In the entire sample, as well as in the boys and girls, body height, weight, BMI and power output were significantly increased in 2020. Table 2 presents changes in the studied characteristics between the two years. Both power output per kilogram of body weight and MET statistically significantly reduced between the study year in the entire sample. However, for genders, this was proven only for boys; in girls, the reduction was insignificant. The type of sport performed by study participants did not statistically significantly relate to the change in power output per kilogram of body weight and the change of MET between the study years. Indoor athletes experienced a mean reduction in relative power output of 0.2 ± 0.72 W/kg, while outdoor athletes of 0.11 ± 0.86 W/kg ($p = 0.592$). A reduction in MET of 0.99 ± 2.79 in indoor athletes and 0.42 ± 3.02 in outdoor athletes was noted ($p = 0.345$). Athletes training individual sports decreases in their relative power output by an aver-

age of 0.08 ± 0.92 W/kg, while team athletes deteriorated by 0.19 ± 0.74 W/kg (p = 0.464). The same athlete subgroups decreased in their MET by 0.56 ± 3.12 and 0.59 ± 2.84 (p = 0.955).

Predicting changes in power output

Both logistic and linear regression analysis (in the entire study sample and in the gender subgroups separately) did not identify any statistically significant predictor of changes in both power output per kilogram of body weight and MET.

Discussion

In the COVID – 19 pandemic restrictions on free movement, leisure activities and sports critically influenced our lifestyle habits. Numerous studies from many countries and regions around the world have analyzed the consequences of quarantine on our health, with diverse outcomes depending on the adherence to a specific diet pattern and physical activity schedule. The study of changes in the lifestyle of the Spanish University Population[15] shows that 36.3% of Spanish students increased their physical activity this results are similar, although higher, to those reported by Rodríguez-Pérez et al.[16], Di Renzo *et al*.[17] and somewhat lower than those found by Celorio-Sarda *et al*.[18], contrary to those of Romero-Blanco *et al*.[19] who found that all groups increased their physical activity.

The results of our study show that between 2 health checks, performed at a one-year interval, the participants increased their mean height, body weight, BMI and power output, but reduced their power output per kilogram of body weight, irrespective of gender. Reduced power output per kilogram of body weight was positively associated with age. The greatest reduction in power output was observed in children aged 14-16 years.

The participants increased their body weight. No reduction in BMI percentiles was noted; conversely, BMI percentiles increased, mainly in boys. Nikolaidis & Karydis, who analyzed the effect of age on body composition in competitive male adolescent soccer players (aged 12-21 years), showed a positive association between age and fat mass, fat-free mass, and a negative association with body fat.[20]

Moreover, they found that a typical gain in the mean BMI value per year was 0.42 kg/m2 within age category 12-21 years. The Czech Republic's Report Card on physical activity for children And youth, part of the Active Healthy Kids Global Alliance global effort, shows that 62% of adolescents participate in organized sport and physical activity programs, with participation in such leisure time activities being associated with better physical and mental health.[21] It may therefore be assumed that it was restrictions on these activities that contributed to performance reduction. In childhood, apart from organized sports activities, leisure time, habitual activities including active transportation to school are of key importance.

In Denmark, where nearly two-thirds of adults use cycling as a means of transport, bike riders were found to have an 8% higher level of fitness. The number of Czech children choosing active forms of transport to school (walking, cycling) has steadily decreased. In 2011, Czech adolescents were 2.7 less likely (OR = 0.365, p <0.001) to use active transportation to school than in 2001, as shown by Dygryn *et al*. in a study of 6,236 participants. Between 2001 and 2011, the proportion of adolescents using active transportation to school decreased from 49.1% to 21%.[22] In this age category, long-term restricted school attendance may result in failing to meet the recommended amount of walking. Boys and girls aged 6-12 years should take at least 15,000 and 12,000 steps a day, respectively.[23] Previous studies indicate that healthy behaviors have complied more beneficially during structured days (e.g. school days) as compared to unstructured days (during vacations or on weekends). This is supported by data showing the importance of structured institutions and organizations (schools, sports clubs) for children's and adolescents' sports activities.[24-28] A physical activity-friendly school environment is associated with lower risk of obesity and a positive youth development-based sports mentorship program improved healthy adolescents' mental well-being, psychological assets, physical fitness and physical activity levels.[29,30]

In their cross-sectional study determining performance level of 200 elite youth hockey players aged 13-17 years, Leiter *et al*. found that aerobic fitness increased to a lesser extent at older ages, with a significant increase in maximum power output between the ages of 13 and 14 years as well as between 14 and 15 years, but an insignificant increase between the ages of 15

and 16.[31] This is consistent with the present study showing the greatest increase in absolute power output in children aged 13 years or younger a smaller increase in those aged 14 to 17 years and the smallest increase in adolescents aged 17 years and older.

Despite the undeniable importance of restrictive measures, such as movement limitations, social distancing or school closures, for containing the COVID-19 pandemic, epidemiological studies have demonstrated a negative impact of certain measures on health through worsening of cardiometabolic parameters in various populations throughout the world. In Europe, an example may be a study of 2,447 Lithuanian adults by Kriaucioniene *et al*. showing that due to COVID-19, one-third of the participants gained weight, negatively changed their dietary patterns and reduced their physical activity.[32] Similarly, Bhutani *et al*. reported increased mean weight (n = 727) resulting from only several months of lockdown in the United States.[33] Studying a population of Greek children and adolescents (n = 397), Androutsos *et al*. showed that during the COVID-19 lockdown, children's/ adolescents' BMI (in 35%), sleep duration and screen time increased, while their physical activity decreased.[34] In a study of 41 Italian children aged 13 years with obesity, Pietrobelli revealed that during the COVID-19 lockdown, time spent in sports activities decreased by 2.30 hours a week; sleep time increased by 0.65 hours a day; screen time increased by 4.85 hours a day; a number of meals eaten per day increased by 1.15.[35] A relationship between too much time spent in front of the screen and poor eating habits has been reported in adolescent girls.[36]

In most countries, epidemiological data have confirmed a dramatic increase in the prevalence of obesity at the time of the pandemic, especially in the young population. The reason was physical inactivity, poor eating habits, sedentary lifestyle.[37,38] Physical inactivity and obesity have also become increasingly important factors in mental illness.[38]

However, the literature focusing on the impact of anti-epidemic measures on children is still scarce. We have not found other studies dealing with the effect of the measures on performance characteristics such as power output. From a public health perspective, it is therefore essential that during restricted school attendance, parents, with state support, provide their children with adequate physical activity, we have focused on the possible health gains originating from that.

Conclusions

However, it is too early to conclude the impact of the COVID-19 pandemic on children's sports performance. We demonstrated, after months of restrictive measures, a statistically significant increase in their body weight and BMI while their power output per kilogram of body weight and MED dropped. The results of the logistic regression analysis as well as the results of the multiple linear regression analysis in the whole group, or separately in the group of girls or boys, did not show any significant predictor of performance worsening between both study years. Therefore, we suggest that restrictions introduced to limit the spread of the virus had detrimental effects on various lifestyle components, especially in young populations. This resulted in augmented levels of physical inactivity and sedentary behaviors and a reduced time spent in play outdoors or sport practices. The sedentary lifestyle during the pandemic of COVID 19, low physical activity, and the media such as the internet, television, radio, the press and others affect the lives of young people can influence them. These findings should be reflected when planning further epidemic measures and the benefits of physical activity need to be emphasized in national programs to prevent the burden of non-communicable diseases. High vaccination coverage of the adolescent population should be supported to prevent not only their weight gain but also performance decline originating from reduced physical activity connected to the restrictive measures.

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Conflict of interest

The authors certify that there is no conflict of interest regarding the manuscript.

References

1. AL-HAJJAR S, MCINTOSH K (2020) Pediatric COVID-19: An update on the expanding pandemic. *Int J Pediatr Adolesc Med* 2020;7(2):61–3.
2. BARBOSA BT, DE LIMA-JUNIOR D, DA

SILVA FILHO EM (2020) The impact of COVID-19 on sporting events and high-performance athletes. *J Sports Med Phys Fitness* 2020; 60:1507-8.
3. STEFKOVA G, ZAMBORIOVA M (2021) Metabolic Syndrome and Mental Health in the Time of Covid-19 Pandemic. *CSWHI 2021*; 12(5): 15 – 21.
4. WHO (2020) Director-General's opening remarks at the media briefing on COVID-19-March 11, 2020. *WHO; 2020* [Internet]. Available from: https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020 [cited 2021, Jul 20].
5. DZUKA J, KLUCAROVA Z, BABINCAK P (2021) Covid-19 in Slovakia: economic, social and psychological factors of subjective well-being and symptoms of depression during a pandemic. *Czechoslovak Psychology*. 2021; LXV, no. 2, p. 125 - 145.
6. FRANCO I, BIANCO A, BONFIGLIO C, SORINO P, MIRIZZI A, CAMPANELLA A, *et al*. (2021) Decreased levels of physical activity: results from a cross-sectional study in southern Italy during the COVID-19 lockdown. *J Sports Med Phys Fitness* 2021; 61:294-300.
7. KENNEY WL, WILMORE JH, COSTILL DL (2015) Physiology of sport and exercise. 6th ed. Champaign: Human Kinetics; 2015.
8. SAINT-MAURICE PF, TROIANO RP, BASSETT DR JR, GRAUBARD BI, CARLSON SA, SHIROMA EJ *et al*. (2020) Association of daily step count and step intensity with mortality among US adults. JAMA 2020; 323:1151–60.
9. PAULIK S, PLSKOVA A, KACMARIKOVA M, OCHABA R (2021) Health Awareness in the Field of Physical Activity in Slovakia Source. *CSWHI 2021*; 12(5): 8 – 14.
10. LEE IM, SHIROMA EJ, LOBELO F, PUSKA P, BLAIR SN, KATZMARZYK PT (2012) Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. *Lancet* 2012; 380:219–29.
11. BLAIR SN (2009) Physical inactivity: the biggest public health problem of the 21st century. Br J Sports Med 2009; 43:1–2.
12. SHEN KL, YANG YH, JIANG RM, WANG TY, ZHAO DC, JIANG Y, *et al*. (2020) Updated diagnosis, treatment and prevention of COVID-19 in children: experts' consensus statement (condensed version of the second edition). World J Pediatr 2020; 16:232–9.
13. GONZALEZ K, FUENTES J, MARQUEZ J L (2017) Physical Inactivity, Sedentary Behavior and Chronic Diseases. *Korean J Fam Med*., 2017, 38(3),111-115.
14. LESKINEN T *et al*. (2020) Comparison between recent and long-term physical activity levels as predictors of cardiometabolic risk: a cohort study. *In BMJ* [online]. vol. 10, p. 15 [cit. 2020-03-19]. Available online: https://bmjopen.bmj.com/content/10/2/e033797.
15. SUMALLA-CANO S, FORBES-HERNANDEZ T, APARICIO-OBREGON S *et al*. (2022) Changes in the Lifestyle of the Spanish University Population during Confinement for COVID-19. Int J Environ Res Public Health. 2022;19(4):2210.
16. RODRIGUEZ-PEREZ C, MOLINA-MONTES E, VERARDO V, ARTACHO R, GARCIA-VILLANOVA B, GUERRA-HERNANDEZ E J, RUIZ-LOPEZ M D (2020) Changes in Dietary Behaviors during the COVID-19 Outbreak Confinement in the Spanish COVIDiet Study. *Nutrients*. 2020; 12:1730.
17. DI RENZO L, GUALTIERI P, PIVARI F, SOLDATI L, ATTINA A, CINELLI G, LEGGERI C, CAPARELLO G, BARREA L, SCERBO F *et al*. (2020) Eating Habits and Lifestyle Changes during COVID-19 Lockdown: An Italian Survey. *J. Transl. Med*. 2020; 18:229. doi: 10.1186/s12967-020-02399-5.
18. CELORIO-SARDA R, COMAS-BASTE O, LATORRE-MORATALLA M L, ZERON-RUGERIO M F, URPI-SARDA M, ILLAN-VILLANUEVA M, FARRAN-CODINA A, IZQUIERDO-PULIDO M, DEL CARMEN VIDAL-CAROU (2021) M. Effect of COVID-19 Lockdown on Dietary Habits and Lifestyle of Food Science Students and Professionals from Spain. *Nutrients*. 2021; 13:1494.
19. ROMERO-BLANCO C, RODRIGUEZ-ALMAGRO J, ONIEVA-ZAFRA M D,

PARRA-FERNANDEZ M L, PRADO-LAGUNA M D C, HERNANDEZ-MARTINEZ A (2020) Physical Activity and Sedentary Lifestyle in University Students: Changes during Confinement Due to the COVID-19 Pandemic. *Int. J. Environ. Res. Public. Health*. 2020;17:6567,

20. NIKOLAIDIS PT, KARYDIS NV (2011) Physique and body composition in soccer players across adolescence. *Asian J Sports Med 2011*;2:75–82.
21. AUBERT S, BARNES JD, FORSE ML, TURNER E, GONZALEZ SA, KALINOWSKI J *et al*. (2019) The international impact of the active healthy kids global alliance physical activity report cards for children and youth. *J Phys Act Health* 2019*;* 16:679–97.
22. DYGRYN J, MITAS J, GABA A, RUBIN L, FROMEL K (2015) Changes in active commuting to school in Czech adolescents in different types of built environment across a 10-year period. *Int J Environ Res Public Health* 2015; 12:12988–98.
23. TUDOR-LOCKE C, AINSWORTH BE, THOMPSON RW, MATTHEWS CE (2002) Comparison of pedometer and accelerometer measures of free living physical activity. *Med Sci Sports Exerc* 2002; 34:2045–51.
24. BRAZENDALE K, BEETS MW, WEAVER RG, PATE RR, TURNER-MCGRIEVY GM, KACZYNSKI AT *et al*. (2017) Understanding differences between summer vs. school obesogenic behaviors of children: the structured days hypothesis. *Int J Behav Nutr Phys Act* 2017;14:100.
25. SCHMIDT SCE, HENN A, ALBRECHT C, WOLL A (2017) Physical activity of german children and adolescents 2003–2012: the MoMo-study. *Int J Environ Res Public Health* 2017;14:1375.
26. SIGMUND E, SIGMUNDOVA D, BADURA P, KALMAN M, HAMRIK Z, PAVELKA J (2015) Temporal trends in overweight and obesity, physical activity and screen time among Czech adolescents from 2002 to 2014: A national health behaviour in school-aged children study. *Int J Environ Res Public Health* 2015; 12:11848–68.
27. KONDAKIS K, KONDAKIS M, ANDROUTSOS O, DE HENAUW S, GONZALEZ-GROSS M, MORENO LA, *et al*. (2020) Cardiorespiratory fitness is associated with body composition and insulin resistance in European adolescents: HELENA study. *J Sports Med Phys Fitness* 2020; 60:1349-57.
28. SIGMUNDOVA D, SIGMUND E, BADURA P, VOKACOVA J, KLEIN D, BUCKSCH J (2017) Parent-child behavioural patterns related to pre-schoolers' overweight/obesity. *Acta Gymnica* 2017; 47:53–63.
29. IP P, HO FKW, LOUIE LHT, CHUNG TWH, CHEUNG YF, LEE SL *et al*. (2017) Childhood Obesity and Physical Activity-Friendly School Environments. *J Pediatr* 2017; 191:110–6.
30. HO FKW, LOUIE LHT, WONG WHS, CHAN KL, TIWARI A, CHOW CB *et al*.(2017) A sports-based youth development program, teen mental health, and physical fitness: an RCT pediatrics. Pediatrics 2017; 140:e20171543.
31. LEITER JR, CORDINGLEY DM, MACDONALD PB (2015) Aerobic development of elite youth ice hockey players. *J Strength Cond Res* 2015; 29:3223–8.
32. KRIAUCIONIENE V, BAGDONAVICIENE L, RODRIGUEZ-PEREZ C, PETKEVICIENE J. Associations between changes in health behaviours and body weight during the COVID-19 quarantine in Lithuania: the Lithuanian COVIDiet Study. *Nutrients* 2020;12:3119.
33. BHUTANI S, DELLEN MRV, COOPER JA (2021) Longitudinal weight gain and related risk behaviors during the COVID-19 pandemic in adults in the US. *Nutrients* 2021; 13:671.
34. ANDROUTSOS O, PERPERIDI M, GEORGIOU C, CHOULIARAS G (2021) Lifestyle changes and determinants of children's and adolescents' body weight increase during the first COVID-19 lockdown in Greece: the COV-EAT study. *Nutrients* 2021; 13:930.
35. PIETROBELLI A, PECORARO L, FERRUZZI A, HEO M, FAITH M, ZOLLER T *et al*. (2020) Effects of COVID–19 lockdown on lifestyle behaviors in children with obesity living in Verona, Italy: a longitudinal study. Obesity. 2020; 28:1382–5.
36. PIETROBELLI A, PECORARO L, FER-

RUZZI A, HEO M, FAITH M, ZOLLER T *et al*. (2020) Effects of COVID–19 lockdown on lifestyle behaviors in children with obesity living in Verona, Italy: a longitudinal study. Obesity. 2020; 28:1382–5.
37. CHOCAIR PR *et al*. (2020) Covid-19 and Metabolic Syndrome. Rev Assoc Med Bras 2020; 66(7):871-87.
38. OZKAN O, KARACOBAN L, DONMEZ G, DEMIREL AH (2020) The importance of preventing the metabolic syndrome pandemic after The COVID-19 outbreak. Turk J Sports Med. 2020; 55(3):256-8.

Table 1 Basic characteristics of the entire sample in both years of the study (in girls; boys)

Characteristic	Year 2019		Year 2020		P-value (Wilcoxon test)
	Mean ± SD	Median	Mean ± SD	Median	
Height (cm)	172.1 ± 8.9 (166.9 ± 5.8; 174.6 ± 9.1)	172.0 (167.0; 177.0)	175.6 ± 8.3 (168.6 ± 6.2; 178.2 ± 7.3)	175.0 (169.0; 179.0)	<0.001 (<0.001; <0.001)
Weight (kg)	62.5 ± 11.7 (59.9 ± 10.1; 63.8 ± 12.2)	61.2 (58.0; 63.1)	67.3 ± 11.2 (62.5 ± 9.0; 69.6 ± 11.4)	66.0 (62.3; 68.5)	<0.001 (<0.001; <0.001)
BMI (kg/m2)	21.0 ± 2.8 (21.5 ± 3.2; 20.7 ± 2.6)	20.7 (21.2; 20.4)	21.9 ± 2.7 (22.0 ± 2.9; 21.8 ± 2.9)	21.7 (21.8; 21.7)	<0.001 (0.001; <0.001)
Power output (W)	272.2 ± 65.4 (228.2 ± 50,2.0; 293.8 ± 61.2)	270.0 (220.0; 180.0)	286.3 ± 71.0 (236.3 ± 61.5; 310.8 ± 62.2)	290.0 (230.0; 310.0)	<0.001 (0.029; <0.001)
Power output per kg (W/kg)	4.40 ± 0.83 3.88 ± 0.85; 4.66 ± 0.69)	4.39 (4.04; 4.46)	4,27 ± 0.88 (3.8 ± 0.97; 4.5 ± 0.75)	4.18 (3.83; 4.46)	<0.001 (0.112; <0.001)
MET	17.4 ± 2.8 (15.3 ± 3.2; 18.5 ± 2.4)	17.4 (15.5; 18.5)	16.9 ± 3.2 (14.9 ± 3.0; 17.8 ± 2.8)	16.8 (14.4; 18.4)	<0.001 (0.076; <0.001)

SD, standard deviation; BMI, body mass index; MET, metabolic equivalent

Table 2 Changes in mean values of studied variables between 2019 and 2020

Variables	all	boys	girls
N	125	84	41
Height (cm)	3,0 ± 3.5	3.6 ± 3.8	1.7 ± 2.1
Weight (kg)	4,8 ± 4.4	5.9 ± 4.5	2.6 ± 3.2
BMI (kg/m2)	0.9 ± 1.1	1.08 ±1.05	0.52 ± 1.05
Power output (W)	14.1 ± 28.1	17.0 ± 28.5	8.2 ± 26.6
Power output per kg (W/kg)	-0.13 ± 0.45	-0.16 ± 0.45	-0.07 ± 0.46*
MET	-0.6 ± 1.9	-0.7 ± 1.9	-0.4 ± 1.9*

BMI, body mass index

* statistically insignificant difference