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IMPACT OF COVID-19 CONFINEMENT ON ANTHROPOMETRIC AND FITNESS FEATURES OF UNIVERSITY STUDENTS

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Abstract. The Coronavirus pandemic impacted severely daily people's life causing changes in lifestyle, behaviour, and social interactions. The question the research aims to answer is: How have the restrictions due to COVID-19 pandemic affected the rate of overweight and fitness levels among university students. The anthropometric parameter we measured is the body mass index (BMI) and the physical test we apply to evaluate the explosive power was the standing long jump. Data were recorded in 2019 and 2022 on similar samples, totalling 474 units. The results confirm a significant statistical difference between the samples tested before and after the confinement. The difference consists of an increase in weight and a decrease in fitness level, which are established health risks. The magnitude of the changes in the physical ability and body weight of young men and women provides relevant information on the characteristics of the present university students and the future workforce.

Keywords: physical education; confinement consequences; body mass index; physical abilities

Introduction

The Coronavirus pandemic impacted severely daily people's life and caused a significant disruption in the educational system (Zhao, Kim 2023) in many countries. At least 1.5 billion students worldwide were not present in schools and universities during the height of the pandemic, causing changes in teaching, learning, and social interactions (Blake, Wadhwa 2020)[1]. One of the adverse impacts of the closure of educational institutions is the reduction in physical activity and limited access to sports and recreational facilities. The combination of this obesogenic environment with the Covid-19 pandemic placed students at risk of weight gain (Ruopeng 2020) and physical abilities decrease.

The COVID-19 lockdown had important repercussions not only related to physical features but also to mental health and relational communication. Affection

deprivation has been found that brings stress, loneliness, anxiety, and depression (Hesse, Mikkelson, & Tian 2021, p. 2965) which negatively impacted academic performance. Previous research has confirmed a correlation between loneliness and reduced physical activity (Netz et al. 2013). Furthermore, during quarantine, adults reduce their physical activity level and increased their sedentary time, causing controversial psychological outcomes.

Physical activity and physical education are different notions, but they both refer to body movement. Physical activity includes all forms of motion: walking and cycling as transportation forms, gardening and other utilitarian household activities, recreational activities such as playing, dancing, hiking, active breaks during school hours, and engaging in organized or spontaneous sports activities. Physical activity means any bodily movement that uses energy.

PE is a discipline that can be found in the education curriculum, being a planned activity of systematic and conscious practice of physical exercises, which aims to achieve staggered objectives over years and study cycles. The PE's most important goals are harmonious physical development, acquiring motor capabilities (Nae 2016), knowledge and behaviours favourable to a healthy and active lifestyle, social skills and sportsmanship. PE for students is a form of physical activity that creates the context for exercise, aiming to ensure human mental and physical development.

Physical activity has multiple positive health outcomes not only related to a harmonious body, movement skills competency, and knowledge to ensure a healthy and active lifestyle (Filip, Ciomag 2016, p. 50) but also to cognitive abilities, and psychological well-being (Pop, Ciomag 2021). Physically active persons, with a good level of cardiovascular fitness, can improve their attention and learning performance, avoiding anxiety and depression (Ratey, Hagerman 2008).

Methods

The anthropometric parameter we focus on is the body mass index (BMI) and the physical test we apply to evaluate the explosive power was the standing long jump. It is a simple test, already known from the gymnasium, which is testing the muscular strength and power of the lower limbs, but needs also good coordination of the body movement. Our research implies two cross-sectional data collections three years apart. One of these samples was tested in 2022 when the university courses were resumed after the restrictions have been lifted. These results were compared with data series collected in 2019 as a baseline. The differences resulted were considered an indication of how anthropometric and fitness features have afflicted the Romanian student population because of the long period of sanitary restriction. Furthermore, we calculated the t-test intending to reach a response to the study questions: How have anthropometric and fitness data of the student population changed in two years of sanitary restrictions?

We measured and tested a total of 494 students with an average age of 19.3±0.7 (range 18 – 21), divided into two samples of 122 young men and 125 women in 2019 and 126 females and 121 males in 2023. The sampling was randomly undertaken in the second university semester and the inclusion criteria were to be a student in the first year, in good health, and attending physical education classes regularly. Students' participation was voluntary and anonymous and the study took place in the sports facilities of Bucharest University of Economic Studies.

Body mass index (BMI) was calculated based on anthropometrical measurements – height and weight. The outcomes gave us a picture of the ratio of underweight, healthy weight, overweight and obese individuals in our sample.

As a fitness test, we applied the standing long jump because is a simple physical test to which students are already accustomed from elementary school. Its purpose is to measure the explosive power of the lower limbs, combining two physical abilities: strength and speed resulting in the capability to produce both in a brief time over a relatively short distance. It is routinely used by specialists for talent selection and prediction of potential in several sports (Burr et al. 2008).

Data obtained through measurement and tests has been statistically processed aiming the hypothesis validation through the mean difference between before and after confinement tests using the t-Test calculated for a statistical significance of $p<0.05$ level. The effect size was calculated and compared with the Cohen scale.

Results

The BMI mean values demonstrate an increase between the 2019 and 2022 samples. Weight is the element in this equation that caused the increase in final values because the students' height had just a slight variation over these years (table 1).

Table 1. Body mass index evolution

BMI	2019	2022	Δ	%
Female	20.36	21.05 ±3.4	+0.69 kg/m^2	+3.39%
Male	21.85	22.88 ±3.9	+1.03kg/m^2	+4.71%

Thus, BMI increased by more than 1kg/m^2 in the men sample, representing an important percentage of 4.71 points. For women, higher BMI values were calculated as well, but not as higher as their male colleagues. The weight percentage gain was lower too, at a level of 3.4 points, representing 0.7 kg/m^2 of BMI absolute figures.

Computing the t-Test for two paired samples of means the result was statistically significant (t Statistic > t calculated: 6.63>6.31, P(T<=t) p= 0.047) and the difference between the two means: $\Delta \neq 0$, reject the null hypothesis.

The group was divided according to BMI range in four groups:

– Underweight – below 18.5 kg/m^2;

– Normal weight – between 18.5 and 24.9 kg/m^2;

– Overweight – 25 – 29.9 kg/m^2;

– Obese – more than 30 kg/m^2.

Observing the results in our sample a different distribution between men and women could be noticed. Most of the women, 87% fall into the underweight and normal weight categories, while men have a half percentage of underweight cases as women and almost equal values in the normal weight category. Men in change, compensate with a higher percentage of persons caring excessive weight -24.5% (Table 2).

Table 2. BMI range percentage in 2022

Category	Under -weight	Normal weight	Overweight	Obese
Female	22%	65%	11.5%	1.5%
Male	11%	64.5%	19%	5.5%
Population	16.5%	64.75%	15.25%	3.5%

Standing long-jump is a simple physical test that measures explosive power. The procedure is to measure the best jump from two or three attempts with a metric band from the takeoff line to the last body part that touches the ground. A decreasing line best illustrates the fitness level trend. In the female student's case, the mean decrease was 20 centimeters from 1,70 m in 2019 to 1,50 min 2022, meaning an 11% drop from initial performance. Men's standing long jump results also decreased, but not so dramatically as women's performance. The mean value (2,13 m±23,4 cm) is 15 centimeters lower than in 2019, meaning a drop of 6,6%.

Table 3. Standing long jump results

SLJ	**2019**	**2022**	Δ	**%**
Female	1.70 m	1.50m	-20 cm	-11%
Male	2.28 m	2.13m	-15 cm	-6.6%

There is a statistically significant difference between standing long jump results in the two samples of college students. The t-test for paired two samples of means confirms that the research alternative hypothesis (H1) is in the predefined limit p< 0,05: t Stat > t Critical: 7> 6.31, P(T<=t) = 0.045.

Discussion

The t-test value is higher than the critical t's value for both tests and consequently, the hypothesis of this study is validated, rejecting at the same time the null hypothesis. Calculating the Cohen effect size for differences between groups means we obtain a value of 0,2 for women and 0,26 for men in the BMI case and a significantly greater value in SLJ: 1,7 for women and 0,7 for men.

Comparing these values with the Cohen effect size index where d=0.2 is considered to be small; 0.5 medium; 0.8 large and 1.3 very large (Sullivan, Feinn 2008) can be deduced that the effect of BMI increase is small, while in fitness level the decrease is very large for women and large for men.

Although, at 20 years of age a quarter of young men in our research sample are overweight and obese. Having in mind that less than 1 per cent (1 of 210 men and 1 of 124 women) of obese adults get back to healthy body weight (Fildes et al. 2015), there are plenty of chances for this generation to surpass the statistics. It already indicates that overweight adults in Romania are more numerous than slim ones, the proportion being roughly 55% to 45% in favour of the heavy ones (ORO, 2014)[2].

Young women seem to be more concerned about physical appearance than men (13% compared with 24,9% with excessive weight). An explanation could be the largely promoted beauty standard in social media.

There were considerable interactions between the COVID-19 pandemic and the overweight and obesity pandemic developing insidiously over the last four decades (Violant-Holz et al. 2020). Independent research recorded similar results: weight gain especially in men (Editorial 2021)[3] and lower in power test (Pastucha et al. 2023), concluding that COVID-19 confinement had a negative impact on maintaining a healthy diet and an active lifestyle (Almousa, Alagal 2022).

Because of the sanitary restrictions, many people spent most of their time in a seated position, so their gluteal muscles are stretched out for a long time. Inactivity affects most of those muscles and also those which run parallel to the spine. Remaining inactive for prolonged periods of time results in muscle atrophy, lowering physical abilities, and even causing pain. Physical insufficient activity explains the decrease in fitness levels and has an influential role in weight gain in the young population.

Only half of Romanian children in primary school (6 – 14 years) play, practice a sport, or are physically active in their leisure time. Moreover, less than 20% of teenagers and youngsters between 15 – 24 years spend time being actively involved in hobbies or independent activities which require physical effort at least once a week (WHO 2018)[4].

Conclusions

The insufficiency of physical activities of university students, due to sanitary restrictions on their mobility and human interaction, has a number of negative effects not only on their weight gain, or precarious fitness level but also on their physical and psychological health status. Public health providers overwhelmed by the pandemic

will be faced with the comorbidities associated with excessive weight and young generation physical traits associated with low resilience.

The magnitude of the changes in the physical ability and body weight of young men and women provides relevant information on the future characteristics of the workforce and their resilience. These data could serve as useful references to educators, as they can better respond to the actual students' needs, possibilities and preferences.

NOTES

1. BLAKE, P., WADHWA, D., 2020. 2020 Year in Review: The impact of COVID-19 in 12 charts https://blogs.worldbank.org/voices/2020-year-review-impact-covid-19-12-charts retrieved 20/05/2023
2. ORO – Obesity in Romania – Prevalence of obesity and risk factors for obesity in the adult population in Romania, 2014. Available at https://www.mediafax.ro/stiinta-sanatate/studiu-obezitatea-in-romania [retrieved 22.05.2023]
3. EDITORIAL, The Lancet Gastroenterology & Hepatology, 2021. Vol 6 June, pp 411, available at https://www.thelancet.com/action/showPdf?pii=S2468-1253%2821%2900143-6, [accessed 29.05.2023]
4. WHO. Romania. Physical activity factsheet WHO, European Commission, 2018. Available at https://www.euro.who.int/en/health-topics/disease-prevention/physical-activity/data-and-statistics/physical-activity-fact-sheets/physical-activity-country-factsheets/romania [retrieved 29.05.2023]

REFERENCES

ALMOUSA, L.; ALAGAL R., 2022. Effects of the COVID-19 pandemic on diet and physical activity and the possible influence factors among Saudi in Riyadh. *Frontiers in Nutrition.* Available from: doi: https://doi.org/10.3389/fnut.2022.1029744.

BURR, J.F.; JAMNIK, R.; BAKER J.; MACPHERSON, A.; GLEDHILL, N.; MCGUIRE, EJ., 2008. Relationship of physical fitness test results and hockey playing potential in elite-level ice hockey players. *J Strength Cond Res*., vol. 22, no. 5, pp. 1535 – 1543. Available from: https://doi.org/10.1519/jsc.0b013e318181ac20.

FILDES, A.; CHARLTON, J.; RUDISILL, C.; LITTLEJOHNS, P.; PREVOST, AT.; GULLIFORD, MC., 2015. Probability of an Obese Person Attaining Normal Body Weight: Cohort Study Using Electronic Health Records. *Am J Public Health*, vol. 105, no. 9. Available from: https://doi.org/10.2105%2FAJPH.2015.302773.

FILIP, C., CIOMAG, R.V., 2018. Well-being – a Balanced Life, *Marathon*, vol. 10, no. 2, pp. 47 – 50, ISSN 2668-0505.

HESSE, C. ; MIKKELSON, A. & TIAN, X., 2021. Affection deprivation during the COVID-19 pandemic: A panel study. *Journal of Social and Personal Relationships*, vol. 38, no. 10. Available from: https://doi.org/10.1177/02654075211046587.

NAE, I.C., 2016. Competitive Sport and Motivation. *Marathon*, vol. 8, no. 1, pp. 90 – 96, ISSN 2668-0505.

NETZ, Y.; GOLDSMITH, R.; SHIMONY, T.; ARNON, M. & ZEEV, A., 2013. Loneliness is associated with an increased risk of sedentary life in older Israelis. *Aging & Mental Health*, vol. 17, no. 1, pp. 40 – 47. Available from: https://doi.org/10.1080/13607863.2012.715140.

PASTUCHA, D.; ŠTĚPÁNEK, L.; BOTEK, M.; FILIPČÍKOVÁ, R.; ZAPLETALOVÁ, J.; HUDEC, Š. & HORÁKOVÁ, D., 2023. Comparison of performance and anthropometric parameters in paediatric competitive athletes during COVID-19 pandemic in the Czech Republic. *Central European Journal of Public Health*, vol. 31, no. 1, pp. 38 – 42. Available from: https://doi.org/10.21101/cejph.a7484.

POP, C.; CIOMAG, V., 2021. Impact of COVID-19 lockdown on body mass index in young adults. *Physical education of students*, vol. 25, no. 2, pp. 98 – 102. Available from: DOI: https://doi.org/10.15561/20755279.2021.0204.

RATEY, J.J.; HAGERMAN, E., 2008. *Spark: The Revolutionary New Science of Exercise and the Brain*. New York: Hachette Book Group. ISBN 978-0316113519.

RUOPENG, AN., 2020. Projecting the impact of the coronavirus disease-19 pandemic on childhood obesity in the United States: A microsimulation model. *Journal of Sport and Health Science*. Available from: DOI: 10.1016/j.jshs.2020.05.006.

SULLIVAN, GM.; FEINN, R., 2012. Using Effect Size — or Why the P Value Is Not Enough. *Journal of Graduate Medical Education*, no. 4, pp. 279 – 282. Available from: https://doi.org/10.4300%2FJGME-D-12-00156.1.

VIOLANT-HOLZ, V.; GALLEGO-JIMÉNEZ, MG.; GONZÁLEZ-GONZÁLEZ, CS.; MUÑOZ-VIOLANT, S.; RODRÍGUEZ, MJ.; SANSANO-NADAL, O.; GUERRA-BALIC, M., 2020. Psychological Health and Physical Activity Levels during the COVID-19 Pandemic: A Systematic Review, *Int. J. Environ. Res. Public Health*, no. 17. Available from: https://doi.org/10.3390/ijerph17249419.

ZHAO, C; LI, J; KIM S-Y., 2023. The Structural Relationships among Academic Pressure, Independent Learning Ability, and Academic Self-Efficacy. *Iran J Public Health*, vol. 5, no. 5, pp. 1008 – 1018. Available from: https://doi.org/10.18502/ijph.v52i5.12719.

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