

# The degree of influence on the students' physical condition during the period of pandemic restrictions

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## Abstract

**Background.** According to the data submitted by the Health Ministry, the number of chronic diseases determined by deficient nutrition and by lack of physical movement increases by day, developing extremely fast metabolic risks, risk of cardiovascular diseases, cancer or psycho-emotional disorders. Undoubtedly the effects generated by the pandemic, amplified this phenomenon that erodes health, the risk of developing chronic associated diseases increases dramatically.

**Aims.** Identifying some eventual changes in the students' physical condition who were subjected to the pandemic restrictions (the experimental group 2021), compared to the students who benefited from the face to face teaching (the control group 2020).

**Methods.** The study included a number of 351 students (boys and girls) from the University of Bucharest, from all years of study, who were signed up for chess classes, sports mountain activities and sports nautical activities from which 209 students were part of the control group (2020) and 142 experimental group (2021, pandemic). A Microsoft Excel program for determining the following statistical parameters: a) T bilateral TEST; b) Average; c) dispersion; d) number of participants; e) Null hypothesis; f) df; g) t Stat; h)  $P(T \leq t)$ ; i) t Critical; j) ANOVA Test was used.

**Results.** The results tell us that the values obtained do not show statistical significant differences, but there was a single exception in the case of determining the Resting Basal Metabolism.

**Conclusions.** We identified the existence of a high grade of honesty from the experimental group (2021, pandemic), regarding self-determining and electronic transmitting of the requested parameters, but no substantial differences were indicated for the parameters collected using the electronic method (email).

**Keywords:** pandemic effects, physical condition, self-determining of morpho-functional and motor parameters.

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## Introduction

The institutions from the health care domain have confirmed for years the fact that obesity is an important morbidity cause among adults and with growing worrying accents on teenagers and children, becoming a serious health issue of the XXI century (Engin, 2017).

In 2016, the studies have shown that over 41 million children under the age of 5 years old were obese or overweight and over 340 million children and teenagers with the age between 5 and 19 years were detected obese or overweight (Cînceanu et al., 2019).

The World Health Organisation (WHO) has admitted since the year 1997 that the obesity phenomenon has become a global epidemic (1). The only country from Europe, Portugal, has officially admitted since the year 2004 that obesity has become a chronic disease (Lancet, 2017). Only in the year 2013, The American Medical Association

in turn has called an alarm officially recognizing that obesity has become a complex chronic disease (Pollack, 2013). Another confirmation has also come in the year 2015 from The Canadian Medical Association, the result of a monitored evolution of over three decades (Kyle et al., 2016).

Pollak (2013) gave a chance to the social balance affirming that to a great extent this scourge of obesity is a disease that can be prevented. Neslihan (2014) ascertains that obesity, because of the complex interaction of the genetic predispositions and the environmental factors, is a multifactorial, heterogeneous and complex disease. Hruby & Hu (2015) in their study showed that obesity affects more than a quarter of the world population.

At the European level, more than a half of the population with the age between 35 and 65 years is obese (2). The World Health Organisation (WHO) estimates that

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until year 2040, nearly 50% of the occidental countries' population will suffer because of overweight. Not even the countries which are developing (the case of Romania), will not be safe from this phenomenon, already being registered an alarming growth of the population affected by obesity.

The prevalence of infantile obesity tends to become an alarming problem having a fulminant growth in the last three decades (Neslihan, 2014). Infantile obesity is recognized as a predictive factor of adulthood obesity, especially in the case of obese children who come from obese parents, existing more and more evidence that these children as they grow passing through the young, adult and grown man stages, because of these hereditary predispositions, will bear negative effects with social, economical and health consequences. Childhood obesity is at the moment recognized as an important social factor already becoming a public health problem confirmed by the prevalence in the increase of obesity in adults both in developed countries as well as in developing countries (3) (Weng et al., 2006).

Obesity has become a public issue because, in addition to decreasing of the quality of life (Taylor et al., 2013) and reduced life expectancy (Grover et al., 2015), there is an increased risk of chronic disease conditions (Nyberg, 2018), such as type 2 diabetes, cardiovascular diseases, high blood pressure, coronary heart disease, asthma and certain types of cancer (Poirer et al., 2006; Guh et al., 2009; Lauby-Secretan et al., 2016). In some cases, even psychological problems occur (4). For society as a whole, obesity involves costs that impose a burden on the health system and social resources.

As a result of these conditions generated by obesity, these people are the most exposed to contact the COVID-19 virus, having the highest risk of mortality due to the comorbidities generated by obesity.

In Romania, in 2012, the DALY (Disability Adjusted Life Years-DALY) burden of illness per 100,000 inhabitants for all causes was 20-40% higher than in western European countries, about 10% higher than in Poland and about 15% lower than in Bulgaria (5).

Basal metabolic index (BMI) is commonly used to define overweight and obesity in adults. People with BMI of 25-30 are labeled as overweight and those with a BMI over 30 are called obese in most Western societies, while in children, obesity occurs at a BMI  $\geq$  95<sup>th</sup> percentile (MGRS, 2006; Burdette et al., 2008).

Following some opinion pools, the interviewed subjects believe that it is increasingly difficult to maintain a "normal" weight in a largely obese social environment (6). This environment varies starting with low breastfeeding, difficulties due to the geographical area or those of a financial nature having access to the ingredients of a healthy diet, lack of cooking skills, abundance and excessive marketing of foods containing energy additives, the preference for a certain type of urban life where even the pressure of a lifestyle that often reduces opportunities for physical activity (Mustajoki, 2015; Jaworowska et al., 2013; Birch & Anzman-Frasca, 2011).

Europe spends between 1.9% and 4.7% from the year's total which represents the costs of medical assistance and 2.8% from the annual cost of hospitalization for treating

obese and overweight patients (Cuschieri & Mamo, 2016).

### **Predisposition to obesity**

*The stage of pre conception* - The studies taken in the biology sphere and human development revealed the fact that the interventions with the purpose of improving the nutritional state of women and men before the procreation act improve subsequently the results on long term for the pregnancy of the future mom, benefits reflected positively and for the resulted child (Barker et al., 2018; Fleming et al., 2018).

*Intrauterine development* - Studies have shown that the period of intrauterine life influences deeply health and long term behavior (Marquez et al., 2013; Lewis et al., 2015; Godfrey et al., 2017; Li et al., 2016). The programming of the health condition of the fetus takes place during the intrauterine development, the conditions from inside of the mom's uterus being as important as the genetical programming which focuses on the mental and physical performances and after that on the performances of the adult (Georgieff et al., 2015; Prado & Dewey, 2014).

Since food has begun to be contaminated, especially with pesticides, many of these pesticides behave like estrogen like endocrine disruptors (Darbre, 2017; Gore et al., 2018). These endocrine disruptors cause the supplementation of adipocytes, so instead of being born with a number of genetically predetermined adipocytes, the fetus will be born with a much higher number (Bateman et al., 2017; Petrakis et al., 2017; Bommarito et al., 2017; Campioli et al., 2014; Lucchese et al., 2017; Kim & Lee, 2017).

*Neonatal period* - Children with rapid growth are at high risk of obesity and developing of diabetes (Weng et al., 2006; Couperus & Nelson, 2006). The lifestyle and nutrition of the mother are essential for the child and the future adult (Couperus & Nelson, 2006).

*Childhood period* - After birth, during the first two years of a child's life, the growth of adipose tissue occurs both in the number and size of adipocytes, a process triggered by triglycerides.

*Adolescence period* - It is a particularly sensitive period, because of the unhealthy and unbalanced lifestyle behaviors (smoking, poor eating and eating disorders) often develop during the teenage years (Stephenson et al., 2018).

Recent Romanian studies have shown that physical activities are associated with young age groups, male sex, rural areas, higher education level and non smoking status (Rada, 2017; Bădău et al., 2018; Roman et al., 2017). Researchers from all over the world confirm that the management of patterns of nutrition, regular exercise, proper nutrition and education are elements that should be taught in schools and universities being important elements of education, with a determining role to overcome these risks related to lifestyle (Bădău et al., 2018; Roman et al., 2017).

Wellness principles involve implementing good lifestyle habits to improve health and the quality of life, to prolong life and achieve total well-being. Also, include factors of general physical preparation adapted to the somatic pattern, adequate nutrition, stress management, disease prevention,

spirituality, avoiding smoking or alcohol abuse, personal safety, regular physical examination and health education (Bădău et al., 2018; Chwalczynska et al., 2017; Byrne et al., 2016).

**Hypotheses**

1. This study aims to ascertain the effectiveness of some tests applied to students and the reality of the answers sent by them in an electronic format (email), taking into account the pandemic restrictions that have imposed the adoption of the online teaching regime.

2. If there has been an alteration of the parameters of the subjects subjected to research (somatic, psychological, motor and metabolic), the honesty and correctness of the data self-determined and sent by the students of the experimental group (2021, pandemic), compared to the control group (2020) whose tested parameters were collected in halls and bases, in physical format.

**Material and methods**

**Research protocol**

The study was conducted according to the ethics and procedures recommended by the World Medical Association (Helsinki) (7), after the subjects have been informed and provided written consent on the GDPR form (“General Data Protection Regulation”).

*a) Period and place of research*

The observational study was carried out over a period of two academic years 2019-2020 (May 19-29, 2020) and 2020-2021 (May 18-28, 2021). Place of research for the control group, the tests were carried out in the sports halls and sports facilities of the Department of Physical Education and Sports; b) for the group experimentally, the tests were carried out by students subjected to the restrictions, in their homes.

*b) Subjects and groups*

The subjects are students in a non-profile higher education institution, enrolled at physical education and sports courses before the pandemic (2020) and electronically registered students, participants in online courses during the pandemic (2021). We tracked the degree of reality in self-determination of the parameters established by mutual agreement with the coordinating teaching staff, the measurements being carried out by students subjected to the pandemic restrictions, following the transmission of the results in electronic format to the framework didactic coordinator. The tests included somatic, physiological, motor and metabolic parameters, set as part of the semester promotion criteria established within the Department of Physical Education and Sports (DEFS) of the University of Bucharest (UB). Graduation requirements include participation in practical lessons (accumulation of a minimum required number of the 14 weeks of school scheduled per semester), participation in a sports competition and passing some somatic, physiological and motor tests.

The study included a number of 351 students (boys and girls) from the University of Bucharest from all years of study, enrolled in chess courses, mountain sports and water sports activities, between of which 209 constituted the control group (2020) and 142 the experimental group

(2021 pandemic). All the participants have completed the GDPR form, agreeing to have their data analyzed and to participate in the study, in accordance with the provisions of Regulation (EU) 679/2016 of the European Parliament and of the Council of April 27 2016 on natural persons with regard to the processing of personal data and regarding the free circulation of this data, and repealing Directive no. 95/46/CE (General Regulation on data protection, “hereinafter “RGPD”) and the relevant national legislation on protection of personal data.

*c) Applied tests*

The tests and measurements applied to the students aimed to determine: Body Mass Index (BMI), Real weight (kg), Ruffier test (Fitness test) from the category of non-comparable samples, based on heart rate response to an incomparable effort, consisting of 30 squats performed in 45 seconds, at a rhythm of 90 of the metronome, which monitors the heart rate at rest and after effort, for 1 minute , the stepped Schöber mobility test “finger-to-ground distance”, which evaluates both the degree of mobility of the spine through the flexion movement of the trunk, as well as the mobility of the coxoformal joints and hamstring and gastrocnemius muscle suppleness, Ideal weight (kg), Basal Metabolism (Kcal/day).

*d) Statistical processing*

A Microsoft Excel program was used to determine the following statistical parameters: a) T-bilateral TEST; b) Average; c) Dispersion; d) Number of Persons; e) Null hypothesis; f) df; g) State; h) P(T<=t); i) t Critical; j) ANOVA Test. The confidence interval was used to determine if the p-value of 0,05 was statistically relevant.

**Results**

As a result of applying the calculation tools, the obtained results were entered and processes with the help of the Excel program, in order to obtain descriptive statistical data. Thus, the results obtained are presented in Tables I, II, III, IV, V.

**Table I**  
The real weight of the subjects.

Indicators	2020	2021
Mean	66.72248804	65.39507042
Variance	271.515213	179.1201883
Observations	209	142
Hypothesized Mean Difference	0	
df	338	
t Stat	0.829550851	
P(T<=t) one-tail	0.203689125	
t Critical one-tail	1.649374276	
P(T<=t) two-tail	0.407378251	>0.05
t Critical two-tail	1.967007311	

t-Test: Two-Sample Assuming, Unequal Variances

The scores obtained for the Real Weight indicator indicate that there are no significant differences, which proves that the experimental group respected and actually applied the measurements in the regime of self-determination.

**Table II**  
Body mass Index.

Indicators	2020	2021
Mean	22.40200957	21.83978873
Variance	17.49877287	9.90120492
Observations	209	142
Hypothesized Mean Difference	0	
df	345	
t Stat	1.435222626	
P(T<=t) one-tail	0.076064805	
t Critical one-tail	1.649282305	
P(T<=t) two-tail	0.15212961	>0.05
t Critical two-tail	1.966863909	

t-Test: Two-Sample Assuming, Unequal Variances

The scores obtained for the body mass index, show us that there is no significant difference, which proves that mostly of the subjects from the experimental group respected and applied correct measurements in self-determination mode. There were also a few cases where the subjects of the experimental group miscalculated the squaring, later being alerted in order to redo the calculation.

**Table III**  
Ruffier Test.

Indicators	2020	2021
Mean	8.998229665	8.947183099
Variance	15.11556849	14.55995655
Observations	209	142
Pooled Variance	14.89109489	
Hypothesized Mean Difference	0	
df	349	
t Stat	0.121637358	
P(T<=t) one-tail	0.451628116	
t Critical one-tail	1.649231411	
P(T<=t) two-tail	0.903256231	>0.05
t Critical two-tail	1.966784557	

t-Test: Two-Sample Assuming, Equal Variances

The scores obtained in the Ruffier Test (Fitness test) indicate that there are no significant differences, which proves that the experimental group respected and correctly applied the measurements in the regime of self-determination. In the case of this test, several situations were identified in which a limited number of subjects of

the experimental group wrongly sampled the three pulses (P1, P2, P3) and hence were generated erroneous results. As such they were contacted electronically (email) and received more information to redo the calculation.

**Table IV**  
Mobility of the spine and coxo-femoral joint.

Indicators	2020	2021
Mean	1.516746411	1.612676056
Variance	0.760535517	0.962391369
Observations	209	142
Pooled Variance	0.842087595	
Hypothesized Mean Difference	0	
df	349	
t Stat	-0.961253555	
P(T<=t) one-tail	0.168545099	
t Critical one-tail	1.649231411	
P(T<=t) two-tail	0.337090199	>0.05
t Critical two-tail	1.966784557	

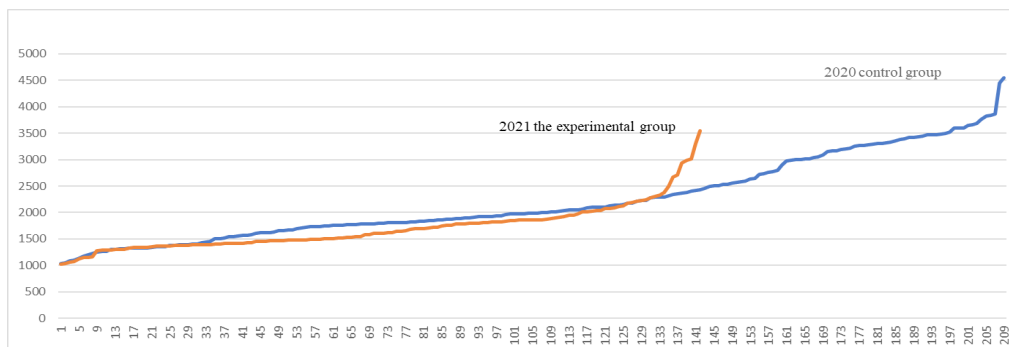
t-Test: Two-Sample Assuming Equal Variances

The results obtained when determining the Mobility of the spine and coxo-femoral joints, indicate that there are no significant differences, which proves that mostly of the subjects of the experimental group respected and correctly applied the measurements in the self-determination regime. There have been a few cases in which the subjects wanted to redo the test observing that after applying the recommendations received from the teaching staff in regarding of some methods to improve their suppleness, the results were better.

**Table V**  
Basal Metabolism.

Indicators	2020	2021
Mean	2223.566268	1704.579437
Variance	587841.5453	187453.409
Observations	209	142
Hypothesized Mean Difference	0	
df	339	
t Stat	8.073050015	
P(T<=t) one-tail	6.03713E-15	
t Critical one-tail	1.649360905	
P(T<=t) two-tail	1.20743E-14	<0.05
t Critical two-tail	1.966986461	

t-Test: Two-Sample Assuming, Unequal Variances



**Fig. 1 – Basal Metabolism.**

The differences are significant. The alternative hypothesis is accepted.

Rest reveals us the fact that we consider that the explanation is that the experimental group that used a calculator of daily caloric consumption (kilocalories) provided by the SUPERFIT Medical Center (8). Our assumption is that certain students in the experimental group have wrongly entered their required data (age, weight, height) other than reality.

## **Discussions**

At the end of the study, the established objectives were achieved 100%. Monitored parameters have certificated the positive evolution of the teaching staff's intervention even in difficult conditions created by the pandemic restrictions, a phenomenon that required the adoption of innovative solutions in order not to interrupt the connection with the students.

The obtained scores demonstrated that the intervention even through innovative (electronic) methods other than direct "face to face" monitoring had a positive effect on all students of the experimental group. Starting from an almost total lack of traditional communication carried out in the halls and sports bases, the lack of social contacts, the presence of only electronic communication levers between the teaching staff frame and students, punctual online contacts for meeting the timetables part of the didactic regulations it was finally obtained good in the act of teaching and testing in order to mark the semester. The objectives to be achieved started to clear up, making correct decisions, the subjects of the experimental group becoming more open, managing to improve their interpersonal relationships, feelings, emotions and fears towards test results.

Also, initiating electronic and online group conversations helped regarding the development of the spirit of helping, culminating in the acquisition of the feeling of joy and openness in communication. Therefore, we noticed a favorable evolution, which involved the transition from a system of traditional teaching to one adapted "on the fly", taking into account the novelty of the situation generated by the pandemic restrictions, lack of electronic infrastructure and specific teaching platforms.

The statistical results obtained for the "Resting Basal Metabolism" parameter (Table V; Fig. 1), show a  $p < 0.05$ , and was the only significant value. This result proved that the intervention of the EXCEL calculation program, is statistically efficient. The formulated hypotheses are accepted namely that a balanced intervention by the teaching staff revealed a positive impact on the styles of communication, implicitly the correct transmission of the parameters required to be self-determined by the students from the experimental group.

We appreciate that the coaching interventions empowered the subjects to assume certain behaviors to achieve objectives, and the online training sessions provided them with the necessary information base to understand their actions.

The subjects were monitored weekly by email and online during the 14 weeks of didactic activity, receiving the specific courses to the sports disciplines they opted

for when enrolling electronically at the beginning of the academic year. Also, additional recommendations throughout semester in order to: adopt a healthy lifestyle, which led to a positive impact on the physical, mental states, emotional and social. This type of teaching and teacher-student interaction through non-invasive interventions were appreciated by the students of the experimental group, a sign that the setting for the manifestation has worked, where the student had the freedom to choose the moment and the solutions to solve the tests under guidance and empowerment of the teaching staff.

The fact that the importance of self-real determination of their own parameters in order to be able to ascertain the stage at which they are in relation to the benchmarks sent by the teaching coordinator via e-mail addresses (tables, graphs, links of some platforms for comparative verification of morpho-functional and motor indicators) can be an explanation of the cause of the insignificant results identified in the tests: Normal weight, BMI, Ruffier test and Mobility of the spine and coxo-femoral joints (also highlighted in Tables I-IV).

## **Conclusions**

1. According to the study samples analyzed, and specifically the subjects of the experimental group where it was necessary to apply a process of self-determination of the parameters of the subjects of the study, we have found that this social category, namely the young students, the future intellectuals in full process of defining a personality realized and proved the importance of participation and the correctness of the approach of this study.

2. With a single exception in the case of determination of Basal Resting Metabolism, where certain subjectivities could have intervened, the effectiveness of the tests applied to students and the reality are established answers sent by them in electronic format (email).

3. There was no alteration of the results of the parameters subjected to the research (somatic, physiological, motor and metabolic) and the sincerity and correctness of the data submitted by the students of the experimental group are confirmed (2021, pandemic).

## **Conflict of interests**

No conflict of interest and no funding to declare.

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