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Study Regarding the Fitness of the Students Enrolled in the Physical and Sportive Education and Physical Therapy and Special Motor Skills Academic Programs, in the Context of Future Professions

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Abstract: ***Background.*** *The development of motor capacity implies a higher level of awareness in the youths, which leads to a fitness that is adapted to the future work place. From the viewpoint of the future professions, both the physical education teachers and the future physical therapists need a high level of motor skills and an increased physical endurance to fatigue. A prime objective of this research was to see how much the vertical spring and and repetition speed can develop in the lower limbs over the course of a semester, and at the same time, how much this is or is not influenced by the subjects' height.* ***Results.*** *The study contained 36 students that were not professional practitioners of a sport (18 from Physical and Sportive Education and 18 from Physical Therapy and Special Motor Skills). The tests were performed using the MGM-15 Miron Georgescu jumping platform. Two tests were conducted 14 weeks apart, recording the subjects' vertical take-off capacity using both legs, and separately using the right and the left leg, as well as their repetition speed for both legs and separately for the right and the left leg.* ***Conclusions.*** *The recorded and statistically analyzed results have shown that there is a linear correlation between these motor actions, with a Pearson coefficient between 1 and -1. The calculated regression model, with an adjusted r square of .401 indicated that the independent variables (the subjects' height and repetition speed) had an influence of 40.1% on the vertical spring using both legs.*

Keywords: *spring, height, repetition speed, students.*

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Background

Studies show that good fitness is given using judicious schemes of physical effort and weight control, which later contributes to a longer lifespan. Thomson (2012) explains this by giving two reasons: first, because good fitness and weight control significantly reduce the incidence of cardiovascular pathology, explained by maintaining blood pressure at moderately low values, and by reducing cholesterol and low-density lipoproteins in the blood and increasing high density lipoproteins, and secondly, a person with good fitness has multiple reserves that they can use in case of an illness (Thompson, 2012; Guyton & Hall, 2019, p.1094-1096). A physical education teacher of a physical therapist has the responsibility to promote and achieve fitness in their pupils or patients. However, in order to get good results, they themselves must have or improve this aspect (Câmpeanu,2003, p.9; Dragomir, 2004, p.23).

The age of students (19 - 25) is the period where the growth and development processes end (Munteanu, 1997, p.123-124), the body reaching maturity from a somatic and functional point of view (Munteanu, 1998, p.115). The respiratory and cardiovascular systems work together, making possible the adaptation of the body to physical effort (Cheuvront et al., 2010) while the metabolism is much more balanced. The body can thus offer the biological support for efforts involving all the basic motor skills - speed, strength, dexterity, and endurance (Ohta et. al., 2005). The bone system is also getting close to permanent adult dimensions. According to the "Physical Education and sports research center" regarding the biomotor potential of the young people at this age, the males reach an average height of 175.3 cm and an average weight of 71.630 kg. The subjects of this study presented characteristics of adolescence combined with young adult features, in the context where they get ready for financial autonomy (Compagnat et. al., 2019)

One of the objectives of this research was to see how much the vertical spring and repetition speed can develop in the lower limbs over the course of a semester, and at the same time, how much this is or is not influenced by the subjects' height.

Methods

Subjects

From the viewpoint of the future professions, both the physical education teachers and the future physical therapists need a high level of motor skills and an increased physical endurance to fatigue. Thus, an

important role for the professional success is played by the fitness, which must be very good. That is why the development of motor capacity implies a higher level of awareness in the youths, which leads to a fitness that is adapted to the future work place.

This study comprised 36 male subjects, first year students (two groups of 18 students each) from different academic programs, Physical and Sportive Education and **Physical Therapy and Special Motor Skills, aged between 18 and 21.**

The students were not professional practitioners of any sport, and did not engage in any other physical activities during their leisure time.

The research methods used were: the documentation method, the observation method, the pedagogical experiment, the testing, the statistical-mathematical method of analyzing and interpreting the data.

Organization of the research

This research was supposed to be conducted during the academic year 2019-2020, but because of the pandemic restrictions, the testing could not go on anymore. Thus, only two testing sessions were performed over the course of the first semester of the aforementioned academic year, in the first week of October 2019, and in January 2020, in week 14 of the first semester, before the exam sessions. These two academic programs were chosen because the course General Bases of Track and field is common for both of them, with 2 classes per week, for 14 weeks, which made the students' physical training benefit from the same means and conditions throughout the whole semester. Over the course of the track and field classes, the subjects performed walking and running drills for 6 hours, spring step drills for 4 hours, spring step in moderate tempo for 4 hours, jumping drills for 8 hours, and throwing drills (pushing, throwing, launching) for 6 hours. There was an emphasis on the correct learning of the performing technique for the basic track and field drills and on the methodical succession of their learning so that the students' physical effort would be medium, a level assessed on the basis of measuring the heart rate and the distance covered over the course of the lessons, using Wotchi smart watches (picture 2).

It has to be said that all subjects were 100% present during all of these classes, and they gave their consent voluntarily to participate in this study, signing an informed consent. Also, this scientific endeavor has the consent of the ethical commission of the institution in regard to the organization and development of the research.

Research Aim and Objectives

The purpose of the research was to verify the hypothesis stating that track and field is one of the practical courses that greatly contributes to the development of the students' fitness.

In this sense, a prime objective of this research was to see how much the vertical spring and repetition speed can develop in the lower limbs over the course of a semester, and at the same time, how much this is or is not influenced by the subjects' height.

In this sense, measurements were taken in regard to the subjects' height and weight and their vertical take-off ability using their right/left leg. At the same time, the repetition speed of jumping using both legs and separately using the right and left leg was also measured.

The second goal envisaged getting an objective image in regard to the effectiveness of the track and field classes for the development of fitness in the subjects from the 2 academic programs throughout a semester under similar conditions of physical training (location, means and methods, duration of work, its volume and intensity).

Instruments

The tests were performed using the MGM-15 Miron Georgescu jumping platform.

The Miron Georgescu Jumping Mat is designed for human performance studies that can evaluate, in series of repeated jumps, the floor contact time, and the time in which the subject is off the floor. The device and software implement by default the "modified Miron Georgescu" method, with 15 jumps/series, elaborated by prof. Pierre Joseph de Hillerin (figure 1).

Considering the data that this platform can offer, six parameters were recorded, as follows:

- the indices for the take-off height using both legs (Ha [m]), using only the right leg (Hd [m]) and using only the left leg (Hs [m]), during the initial and final tests.
- the indices for the repetition speed for the jumps using both legs (V.R.a[sec]), using only the right leg (V.R.d[sec]) and using only the left leg (V.R.s[sec]), during the initial and final tests.

The average number of take-offs gave data regarding the subjects' strength, while the average repetition speed gave data regarding the subjects' speed. The interpretation of the results can help one observe whether over the course of the studies, the physical activity should be focused also on the

development of strength, or just on speed and the imbalance between the two.

The mat has a surface of 1 x 1.2 m, and is coupled through a serial interface (RS-232) to a laptop/computer. Its purpose is to record the time during which the subject is not in contact with the floor (Ta) and the time during which the subject is in contact with the floor (Ts), with a precision of 0.001 seconds. The challenge consists in performing 15 take-offs using both legs, 15 using only the left leg, and 15 using only the right leg.



Figure 1 MGM-15 Miron Georgescu Jumping Mat

The distances covered and the heart rate during the classes were recorded using Wotchi smart watches**.** This watch helped monitor the subjects' physical activity from the point of view of volume and intensity.



Figure 2 Wotchi smart watch

The subjects' height and weight were measured under identical basic conditions, at 8 AM, before breakfast, one time before the initial testing and a second time before the second testing.

Statistical analysis

All data were centralized and interpreted using the statistical analysis software SPSS-20. The authors validated and discussed the correlations in which the Pearson coefficient values were recorded between 1 and -1, indicating which of the analyzed elements were directly proportional and which were inversely proportional.

Results

The results of the tests performed on the MGM-15 Miron Georgescu jumping mat by the subjects are presented in table 1 (for the PSE students) and in table 2 (for the PTSPS students).

Table 1 presents the statistical results recorded by the Physical and Sportive Education students during the two tests in regards to height, weight, take-off height using both legs (Ha [m]), using only the right leg (Hd [m]), using only the left leg (Hs [m]), repetition speed using both legs (V.R.a [sec]), using only the right leg (V.R.d [sec]) and using only the left leg (V.R.s [sec]).

Table 1 Statistical markers recorded during the tests performed by the PSE students on the MGM-15 Miron Georgescu jumping mat

Statistical markers Test 1	Height [m]	Weight [kg]	Ha [m]	Hd [m]	Hs [m]	V.R.a [sec]	V.R.d [sec]	V.R.s [sec]
average	1.79	74.61	0.347	0.197	0.205	0.201	0.282	0.280
Standard deviation	0.065	6.766	0.025	0.030	0.020	0.038	0.035	0.039
Maximum value	1.92	86	0.41	0.27	0.26	0.27	0.36	0.36
Minimum value	1.67	62	0.31	0.14	0.18	0.13	0.21	0.21
Test 2								
average	1.79	74.61	0.341	0.213	0.225	0.195	0.277	0.274
Standard deviation	0.058	6.766	0.044	0.0248	0.031	0.0267	0.030	0.029
Maximum value	1.88	86	0.44	0.29	0.30	0.23	0.33	0.34
Minimum value	1.67	62	0.25	0.16	0.14	0.14	0.22	0.22

Table 2 presents the statistical results recorded by the Physical Therapy and Special Motor Skills students during the two tests, for the same markers.

Table 2 Statistical markers recorded during the tests performed by the PTSPS students on the MGM-15 Miron Georgescu jumping mat

Statistical markers Test 1	Height [m]	Weight [kg]	Ha [m]	Hd [m]	Hs [m]	V.R.a [sec]	V.R.d [sec]	V.R.s [sec]
average	1.77	71,285	0,261	0,144	0,151	0,194	0,284	0,277
Standard deviation	0,063	11,313	0,070	0,063	0,030	0,026	0,036	0,040
Maximum value	1.94	96	0.29	0.19	0.2	0.24	0.38	0.38
Minimum value	1.63	50	0.19	0.07	0.1	0.15	0.23	0.20
Test 2								
average	1.77	71.388	0.271	0.154	0.156	0.195	0.285	0.272
Standard deviation	0.518	15.522	0.045	0.049	0.042	0.037	0.049	0.045
Maximum value	1.94	96	0.34	0.23	0.23	0.28	0.40	0.35
Minimum value	1.62	50	0.19	0.07	0.06	0.14	0.19	0.18

In order to verify the relations between the vertical take-off using both legs and separately using the right/left leg and the repetition speed using both legs and separately using the right/left leg, the authors used regression models. Out of all the obtained regression models, the authors selected two - the linear regression model for the vertical take-off using both legs as a dependent variable and the repetition speed as an independent variable (Table 3), and the linear regression model for the vertical take-off using both legs as a dependent variable and the repetition speed for both legs and the height as independent variables (Table 4), models made after the initial testing.

Table 3 SPSS regression model for the vertical take-off and repetition speed

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.095[a]	.009	-.053	.03287	.009	.146	1	16	.707

a. Predictors: (Constant), Initial jump repetition on both legs

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	**Regression**	**.000**	1	.000	.146	.707[b]
	Residual	.017	16	.001		
	Total	.017	17			

a. Dependent Variable: Initial both leg spring

b. Predictors: (Constant), Initial jump repetition on both legs

In this case, for a linear regression with a value of 0, no statistical link can be made between the two analyzed markers.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.167	.060		2.797	.013
	Initial jump repetition on both legs	-.116	.305	-.095	-.382	.707

a. Dependent Variable: Initial both legs spring

The data analysis shows that the vertical take-off does not influence the repetition speed.

The linear regression model for the vertical take-off using both legs as dependent variable and the repetition speed for both legs and height as independent variables is presented in table 4.

Table 4 SPSS regression model for the vertical take-off, repetition speed and height

Model Summary

Model	R	R Square	**Adjusted R Square**	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.687[a]	.472	**.401**	.02478	.472	6.701	2	15	.008

a. Predictors: (Constant), Initial height, Initial jump repetition on both feet

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	**Regression**	**.008**	2	.004	6,701	.008[b]
	Residual	.009	15	.001		
	Total	.017	17			

a. Dependent Variable: Initial both legs spring

b. Predictors: (Constant), Initial height, Initial jump repetition on both legs

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.191	.109		-1,760	.099
	Initial jump repetition on both legs	-.655	.274	-.535	-2.395	.030
	Initial height	.261	.072	.810	3,626	.002

a. Dependent Variable: Initial both legs spring

Adjusted r square .401 indicates that the independent variables (the subjects' height and repetition speed) have an influence of 40.1% on the spring using both legs, in regard to the initial results. The linear regression, in this case, has a statistically significant value of 0.08.

The Pearson correlations indicate a weak correlation of -.011 between the right leg take-off and the right leg repetition speed. A similar coefficient, of .109 was found also between the left leg take-off and the left leg repetition speed, leading to the conclusion that the vertical take-off height is not directly proportional to the repetition speed.

The records of the physical activity during the 28 track and field hours show that during the 6 hours of walking and running, each subject covered 11,340 meters, with an average heart rate (HR) of 145 beats/minute. During the spring step drills classes (4 hours), the distance covered was of 6800 m, with an average HR of 158 b/min. During the 4 hours of spring step in moderate tempo drills, the distance covered by the subjects was of 10,670 m, with an average HR of 142 b/min. The highest work intensity was recorded during the 8 hours of jumping drills, with a distance covered of 7390 m, 1270 take-offs, and an average HR of 170 b/min. During the 6 hours of throwing drills, the distance covered was of 5760 m, with 640 throws, and an average HR of 135 b/min.

Discussions

The physical education teacher and physical therapist professions imply in equal measure special practical skills and very good communication skills, but what is also very important is understanding the basic mechanisms of movement, so that the transmission or application of the means at their

disposal during the teaching/rehabilitation process would have the maximum desired effect. All the aforementioned skills also imply the future practitioners having very good fitness, which should be taken into consideration by the teachers who train them. From this point of view, the authors believe that track and field is one of the practical classes that should largely contribute to this goal.

Table 1 shows that the PSE subjects' height and weight did not suffer modifications, their average being the same both at the beginning of the study and at its end.

The average take-off using both legs results (Ha [m]) shows an average progress of 0.006 m. Individually, the maximum value was of 0.41 m during the initial testing and of 0.44 m during the final testing.

In regards to the take-off using the right leg (Hd [m]), it recorded a progress of 0.016 m, with a maximum individual value of 0.27 m initially and of 0.29 m finally. The average value of the take-off using the left leg (Hd [m]) recorded a progress of 0.020 m, with a maximum individual value of 0.026 m initially and of 0.030 m finally.

In regards to the average repetition speed for both legs (V.r.a. [sec]), it recorded a progress of 0.006 seconds. The initial maximum individual value was of 0.27 sec, and the final one, of 0.23 sec. The average repetition speed for the right leg (V.r.d. [sec]) recorded a progress of 0.005 seconds. The initial maximum individual value was of 0.36 sec, and the final one, of 0.33 sec.

The last analyzed marker was the take-off speed using the left leg. In this case, the initial average V.r.s. [sec] was of 0.280 sec and the final one of 0.274, resulting a progress of also 0.006 seconds.

Table 2 shows that the PTSMS subjects' height did not suffer modifications, their average being the same both at the beginning of the study and at its end - of 1.77 m. In regards to their weight, it had an insignificant increase of 0.103 kg in the final testing.

The average take-off using both legs results (Ha [m]) shows an average progress of 0.010 m, 0.004 m higher than the PSE students. Individually, the maximum value was of 0.29 m during the initial testing and of 0.34 m during the final testing. In regards to the take-off using the right leg (Hd [m]), it recorded a progress of 0.010 m, with a maximum individual value of 0.144 m initially and of 0.154 m finally. The average value of the take-off using the left leg (Hd [m]) recorded a progress of 0.005 m, with a maximum individual value of 0.151 m initially and of 0.156 m finally. In regards to the average repetition speed for both legs (V.r.a. [sec]), it recorded a progress of 0.001 seconds. The initial maximum individual value was of

0.24 sec, and the final one, of 0.28 sec. The average repetition speed for the right leg (V.r.d. [sec]) recorded a progress of 0.001 seconds. The initial maximum individual value was of 0.38 sec, and the final one, of 0.40 sec. The last analyzed marker was the take-off speed using the left leg. In this case, the initial average V.r.s. [sec] was of 0.277 sec and the final one of 0.272, resulting a progress of also 0.005 seconds. The initial maximum individual value was of 0.38 sec, and the final one, of 0.35 sec.

Conclusions

The data recorded, analyzed and presented above shows that the two groups of students were homogeneous from a somatic development standpoint: 1.79 m /74.61 kg (height/weight PSE students) and 1.77 m/ 71.295 kg (PTSMS students, with an extra 0.103 kg during the second testing).

The test results also indicate close values for the two groups, in regards to their ability to vertically take-off using both legs and separately using the right/left leg, and in regards to the repetition speed using both legs and separately using the right/left leg. Thus, the average vertical take-off progress for the PSE students was of 0.006 m, and of 0.010 m for the PTSMS students. The PSE students' average vertical take-off progress using the right leg was of 0.016 m and of 0.010 m for the PTSMS students. The average vertical take-off progress using the left leg was of 0.020 m (PSE) and of 0.005 (PTSMS). A bigger progress, of 0.006 seconds, was recorded by the PSE students for the repetition speed using both legs, compared to their PTSMS colleagues, who recorded a progress of 0.001 seconds. A large difference between the 2 groups is encountered also for the take-off speed using the right leg, where there is a progress of 0.005 seconds (PSE) versus 0.001 seconds (PTSMS). The values of take-off speed using the left leg, however, are again closer for the two groups. The averages for this marker were 0.006 seconds for PSE and of 0.005 seconds for PTSMS.

After centralizing the distances covered and the intensity during the track and field classes, the results show that all the subjects covered a total distance of 30620 m (1093 m/class), 1200 take-offs, and 640 throws, recording an average HR/class of 150 beats/minute.

All these results lead to two important conclusions: one theoretical and one practical.

The first conclusion refers to the fact that the vertical take-off does not influence the repetition speed, but the repetition speed together with the height influence the vertical take-off.

The second conclusion is that the work during the track and field lessons did not lead to a statistically significant progress in regards to the students' speed-strength-endurance skills. Based on the results, the authors recommend a reevaluation of the work volume and intensity during these classes, so that their contribution to the development of the students' fitness would be more visible. Thus, during the classes for the PTSMS students, the drills should be focused more on the development of the right and left leg spring and of the repetition speed for each leg, whereas for the PSE students, more attention should be paid to the development of spring using both legs.

At the end, it must be mentioned that every author had an equal contribution in this study.

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