The Motor Capacity Development Level in 15-16 Year-Old Female Students from "Carol I" National College in Craiova Compared with the Results of Female Students from Other High Schools in the Country

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Abstract:
Background: Physical education is the only school subject included in the core curriculum that aims both to develop motor capacity, namely motor skills, abilities and habits, and to educate young people for an active lifestyle through physical exercise. The development of motor skills supports optimal health, physical fitness and a positive psycho-emotional state, which represent benefits felt by all practitioners of motor activities. Numerous studies have shown that the level of performance from a motor perspective influences children's predisposition to physical activity.
Materials and Methods: This research was conducted in the first semester of the school year 2020-2021 in order to analyze the level of development of some motor skills in 2 groups consisting of 9th-grade and 10th-grade female students (35 subjects each) from "Carol I" National College in Craiova compared with the results obtained by 236 subjects of the same age, namely female students from 4 other high schools in the country. As regards three of the tests, the means of the performances of the investigated groups were also analyzed in relation to the results presented by the biomotor potential study carried out in 2017-2018.
Results: Following the processing of the recorded data and their comparative analysis, we noticed that the subjects of the target groups obtained results below the means of the other groups of subjects of the same age and, in two of the tests, their results were below the means presented in the biomotor potential study carried out in 2017. Conclusion: The above-mentioned results made us conclude that the ranking of female students from "Carol I" National College was unsatisfactory compared with the other high schools, although one of the causes may have been the limitation of physical activity imposed by the pandemic caused by the COVID-19 virus, given that all the subjects included in the research were in the same situation.
Key Word: Physical education in the school system; Motor capacity; High school students

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I. Introduction

Physical activity represents an integral part of human beings because it contributes to the harmonious development of the body, as explained by López[1]. The same author supports the importance of physical education for the proper functioning of body systems, as well as for the psychomotor development including motor skills, abilities and habits. Good physical fitness will prevent health problems later in life[2,3]. It should be noted that, although physical fitness is partially genetically determined, it can be influenced by environmental factors, mainly by means of exercise[2].

There is considerable evidence of the impact of daily physical activity on the development and health of adolescents and young people[4]. Positive effects on their cognitive functioning and an increase in their self-esteem were noticed[5].

The physical activity volume is associated with an increase in motor fitness[6] which has a positive effect on health[7].

High school physical education is included in the framework curriculum as a compulsory subject. In the Romanian education system, the high school represents a higher, optional stage and a continuation of the students' general training. Physical education contributes not only to the increase of the students' biomotor potential but also to the shaping of their personality.

Research conducted in the Romanian education system in recent years has highlighted issues related to the insufficient number of hours for the physical education classes[8]. This has led to the allocation of extra time for physical activities, outside of the scheduled class hours, in order to maintain a healthy lifestyle.

In the current context characterized by the pandemic, the need for physical exercises has been highlighted more strongly.

The fact that classes were not held on-site made us study its impact on the level of development of motor skills in high school female students.

II. Materials and Methods

The present research included a number of 306 subjects, high school female students, 15-16 years of age, from the following four counties: Dolj, Gorj, Satu Mare and Botoşani. The high schools were randomly chosen, and the participants were female adolescents from a wide range of socioeconomic backgrounds. This approach took into account the fact that we noticed a decrease in the performances obtained in recent years in the tests for assessing motor skills in 9th and 10th-grade female students at "Carol I" National College in Craiova.

We considered it necessary to compare these results with those obtained by female students at other high schools in the country. Considering the fact that, in two of the tests, there are reference data presented in the study of students' potential conducted in 2017, the results obtained were also compared with them. None of the subjects included in the research had behavioural, neurological or orthopedic problems and did not have learning difficulties. All students agreed to participate. The data were collected in the first part of the first semester, (September 21 - October 9, 2020) and online as initial state testing for the school year 2020-2021.

The same tests were chosen for both the 9th grade and the 10th grade, given the situation caused by the pandemic. In order to determine the level of motor development, the following motor tests were given: the 50m running speed, the standing long jump, push-ups, sit-ups for abdominal strength and back extensions for back strength. The recording methods were the standard ones.

The data were written in tables and the arithmetic mean, the standard deviation and the coefficient of variation were calculated for each test and for each educational institution, being subsequently analyzed by descriptive statistics and independent sampling tests. These values were compared with the SUVAD requirements and the measurement values recorded in 2017- 2018 at national level.

The testing procedures were carried out on the school premises and also online (strength tests), during physical education classes.

Table no 1: The number of students participating in the research.

| High School	9th grade	10th grade
"Carol I" National College, Craiova, Romania	35	35
"Fraţii Buzeşti" National College, Craiova, Romania	31	29
"Ioan Slavici" National College, Satu Mare, Romania	28	29
"Tudor Vladimirescu" National College, Gorj, Romania	32	30
"A.T. Laurian" National College, Botoşani, Romania	30	27
Total	**156**	**150**
TOTAL	**306**	

III. Results

The value of the arithmetic mean obtained by the 9th-grade female students of "Carol I" National College in the 50m running speed test is 9.17sec, which is below the 8.7sec mean of the other high schools. As regards the 10th grade, "Carol I" National College recorded a mean of 9.03sec, which is a lower performance compared with the other high schools which recorded a mean of 8.68sec. In comparison with the other high schools, the difference is 0.47sec for the 9th grade and 0.35sec for the 10th grade.

Taking into account the data recorded for the standing long jump, the following aspects stand out. The results obtained by the 9th-grade students from "Carol I" National College recorded an arithmetic mean of 114.54 cm, higher than those of the other high schools included in the research, namely 106.71 cm. The difference of 7.83 cm between the two groups is not significant. The 10th-grade students from "Carol I" National College obtained a mean of 82.71 cm, below the mean obtained by the students of the other high schools in the country who had a mean of 102.02 cm, with a difference of (-19.31 cm).

Table no 2: The values of the arithmetic mean in the motor tests: the 50m running speed and the standing long jump

Educational Institution	Mean (X̄)			
	50m running speed		standing long jump	
	9th grade	**10th grade**	**9th grade**	**10th grade**
"Carol I" National College, Dolj	9,17	9,03	114,54	82,71
"Ioan Slavici" National College, Satu Mare	8,80	8,66	127,86	72,96
"A.T. Laurian" National College, Botoşani	8,56	8,47	121,17	128,67
"Fraţii Buzeşti" National College, Dolj	8,94	8,83	79,87	101,05
"Tudor Vladimirescu" National College, Gorj	8,45	8,73	100,66	107,07
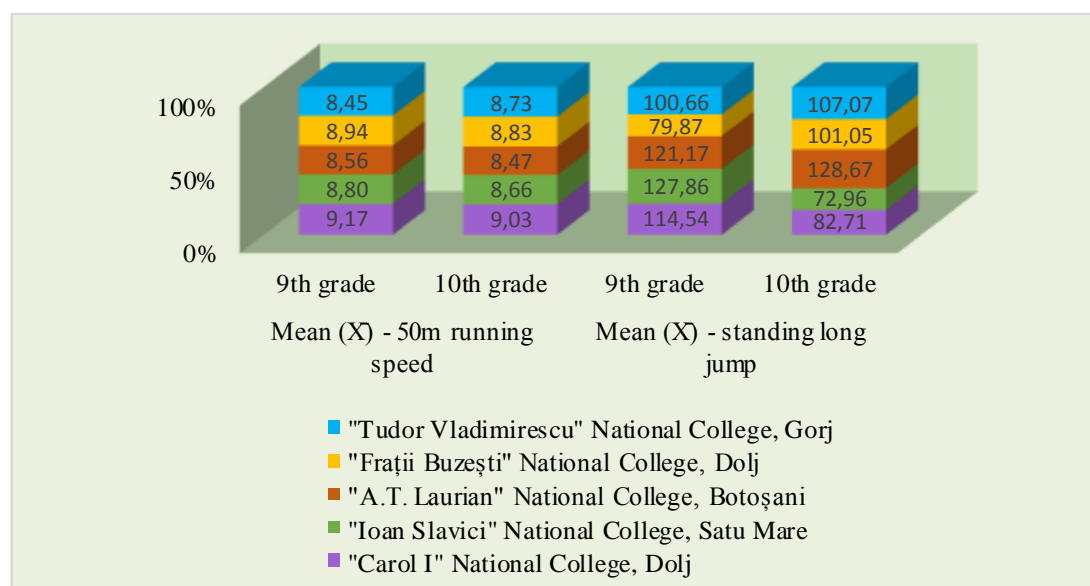
Table no 3: The values of the arithmetic mean in the motor tests: the 50m running speed of the target group compared with the other high schools in the country, biomotor potential and SUVAD requirements

Educational Institution	Mean (X̄) - 50 m running speed	
	9th grade	**10th grade**
"Carol I" National College, Dolj	9,17	9,03
Other high schools in the country	8,70	8,68
Biomotric potential 2017/2018	8,87	9,00
SUVAD	9,00	8,90
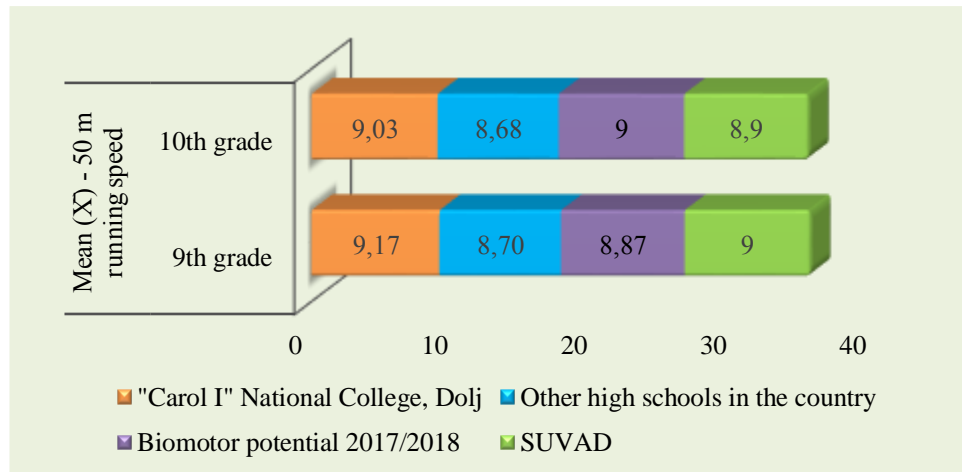
SUVAD –The National School System of Verification and Assessment for Physical Education

The difference between the values obtained by the students of "Carol I" National College and the biomotor potential is 0.3sec for the 9th grade and 0.03sec for the 10th grade. However, we notice the higher values of the two high schools in Craiova, compared to the national biomotor potential in 2017-2018, considering the data recorded on the value of the arithmetic mean, which show much weaker performance located below its average.

The values of the arithmetic mean of SUVAD are 9.0sec for the 9th grade and 8.9sec for the 10th grade. The mean recorded by the students of "Carol I" National College is lower than the mean of SUVAD requirements, namely by 17sec for the 9th grade and 13sec for the 10th grade. This SUVAD – The National School System of Verification and Assessment for Physical Education is currently used[9,10].

Table no 4: Comparison of "Carol I" National College with other high schools in the country using the t-test.

Class	50m running speed					
	t value one-tail	p value one-tail	The significance threshold	t value one-tail	p value one-tail	The significance threshold
9th grade	-0,14	.881	* is not significant	-0,14	.440	* is not significant
10th grade	1,11	.264	* is not significant	1,11	.132	* is not significant

*p <.01

Regarding the homogeneity of the investigated groups, both the standard deviation and the coefficient of variation indicate a small dispersion of the data in all cases. The coefficient of variation falls below 10%, so we notice homogeneity in all groups.

However, compared to the arithmetic mean recorded in the year 2017/2018 within the biomotor potential, it represents a considerable regression in the students' motor capacity both in the case of the students from "Carol I" National College and the other students from the high schools in the country. The students from "Carol I" registered a difference of 31.84 cm, while the students from the other high schools register a difference of 39.67 cm compared to the values registered in 2017/2018 within the biomotor potential.
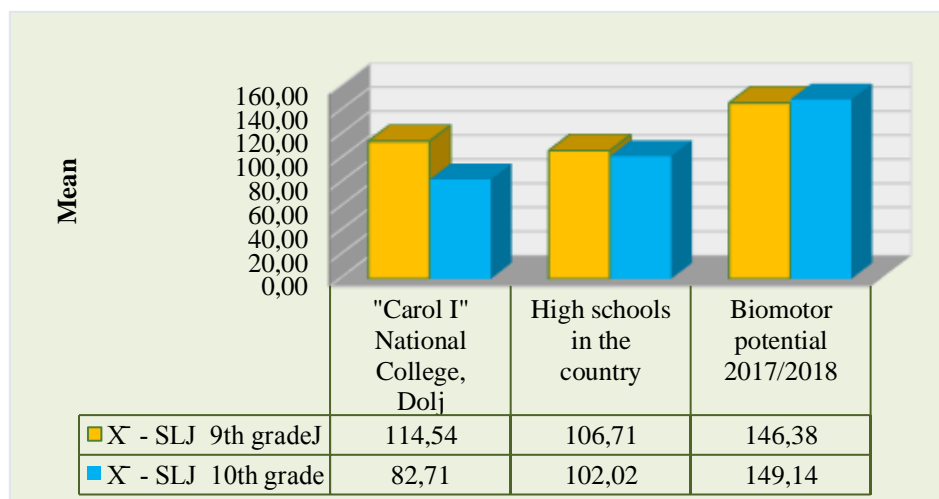
In 2017-2018 the national biomotor potential recorded arithmetic mean values of 156.38 cm for the 9th grade and 149.14 cm for the 10th grade. According to the results of the test, the 9th-grade students from "Carol I" National College ranked second and the 10th-grade students ranked third. Although these performances are weaker than those presented in the national biomotor potential of students for the school year 2017-2018, the differences resulting from the comparison of these results with those of the other high schools are big for the 9th grade and smaller for the 10th grade.

Therefore, we consider that the above-mentioned lower performances in the two motor tests achieved by the students from "Carol I" National College compared to the biomotor potential should be analyzed and an attempt to remedy them should be considered in the future.

Table no 5: The values recorded in the standing long jump of "Carol I" National College compared with other high schools in the country and biomotor potential in 2017/2018

Educational Institution	$\bar{X}$ - SLJ	
	9th gradeJ	**10th grade**
"Carol I" N.C. Dolj	114,54	82,71
High schools in the country	106,71	102,02
Biomotric potential 2017/2018	146,38	149,14

SLJ – standing long jump

	"Carol I" National College, Dolj	High schools in the country	Biomotor potential 2017/2018
$\bar{X}$ - SLJ 9th gradeJ	114,54	106,71	146,38
$\bar{X}$ - SLJ 10th grade	82,71	102,02	149,14

**Table no 6:** Comparison of "Carol I" National College with other high schools in the country using the t-test.

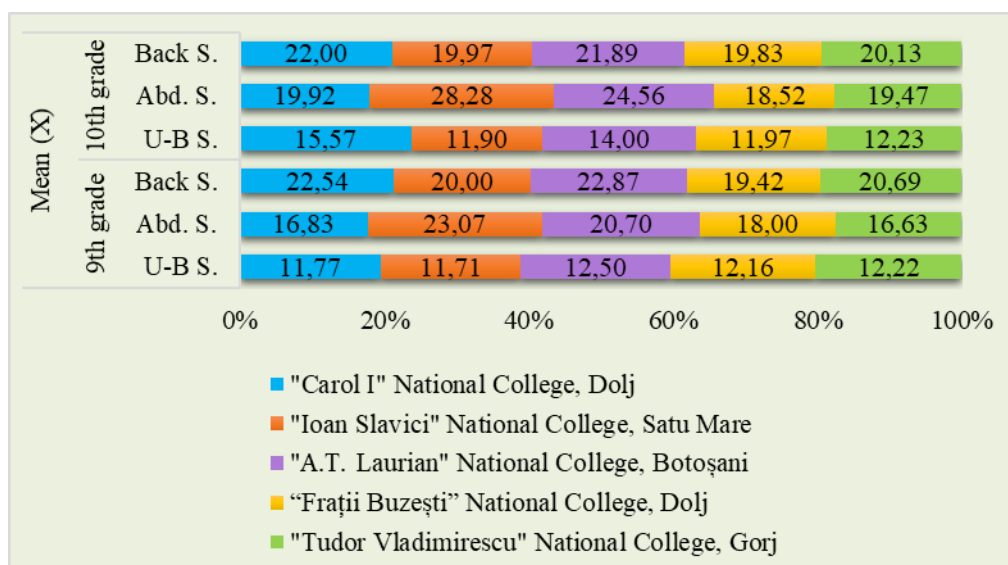| Class	Standing long jump					
	t value one-tail	**p value one-tail**	**The significance threshold**	**t value one-tail**	**p value one-tail**	**The significance threshold**
9th grade	0,58	.281	* is not significant	0,44	.562	* is not significant
10th grade	-1,33	.093	* is not significant	-1,33	.186	* is not significant

*$p < .01$

Table no 7: The values of the standard deviation and the coefficient of variation in the motor tests: the 50m running speed and the standing long jump.

| Educational Institution	Statistical data	$\bar{X}$ - 50 m D		$\bar{X}$ - SLJ	
		9th grade	**10th grade**	**9th grade**	**10th grade**
"Carol I" National College, Dolj	S	0,38	0,51	67,57	72,58
	CV %	4,16	5,77	59,86	87,75
"Ioan Slavici" National College, Satu Mare	S	0,53	0,46	61,32	69,99
	CV %	6,09	5,27	48,84	95,92
"A.T. Laurian" National College, Botoșani	S	0,31	0,37	68,88	66,29
	CV %	3,74	4,37	57,82	52,97
"Frații Buzești" National College, Dolj	S	0,67	0,74	69,08	70,26
	CV %	7,52	8,4	87,92	70,77
"Tudor Vladimirescu" National College, Gorj	S	0,57	0,57	71,35	74,2
	CV %	6,76	6,51	72,02	70,49

On the other hand, in the case of the standing long jump, by calculating the coefficient of variation, there is a good homogeneity for the students of "Carol I" National College in Dolj, "A.T. Laurian" National College in Botoșani and "Tudor Vladimirescu" National College in Gorj (10th grade), with values below 10%, compared with the other high schools which are not homogeneous.
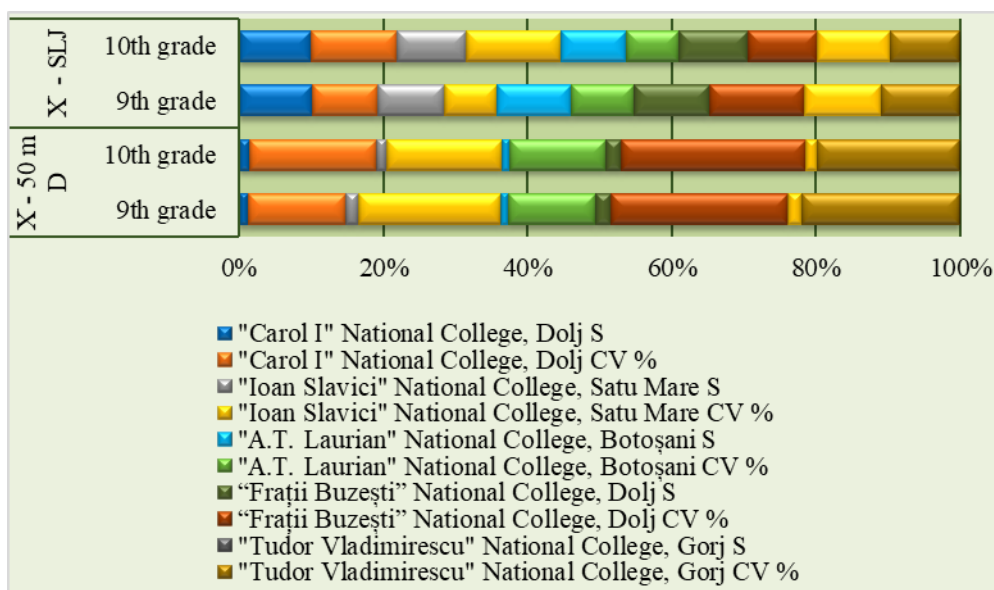
In the upper-body strength test, the values of the mean for the female students of "Carol I" National College are: 11.77 executions for the 9th grade and 15.57 for the 10th grade. As regards the other high schools, the values of the mean are 12.16 executions for the 9th grade and 12.49 for the 10th grade. These values are found in the figure below. We can say that the values of the mean in the case of the students from "Carol I" National College are lower compared to the other high schools, namely by (-0.39) executions for the 9th grade, being an insignificant difference but which ranks the group second to last. For the 10th grade, the values of the mean are higher by 3.08 executions, the group ranking first from the point of view of the performance value.

U-B S. – upper-body strength (push-ups)
Abd. S – abdominal strength (sit-ups)
Back S. – back strength (back extensions)

	Mean (X) U-B S.	
	9th grade	10th grade
■ "Carol I" National College, Dolj	11,77	15,57
■ High schools in the country	12,16	12,49
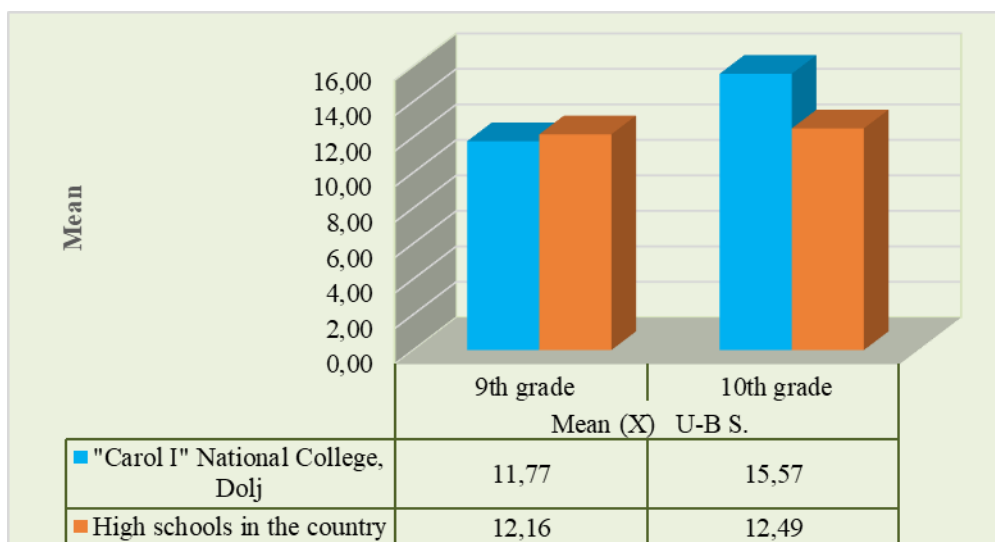
Table no 8: Comparison of "Carol I" National College with other high schools in the country using the t-test.

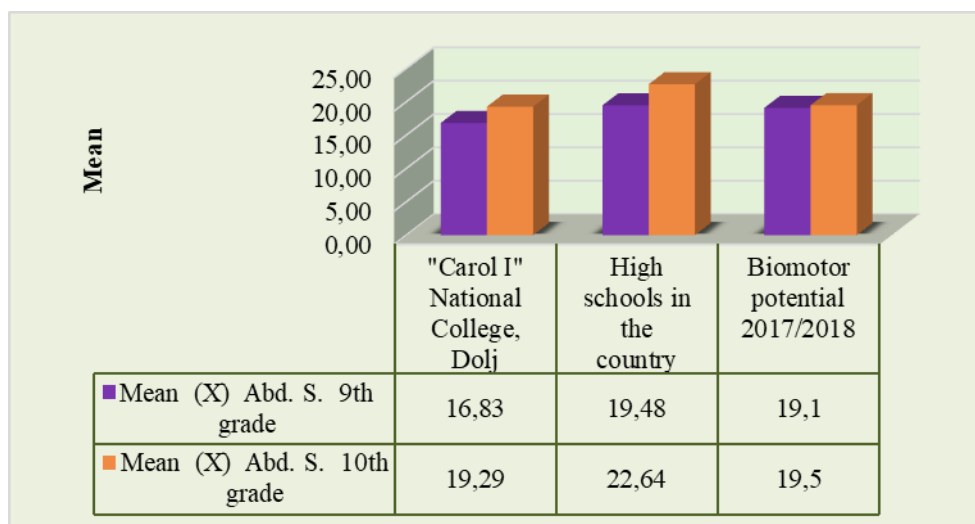| Class	U-B S.					
	t value one-tail	p value one-tail	The significance threshold	t value one-tail	p value one-tail	The significance threshold
9th grade	-0,68	.245	** significant	-0,68	.491	** significant
10th grade	4,65	< 0.001	** significant	4,65	< 0.001	** significant

**p <.01

By applying the student's t-test and calculating the correlation index p, all the values are significantly lower than 0.01, and the values of the p-index highlight "Carol I" National College compared to other high schools in the country for both one-tail and two-tail.

Regarding abdominal strength, namely sit-ups performed by the 9th and 10th-grade female students, the recorded data are as follows:

- The value of the mean in the case of the female students from "Carol I" National College is 16.83 for the 9th grade and 19.29 executions for the 10th grade.

- The value of the mean of the other high schools in the country is 19.48 executions for the 9th grade and 22.64 executions for the 10th grade. We notice that the values of the mean in the case of "Carol I" National College are lower compared with the values of the other high schools and also to the values of the mean of the biomotor potential in 2017-2018 (19.10 for the 9th grade and 19.50 for the 10th grade). The difference between the value of the mean in the case of the female students of "Carol I" National College and the biomotor potential is (-2.27) for the 9th grade and (-0.21) for the 10th grade.

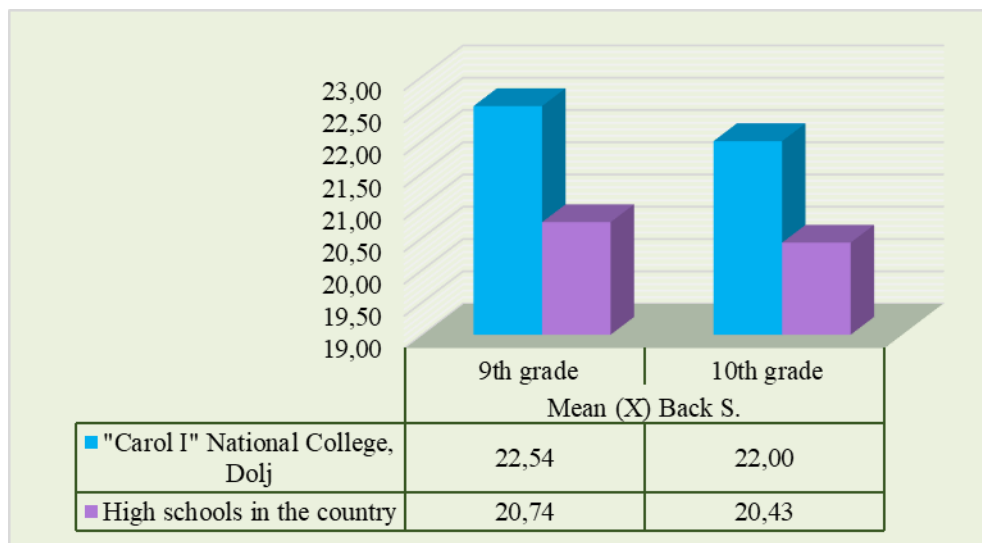|	"Carol I" National College, Dolj	High schools in the country	Biomotor potential 2017/2018
■ Mean (X) Abd. S. 9th grade	16,83	19,48	19,1
■ Mean (X) Abd. S. 10th grade	19,29	22,64	19,5

Abd. S. – abdominal strength (sit-ups)

Table no 9: Comparison of "Carol I" National College with other high schools in the country using the t-test.

Class	Abd. S.					
	t value one-tail	p value one-tail	The significance threshold	t value one-tail	p value one-tail	The significance threshold
9th grade	-2,53	.006	** significant	-2,53	.012	* is not significant
10th grade	-2,54	.006	** significant	-2,54	.012	* is not significant

*p <.01

In the back strength test, the values of the arithmetic mean for the female students of "Carol I" National College are 22.53 for the 9th grade and 22.70 executions for the 10th grade. The values of the arithmetic mean in the case of the other four high schools are 20.73 for the 9th grade and 20.45 executions for the 10th grade. Therefore, we can say that the values of the arithmetic mean are higher for "Carol I" National College. The difference between the values achieved by the female students of "Carol I" National College compared with the values obtained by the female students of the other high schools in the country is 1.80 executions for the 9th grade and 2.25 executions for the 10th grade.

As regards all five high schools, for the 9th and 10th grades and in all three tests, the values of the standard deviation and of the coefficient of variation indicate a large dispersion of values, namely non-homogeneous groups.

	9th grade	10th grade
Mean (X) Back S.		
■ "Carol I" National College, Dolj	22,54	22,00
■ High schools in the country	20,74	20,43

Back S. – back strength (back extensions)

Table no 10: Comparison of "Carol I" National College with other high schools in the country using the t-test.

| Class	Back S.					
	t value one-tail	p value one-tail	The significance threshold	t value one-tail	p value one-tail	The significance threshold
9th grade	1,49	.068	* is not significant	1,49	.137	*is not significant
10th grade	1,24	.108	* is not significant	1,24	.216	*is not significant

**p <.01

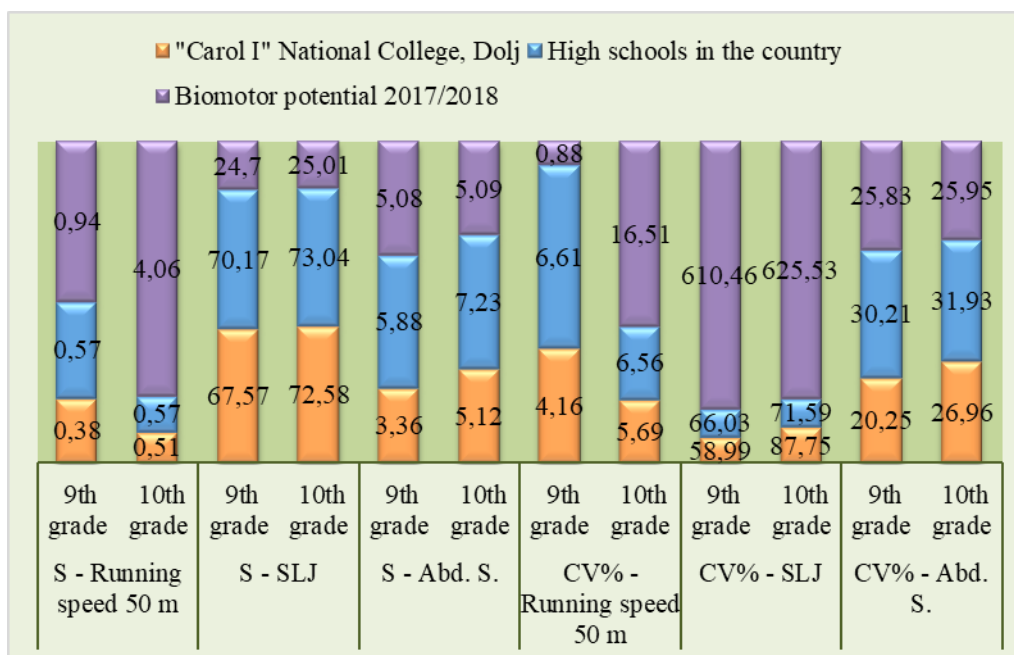**Table no 11:** The values of the standard deviation and the coefficient of variation in the strength tests.

Educational Institution	Statistical data	9th grade			10th grade		
		U-B S.	Abd. S.	Back S.	U-B S.	Abd. S.	Back S.
"Carol I" N.C. Dolj	**S**	2,82	3,36	4,82	3,99	5,12	5,00
	CV %	23,95	19,96	21,4	25,61	26,57	22,74
"Ioan Slavici" N.C. Satu Mare	**S**	2,62	7,68	7,20	2,54	5,85	9,02

	CV %	22,34	33,27	35,98	21,33	20,68	45,19
"A.T. Laurian" N.C. Botoșani	**S**	2,92	5,43	6,55	4,07	7,02	8,40
	CV %	29,18	38,82	38,53	29,09	28,59	38,39
"Frații Buzești" N.C. Dolj	**S**	3,07	4,77	6,85	2,58	5,14	5,01
	CV %	25,24	26,51	35,26	21,56	27,74	25,27
"Tudor Vladimirescu" N.C. Gorj	**S**	2,95	2,58	5,19	3,01	6,08	3,85
	CV %	24,19	15,54	25,07	24,58	31,24	19,14
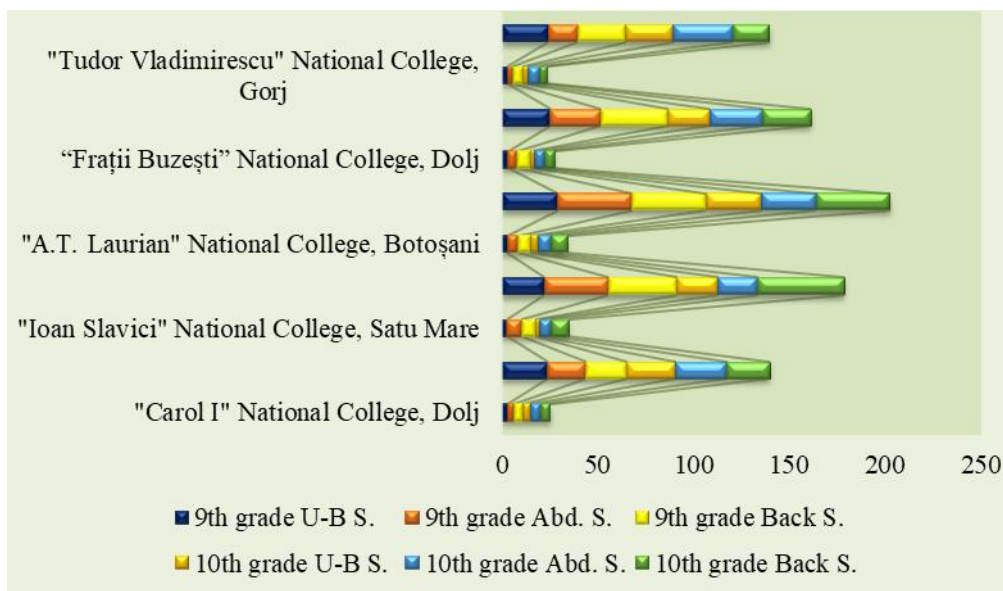
As regards all five high schools, for the 9th and 10th grades and in all three tests, the values of the standard deviation and of the coefficient of variation indicate a large dispersion of values, namely non-homogeneous groups.

The standard deviation (S) in the 50 m running speed test recorded the following values:
- 0.38sec for the 9th-grade students of "Carol I" National College and 0.51sec for the 10th-grade students of the same high school.
- 0.57 sec. for both classes of students from the other high schools in the country.

- 0.94 sec for the 9th grade and 4.06 sec for the 10th grade in terms of the 2017/2018 biomotor potential.

All groups of investigated students have values of the coefficient of variation below 10%, so they are homogeneous, except for the group of subjects of the biomotor potential that has the value of 16.51sec, falling into the middle category.

In the standing long jump test, the coefficient of variation for all the high schools included in the research has very high values, over 20%, so the groups are not homogeneous.

In the sit-ups test, we notice that both the investigated groups and the group of subjects tested in the 2017-2018 school year are not homogeneous, the calculated values being over 20%.

IV. Discussion

By analyzing the presented data, we can say that the average performances of the female students of "Carol I" National College are generally lower compared with the performances of the female students of the same age from other high schools in the country, as well as compared with the means of two of the tests similar to those presented in the study of the biomotor potential conducted in 2017-2018. These motor tests were taught in the online system, thus lacking the teacher's control and students' feedback.

We also notice some exceptions as regards the standing long jump test, in which the group of 9th-grade female students from "Carol I" National College obtained superior results both to the mean of the other high schools and to the means presented in the study of the previously mentioned biomotor potential. A good performance was achieved by the 10th-grade female students in the target group both in the upper-body strength test (push-ups), the difference of 3.08 executions being a sufficiently significant one and in the back extensions test, where the difference is of 1.57 executions. Likewise, the 10th-grade female students from "Carol I" National College also registered superior values in the back strength test: back extensions, with a difference of over 1.80 executions compared to the female students from the other high schools in the country.

Thus, it is noticed the need for intervention in order to improve these results through effective and stimulating measures and means, taking into account the need to achieve good physical fitness for developing motor capacity, especially in high school female students who, for various reasons, do not have an active lifestyle characterized by physical exercise.

Motor skills promote and support health, namely a state of physical and mental well-being achieved by any practitioner, as I. Neacşu explains, "the right to health, just like the right to a good education represent fundamental values of the human being"[11].

The sports facility of "Carol I" National College in Craiova includes a swimming pool. A previous survey revealed that 87% of the high school female students expressed their desire to spend part of their physical education classes on its premises.

The curriculum is designed in such a way that children are engaged in physical activities that prove relevant scientific knowledge. The goal is to develop and maintain students' personal fitness.

A recent meta-analysis has shown that physical education programs, including fitness activities, can significantly increase the time spent while performing vigorous- or moderate-intensity physical activity[12].

The period when physical education classes were conducted online has had a negative impact on the level of development of students' motor skills, with lower performances compared with both the average performances of the biomotor potential and with SUVAD requirements. This is especially obvious with regard to the motor tests: the 50m running speed and the standing long jump. We note that this research does not investigate the level of acquisition of sports skills and abilities, where regression may be much higher. Obviously, these performances of the investigative research are much lower.

V. Conclusion

We consider that this study is limited to the application domain, with a rather small number of high school female students. However, such an approach helps both to make a good diagnosis of female students' motor skills and to implement programmes through extracurricular activities in order to stimulate exercise and improve possible deficiencies.

The nationally standardized data on providing and performing intense or moderate physical activity are insufficient to allow the assessment of the current state and trends in physical education in Romania.

The long-term impact of physical education has been under-studied and it should be a research priority in order to support the development of evidence-based policies.

It is clear that this pandemic has completely disrupted an education system that is said to have already lost its relevance not only in Romania but also globally.

As specialists, our main goal during this time has been to spend our free time through sports activities rather than using gadgets, but the pandemic has greatly hindered our attempts.

However, we believe that specially designed programmes are needed to improve students' motor performance according to the requirements of their age level.

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