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Comparative Study on Genders regarding the Dynamic Balance Disorders in a School Age Population Segment

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Abstract

Balance is a function of the musculoskeletal system that is indispensable to the motor function because it ensures the stability of postures and the orientation of body movements in space. The sense of balance is complex and it allows the adjustment of the position of the head according to the body and of the position of the body according to the environment. Balance has two forms of adaptive reactions: dynamic balance and static balance. This paper aims to identify the possible disorders of the dynamic balance among the school age population, through a gender comparative study. The subjects of this research were children between the ages of 7 and 10. On the occasion of the International Day of Sport for Development and Peace, on April 6, 2017, within a project organized by the Faculty of Movement, Sports, and Health Sciences, at the "Vasile Alecsandri" University of Bacău, this team of authors has assessed the bio-motor potential in a school age population. The number of investigated subjects was 150 primary school pupils, 75 females and 75 males. The tests used to assess their dynamic balance were the Bass test and the Fukuda test. The observational experiment evaluated the initial and the final tests for the dynamic balance. The conclusions that can be drawn from this study show that there is a high number of children with disorder balance, both male and female. This can lead to significant long term implications for the harmonious psycho-motor development of their bodies.

Keywords: *disorders, dynamic balance, children.*

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1. Introduction

Balance is a function of the musculoskeletal system that is indispensable to the motor function because it ensures the stability of postures and the orientation of body movements in space. The sense of balance is complex and it allows the adjustment of the position of the head according to the body and of the position of the body according to the environment. Balance presents two forms of adaptive reactions: dynamic balance and static balance.

Balance, as an adaptation skill, allows the individual to resist the gravitational pull, maintaining a vertical position, and serves as reference for space orientation.

This paper aims to identify the possible disorders of the dynamic balance among the school age population, through a gender comparative study.

2. Problem Statement

Balance is defined as a state of action and reaction between two or more body parts or organs. Static balance, necessary for a normal state of the body, is the ability to maintain balance during certain fix positions [2].

Balance keeping in humans can be observed from the efforts they make to achieve a vertical position, to keep it, and then to move or perform various motor actions.

An analysis of the professional literature allowed the observation that the manifestation and control of balance, as elements composing the general psychomotor activity in humans, are developed since birth, going through several stages, according to various perturbing factors. Thus, a multitude of genetic, ecological and social factors influence the individuals' growth and development during the fetal and neonatal life [6]. More than that, the newborn who starts her extra-uterine life earlier than anticipated experiences various types of physiological, psychological, and environmental dangers [5].

An interruption of the development process has long term, short term, and even permanent consequences. Plus, premature babies are more predisposed to motor disorders and poor postural performances during childhood, compared to the ones born on term [7, 8].

The person acquires skills in order to move appropriately for each situation. Keeping the internal and external forces in balance thus represents for the humans a fundamental disposition for productivity. The quality of this productivity condition is established mostly by psycho-physical factors,

while the complex balance performances are possible when the superior cortical structures are developed enough.

Considering the important role played by the vestibular system in developing the body, the defects in the vestibular functions during childhood have a potential negative influence on other motor skills, sight disorders, postural control disorders, body coordination and sensory integration [3].

According to certain Romanian experts, balance represents the state of a body, which, subjected to the action of certain forces, maintains its movement ability, no matter whether if that body is in a static or dynamic state [1].

Balance is a complex process that involves two important functions: on one side, the reception and organization of sensory input, on the other, the program and performance of the actual movements. The two functions ensure the optimal posture of the body by maintaining the center of gravity inside the support base [4].

According to certain physical education and sports specialists, balance is that "resting state characterized by an equalization of internal and external forces acting on the body".

3. Research Questions/Aims of the research

Considering the current studies in the professional literature, this observational study was deemed necessary, to establish the correlations between balance and standing disorders, and posture control in children in this age category.

This *paper aims* to identify the possible disorders of the dynamic balance among the school age population, through a gender comparative study.

The *first hypothesis* presumes that by assessing the dynamic balance, one can identify dynamic balance disorders in a segment of a school population.

The *second hypothesis* presumes that by identifying the balance disorders, one can establish a gender differentiation, in the same school population.

4. Research Methods

The subjects of this research were children between the ages of 7 and 10. On the occasion of the International Day of Sport for Development

and Peace, on April 6, 2017, within a project organized by the Faculty of Movement, Sports, and Health Sciences, at the "Vasile Alecsandri" University of Bacau, this team of authors has assessed the bio-motor potential in a school age population. The number of investigated subjects was 150 primary school pupils, 75 females and 75 males. The observational experiment aimed to identify the dynamic balance level.

The research methods used were: the study of the specialized literature, the observation method, the inquiry method, the measuring and assessment method, the data interpretation method. The tests used to assess their dynamic balance were the Bass test and the Fukuda test.

5. Findings

What follows are the results recorded by the group of subjects during the two tests, and their interpretation.

5.1. The Bass test

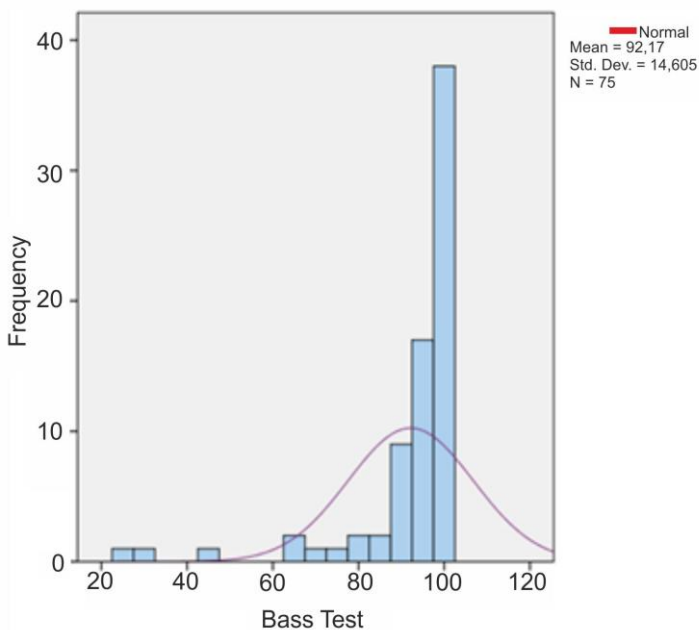


Figure 1. Statistical indices obtained by the female Subjects during the Bass test

During the Bass test (see Figure 1), the female subjects recorded the following values: arithmetical mean $M=92.17$, Median, $Med=98$, Module = 100. As a result, the distribution is bimodal, asymmetrical toward left (skewness is negative), the results tending toward high values. The kurtosis has a positive value, indicating a leptokurtic distribution, thus a high degree of homogeneity in the group of subjects. It can be observed that the minimal value was 25, and the maximum value 100, the standard deviation was 14.606, which, together with the variability coefficient of 15.86% ($<30\%$), indicates a good homogeneity of the results, the arithmetical mean being representative.

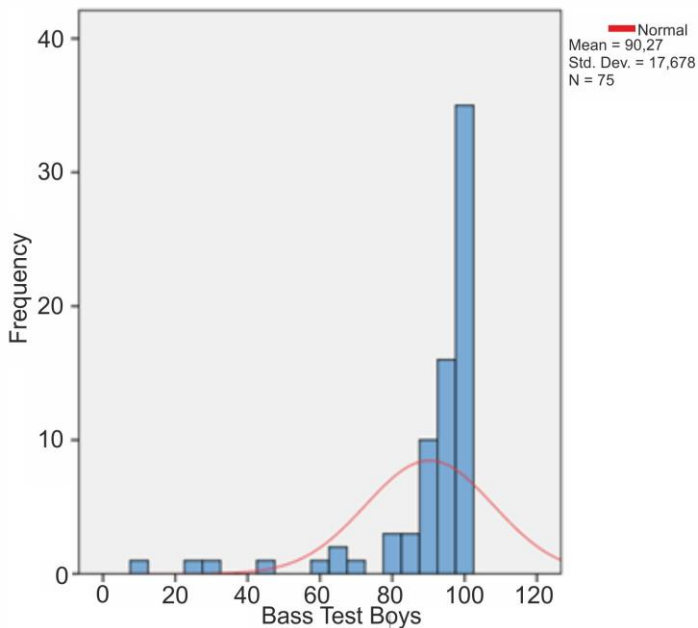


Figure 2. Statistical indices obtained by the male subjects during the Bass test

During the Bass test (see Figure 2), the male subjects recorded the following values: arithmetical mean $M=90.27$, Median, $Med=96$, Module = 100. As a result, the distribution is unimodal, asymmetrical toward left (skewness is negative), the results tending toward high values. The kurtosis has a positive value, indicating a leptokurtic distribution, thus a high degree of homogeneity in the group of subjects. It can be observed that the minimal value was 10, and the maximum value 100, the standard deviation

was 17.678, which, together with the variability coefficient of 19.58% (<30%), indicates a good homogeneity of the results, the arithmetical mean being representative.

5.2. The Fukuda test

Table 1. Statistical indices obtained as a result of the statistical interpretation of the values recorded by the female subjects during the Fukuda test

Fukuda Test - females					
	Frequency	Percentage	Valid percentage	Cumulated percentage	
Valid	- (no deviation)	12	16.0	16.0	16.0
	< 30° right	35	46.7	46.7	62.7
	< 30° left	28	37.3	37.3	100.0
	Total	75	100.0	100.0	

As a result of the statistical analysis of the data recorded by the female subjects during the Fukuda test (see Table 1), the following results were obtained: 16% (12 subjects) got the result "no deviation"; 37.3% of the subjects (28 subjects) got the result "< 30° left", and 46.7% (35 subjects) got the result "< 30° right". The results are presented in the figure below.

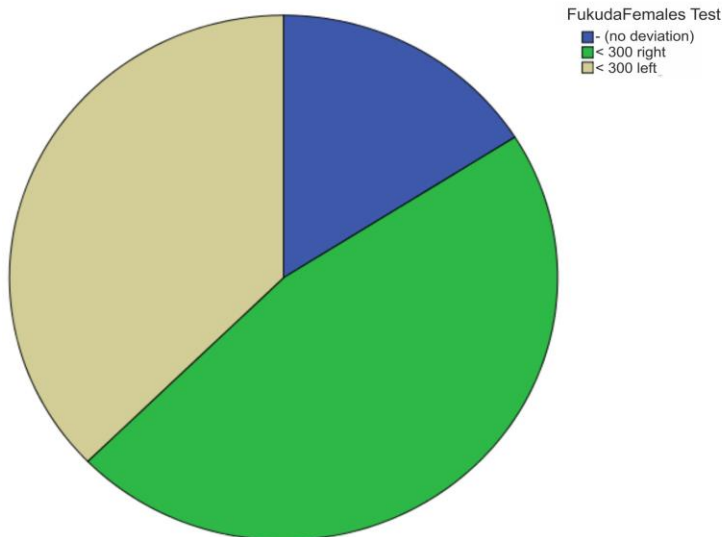


Figure 3. The dynamics of the results' progress for the Fukuda test, female subjects

Figure 3 shows a high percentage of the subjects (46.7%) that recorded a deviation higher than 300 toward left, and a lower percentage (12%) that recorded no deviation.

Table 2. Statistical indices obtained as a result of the statistical interpretation of the values recorded by the male subjects during the Fukuda test

Fukuda Test - males				
	Frequency	Percentage	Valid percentage	Cumulated percentage
- (no deviation)	11	14.7	14.7	14.7
< 30° right	39	52.0	52.0	66.7
< 30° left	25	33.3	33.3	100.0
Total	75	100.0	100.0	

As a result of the statistical analysis of the data recorded by the male subjects during the Fukuda test (see Table 2), the following results were obtained: 14.7% (11 subjects) got the result "no deviation"; 33.3% of the subjects (25 subjects) got the result "< 30° left", and 52 % (39 subjects) got the result "< 30° right". The results are presented in the figure below.

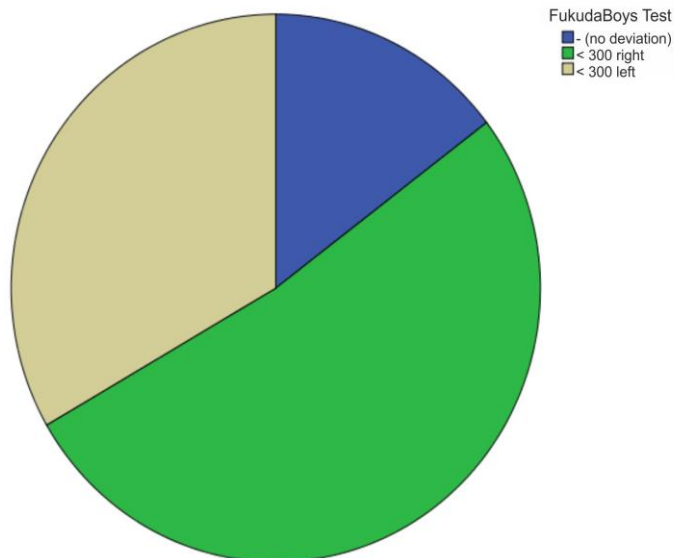


Figure 4. The dynamics of the results' progress for the Fukuda test, male subjects

Figure 4 shows a high percentage of the subjects (52%) that recorded a deviation higher than 300 toward left, and a lower percentage (11%) that recorded no deviation.

Table 3. Representative variables on genders, for the Bass test

The Bass Test							
Arithmetical mean		Standard deviation		Variability coefficient		Minimum score	
Females	Males	Females	Males	Females	Males	Females	Males
92.17	90.27	14.606	17.678	15.86	19.58	25	10

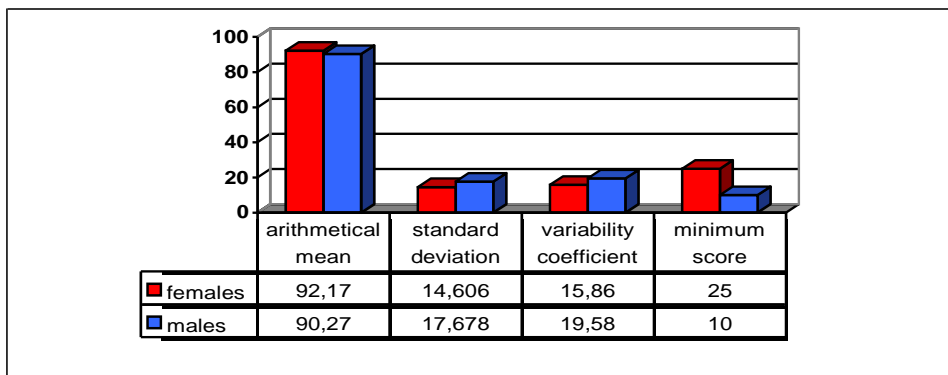


Figure 5. Dynamics of the variables' progress for the Bass test

Figure 5 shows that the results recorded for the 4 statistical variables - arithmetical mean, standard deviation, variability coefficient, and minimum score - are significantly better for the female subjects.

Table 4. Table with comparative representative variables by sex for the Fukuda test

The Fukuda Test					
No deviation		< 30° right		< 30° left	
Females	Males	Females	Males	Females	Males
12/16%	11/14.7%	35/46.7%	39/52%	28/37.3%	25/33.3%

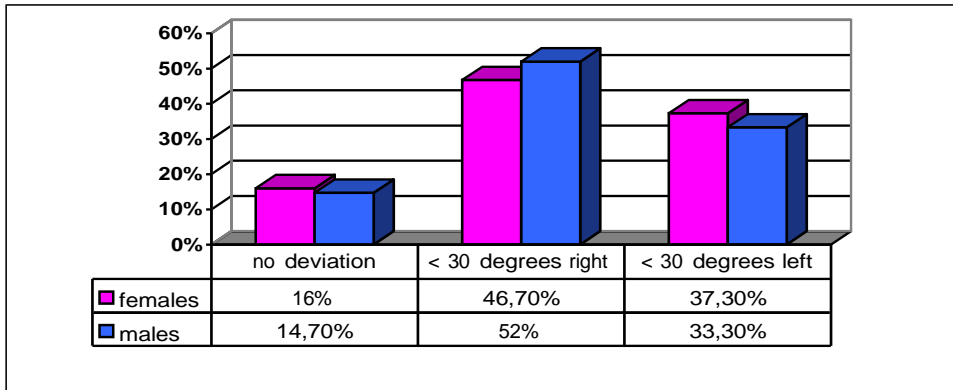


Figure 6. Dynamics of the variables' progress for the Fukuda test

Figure 6 shows that the results recorded for the variables are significantly better for the female subjects.

6. Discussions

At the end of this study, it can be said that the existence of a large number of children, male or female, with balance disorders, can have severe implications for the long term harmonious psychomotor growth and development of their bodies. Also, this kind of studies must be continued on other segments of the population, in order to identify, according to age, the most critical moment of the growth and development that favors this type of disorders.

7. Conclusions

The conclusions that can be drawn following the presentation and interpretation of the data are the following:

Considering the first hypothesis, stating that *by assessing the dynamic balance, one can identify dynamic balance disorders in a segment of a school population*, it can be said that, according to the Bass test results, the two groups of subjects (males and females) indicate homogeneity of the results, thus no gender differences between the two. There is also a good arithmetical mean for the two groups, better for the female subjects; the minimum score recorded by the male subjects is 10, while the one recorded by the female subjects is 25. There was no dynamic balance disorders recorded during this test.

In regards to the Fukuda test results, they confirm the presence of

dynamic balance disorders in both groups of subjects. The percentage of deviations of 30 degrees to the right or to the left is significantly higher (64 subjects - 85.3% of the male subjects, and 63 subjects - 84% of the female subjects) than the absence of deviations (11 subjects - 14.7% of the male subjects, and 12 subjects - 16% of the female subjects). The balance disorders with a deviation of 30 degrees to the right were recorded in both groups almost equally (39 subjects - 52% of the male subjects, and 35 subjects - 46.7% of the female subjects).

The second hypothesis, stating that *by identifying the balance disorders, one can establish a gender differentiation, in the same school population*, has not been confirmed. This statement is supported by the homogeneity of the results.

Thus, it can be said that after applying the two tests, only in the case of the Fukuda test the balance disorders were recorded in both groups of subjects. Their presence can be due to the characteristics of the test, which imposes restrictions in the subjects' field of vision.

In regards to the gender differences for this segment of the population, they are insignificant.

Acknowledgement:

The team that carried out the present study declares on their own responsibility that the subjects participating in the research and their parents were informed of the voluntary nature of participation in the research, understood the information received and requested for research. They understood that withdrawal from the research can be done at any time, without any adverse consequences on the participant or legal representative. Research has observed the ethical standards of research, we mention that the legal representatives of the research participants have given their informed consent for the participation of their children to this research.

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