SUMMARY

Introduction

Postural stability is the result of morphological, neurophysiological and environmental factors, therefore its relationship with a specific activity or motor skill in a specific environment is sought. Despite many publications on the ability to maintain balance, it has not been determined what determines mostly its development. It is still difficult to clearly indicate what, apart from age, gender, the degree of sensory integration and somatic structure, determines the development of postural stability.

Research on postural stability and its relationship with motor skills among children is becoming more and more common. They often include a different set of fitness and equivalent tests and are carried out in different age groups. The relationship between postural stability and motor skills tests among children has not been clearly established, and research results vary significantly depending on the balance assessment methods used. Determining the influence of somatic structure, in particular weight-height proportions and the relative length of lower limbs, in relation with postural stability and motor skills may be a new direction in the search for determinants of postural stability.

Understanding the factors that influence postural stability and motor skills may be important for developing effective strategies to prevent and treat balance disorders and improve motor skills for children of all ages.

Aim of study

The aim of the study is to determine the relationship between the level of postural stability and selected motor skills among children between the age of 7 and 10, considering their somatic structure. The following research questions were formulated to clarify the above: (1) To what extent the level of stability in static and dynamic conditions is related to the results of motor tests of the examined children, and how this relationship changes for different age groups? (2) Does the somatic structure of the subjects affect the relationship between the results of balance and motor tests, and to what extent? (3) Is the correlation between the results of balance and motor tests similar for both genders?

Material and methods

The research covered 1,230 students in primary schools in Zakopane (579 girls and 651 boys) aged 7–10. Static balance was measured on the CQ Electronic stabilograph platform. The subject stood freely and held a still position for 30 seconds, directing his gaze to the fixation point. The following were recorded: the length of the COP path (SP [mm]), the average COP range (MA [mm]), the average speed of COP movement (MV [mm/s]) and the surface area covered by the COP (SA [mm2]). Dynamic balance was determined using the Libra balance platform. The subject's task was to perform an equivalent test, which involved controlling the feet pressure on the platform in such a way that the line drawn by him on the screen (sine wave) corelated with the reference line. The test lasted one minute and was performed only in the frontal plane. Stability index (IS) and total surface area (PC) were recorded.

To determine the level of selected motor skills, tests from the Eurofit and International test batteries as well as running around the envelope were used. They corresponded to the following measurements: endurance (endurance shuttle run, forward bends from lying on your back), speed (standing long jump, agility run (4x10m), envelope-shaped run) and flexibility (front bend of the torso). They were performed according to the authors' instructions.

In order to determine the impact of the somatic structure on the relationship between the level of stability and motor performance, the body mass index (BMI) and the length of the lower limbs (Manouvier) were determined, and then, based on their values, all the studied boys and girls were divided into three subgroups (group 1 $\overline{x}$ -0.5 SD, 2 $\overline{x}$ ±0.5 SD, and 3 above $\overline{x}$ +0.5 SD).

Results

Based on the speed tests' results, there is small correlation between postural stability in static conditions and motor skills. The strongest correlations were noted with MV and standing long jump (♀ 0.05), agility running (♂ 0.05; ♀ 0.1) and envelope-shaped run (♂ 0.1; ♀ 0.8). In moderately dynamic conditions, with both speed and endurance tests (shuttle running, lying down sit-ups) in both sexes. In dynamic conditions, when testing speed and endurance (shuttle running, sit-ups), the correlation was moderate. The highest correlations were noted between IS, PC and standing long jump (♂ 0.10; ♀ 0.12), running around envelope (♂ 0.15; ♀ 0.23) and lying down sit-ups (♂ 0.12; ♀ 0.10). There was no tendency or trend indicating changes in the strength of partial correlations with age of the respondents. The age of respondents had no effect

on changes in the strength of partial correlations. It was found that the range of dispersion of results, around the regression line, decreased with the children's chronological growth.

The somatic structure of the subjects, expressed by the BMI and Manouvrier index, influences the relationship between balance and motor tests. In static conditions, in the BMI groups, the strongest relationships were noted in the results of endurance running (♂BMI3, ♀ BMI 1) and locomotion speed tests (♂BMI 2; ♀ BMI 1). In dynamic conditions, stronger associations between the BMI 3 and BMI 1 groups were demonstrated in the results of endurance tests for boys and speed tests for girls.

Postural stability results are stronger in the Manouvier index groups in static conditions it was found with speed abilities, mainly locomotion speed (♂WM 3, ♀WM 1). In the Manouvier index groups it was found that, in static conditions, along with speed abilities, mainly locomotion speed (♂WM 3, ♀WM 1), postural stability results are stronger. In dynamic conditions, stronger relationships between balance and endurance tests were observed in boys' group (WM 1) and with speed tests in girls' group (WM 3). There were no significant relationships between balance and the measurement of flexibility.

The results of motor skills tests to a small extent explain the level of balance in static conditions (♀5.05 - 13.51%; ♂2.79 - 9.98%). Boys had a higher level of model fit in dynamic conditions (19.89 - 20.01%), compared to girls (11.73 - 11.74%). The variables with the greatest impact on the degree of clarification of the boys' postural stability models were envelope-shaped run, agility and endurance, and lying down sit-ups. For girls these were envelope-shaped run, lying down sit-ups, long jump and flexibility.

Conclusions

1. Despite athe significant, proportional improvement in the values of all analyzed variables, the relationships of postural stability measures with the results of teststests results of selected motor skills do not indicate the existence of a clear relationship correlationbetween them. It is also impossible to demonstrate a tendency or trend in changes in of the strength of partial correlations with the age of the respondents. In static conditions, the results of speed ability tests have a significant impact on the level of stability, and in dynamic conditions - for whichwhere the strength of the relationship between the variables was greater - the results of endurance and speed abilities tests.

2. Body structure significantly influences the relationship correlation between the results of balance and motor tests. Groups created based on the values of BMI and Manouvier indices shaped the mutual interactions of the analyzed variables to varying degreesat different levels. In free standing, they had a small effect on the relationship between stability and endurance, but a significant effect on speed. In BMI groups, their strength decreased with the increase in the index value, and Manouvier's strength - in for boys it increased with the relative lengthening of their lower limbs, and in for girls - the opposite. In dynamic conditions, the relationships between variables were was stronger and the differences within the groups of indicators were smaller. Higher values of correlation coefficients were recorded with speed, and but also with endurance - they were at a low to moderate level.

3. Girls had more favorable values of stability measures in all age groups. Both sexes also differed in the strength and scope of interactions between the groups of analyzed variables, both in terms of the entire age group and dividedas well as by the values of body composition indicators. In static conditions, thea greater number of significant partial correlations were was found in girls' group, while in dynamic conditions - in boys' group. In free standing, the range of explained common variability is similar in for both sexes, while in balancing in for boys it is twice as largehigher than for as in girls.

4. The results of postural stability measures and motor tests of 1,230 children aged 7-10 years constitute a valuable reference database that can be used in many future studies. Taking into account the somatic structure of the subjects. The correlational analyzes comparative analysis carried out in this study, taking into account the somatic structure of the subjects, can be used by PE teachers, trainers and clinicians to develop programs determining the degree of sensory integration in their students, which this could also will contribute to the targeted development of motor skills and facilitate the possible treatment of motor skills disorders.

Kraków, 11.09.2023r.

Rozprawa doktorska

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