SECTION – FUNDAMENTAL AND APPLIED KINESIOLOGY

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BALANCE LEVEL STANDING ON UNSTABLE SURFACE IN WOMEN DIFFERENTIATED BY THEIR FIELD OF STUDY

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Authors' contribution:

A. Study design/planning
B. Data collection/entry
C. Data analysis/statistics
D. Data interpretation
E. Preparation of manuscript
F. Literature analysis/search
G. Funds collection

Key words: dynamic balance, unstable surface, environmental conditions.

Abstract

Study aim: The aim of the study is to determine the degree of differentiation in the level of postural stability under dynamic conditions (forced by moving surface) in female students depending on their chosen field of study.

The following research questions were put forward:

1. does the selected field of study and the level of physical activity of the women associated with this field affect their postural stability?
2. do the potential, observed differences in stability of the studied student groups exist to a similar extent in the frontal and sagittal planes?

Basic procedures: The studies involved a total of 87 women, students of three faculties: Collegium Medicum (CM) obstetrics (33), AWF physiotherapy (28), AWF physical education (26). The premise qualifying the participants for the group was lack of previous contact with competitive sports.

Postural stability tests were carried out on an EasyTech Libra postural balance platform. They included two trials, carried outseparately in the frontal and sagittal planes (a total of four measurements):

1. standing position, feet parallel, straight line, with feedback;
2. standing position, feet parallel, sinusoid, with feedback.

Conclusions:

1. Among the students of various fields of study, there were no statistically significant differences with respect to all of the tested parameters of postural stability. The differentiating group, the stability of which significantly exceeded the others, consisted of physical education students. There were no differences in the level of stability among female students of obstetrics and physiotherapy. The causes of identified diversity should be seen in the level of physical activity of the studied women.
2. There were no significant differences in the stability level of the individual student groups considered in the frontal and sagittal planes, in maintaining a standing position on the platform or in the performance of the equivalent task by the studied students. The scale of differentiation degree between the groups was similar irrespective of the direction of platform deflection.

Introduction

Issues related to the ability to maintain balance are the subject of research in many fields of science. This is due to the very important role it plays in our daily lives. These studies are usually focused on verifying hypotheses related to strategies of maintaining balance during quiet-standing [1, 2], and rarely refer to specific physical activity carried out under dynamic conditions [3- 5].

Many authors distinguish between two types of balance: static - understood as the ability to maintain a balanced position, and dynamic – based on maintaining or regaining a balanced position during motor activity or immediately after its performance. [6] This division, however, is a bit artificial because the body aims at the so-called equilibrium point, but in practice, it is never reached which means that we are never balanced. The most common dynamic as well as static balance are considered on two planes: sagittal and frontal, even if the device allows multi-axis measurements. Without minimizing the importance of stabilographic measurements, for clinical diagnostics or biomechanical research, more and more authors tend to determine greater usefulness in daily activities and sports for the measurement of dynamic balance as more similar to the real conditions occurring in everyday life [7]. More valuable information seems to be how the process of maintaining balance occurs in dynamic conditions, consciously swaying from a state of balance and back to it [8, 9].

Dynamic balance is measured in laboratory conditions on moving platforms (balance), two or multi-axis and on solid platforms coated with a material creating an unstable surface (various types of foam or sponge) (Bressel et al. 2007). There are still not many studies on the subject and the ones existing are mainly concentrated on comparing the two balance types [9, 10]. This is undoubtedly related to the small availability of adequate measuring equipment to date [8].

Coordination of balance maintaining processes of the body is an essential condition for the effectiveness of human motor behavior [6]. Upright position creates an unstable dynamic system subjected to constantly changing and often unpredictable conditions and frequent interference. They determine the selection of appropriate strategies for dealing with the learning of new or modifying existing patterns of behavior associated with maintaining stability of the body [11]. Stability is a broader concept and means the ability to recover the lost equilibrium as a result of destabilizing factors [12].

The academic community is a special group, which in the general opinion represents socially desirable traits and values, which often makes it the subject of scientific research. It was subjected to the studies carried out by: sociologists, educators, psychologists, biologists, theorists, physical education theorists, sports and also anthropomotorists [13]. Within the realm of the latter field of science, the assessment and development of individual components of somatic build are dealt with [14], and the level of activity and physical fitness of students [13, 15- 17]. In recent times, this type of analysis has become more desirable due to the fact that most universities have resigned from conducting physical education classes. It is inseparably connected with the question of whether students' own physical activity is sufficient enough without organized stimulation to achieve the positive measures of health, which in the American concept may be included in the structure of physical fitness in terms of health-related fitness (H-RF) [13].

So far, the least explored area of students' physical activity seems to be coordination capacity. In this study, we have studied the basic one, which undoubtedly is balance. It was decided to compare its level in three groups of female-students with varied, chosen fields of study and levels of physical activity. These groups are comprised of students from the Jagiellonian University, Collegium Medicum (CM) and the University School of Physical Education (AWF), studying in the fields of obstetrics, physiotherapy and physical education.

The aim of the study is to determine the degree of differentiation in the level of postural stability under dynamic conditions (forced by moving surface) in students depending on their field of study.

The following research questions were formulated:

1. Does the selected field of study, and the level of physical activity of the women related to this field affect their postural stability?
2. Do any of the observed differences in the stability level of the studied student groups exist to a similar extent in the frontal and sagittal planes?

Material and methods

studied group

The study included a total of 87 female students of two universities: UJ Collegium Medicum (CM) and AWF, studying in the field of obstetrics (CM 33 persons), physiotherapy (AWF-PT 28 persons), and physical education (AWF-PE 26 persons). The premise for qualification into the group was lack of previous contact with competitive sports, which could distort the measurement results.

None of the women participating in the study complained of imbalance or stated previous injuries which could affect the results of postural stability measurements. Participation in the study was voluntary.

The detailed characteristics of the population are given in Table 1.

Table1. Basic somatic characteristics of the studied female students of individual fields of study (; SD)

group	*n*	statistics	age	body height	body mass	BMI
Collegium Medicum field obstetrics (CM)	33	$\bar{x}$	20.8	166.2	59.8	21.6
		s	1.2	5.8	8.4	2.7
Univeristy School of Physical Education field – physical therapy (AWF-PT)	28	$\bar{x}$	20.8	166.5	60.2	21.7
		s	0.8	6.8	8.3	2.4
Univeristy School of Physical Education field – physical education (AWF-PE)	26	$\bar{x}$	20.6	166.7	58.4	21.0
		s	0.6	6.9	7.4	2.0

Apparatus

To determine the level of stability on an unstable surface, we used the Italian, Libra EasyTech balance platform (stabilometer) with the dimensions: length 430 mm; width 420 mm; height 65 mm and weight 2.5 kg. The measurements consisted of two elements: a platform with a USB interface, operated with the EasyTech 2.2-001-2.0 computer program and a computer set. During the trial, the stabilometer allowed to take a measurement in one axis, at the angular balance range of 15° in each direction and the maximum measurement error of 0.1° platform tilt. The measuring system of the device was a potentiometer, from which electrical signals are processed by an analog-digital card.

In the present study, we used two types of movement path patterns: a straight line (Fig. 1) and a sine wave with an amplitude of 5°C and a frequency of 10 cycles/min (Fig. 2). We used the balance curvature of r=40 cm and the sixth degree of difficulty (the deviation from the reference line by 5° in each direction). These parameters are set based on previous studies using the Libra platform [18].

The EasyTech 2.2-001-2.0 software processes the data derived from the platform defining the angular change of its position in time and calculates four stability parameters, separately for deflections in the lateral frontal and anterior rear sagittal planes:

- total area - the area between the movement path line obtained by the subject ("by way of stabilometer") and the example line. This parameter is the main indicator of stability, independent of the set degree of difficulty of the test. Its value is calculated as an integral function of the inclination of the platform (°) from the level after the time (s).
- external area - the area between the movement path line obtained by the subject and the line of the set degree of difficulty.
- external time – the total time of the subject beyond the set degree of difficulty
- recovery time – the longest single period of time beyond the set degree of difficulty

On the basis of the weighted average of all the parameters, the program calculates the stability index within a range from 0 to 100, where 100 represents the weakest value and 0 the best stability.

Research procedure

The task of the studied women was to maneuver the platform in such a way, by putting the appropriate foot pressure on the surface, that the line drawn on the computer screen reflects the center line best as possible (coinciding with it). Apart from the center line, two lines parallel to it, defining the scope of the adopted degree of difficulty of the test were displayed on both sides of the screen.

Each participant was subjected to two trials. In each of them, the subject stood upright on the platform, feet apart parallel to hip width. The measurements were performed separately for the frontal and sagittal planes (a total of four measurements):

1. The first task was to maintain the platform leveled with the use of visual feedback in the form of a graphical image of the test course displayed on the monitor screen. The subject tried to adjust her line to the established pattern, which in this case was a straight line. An example of the feedback from trial 1 is shown in Fig. 1.
2. In the second task, the subject performed a motor exercise based on consciously tilting the platform in the right direction, according to the specified path, which in this case was a sine wave. Just as in trial 1, the course of trial 2 was displayed on the monitor screen (Fig. 2).

All trails lasted one minute with a 20-second interval to change the balancing planes. Before proper measurements, a warm-up was conducted, which was a shortened version of trails 1 and 2 (2 x 30 sec in the frontal and 2 x 30 s in the sagittal plane with a 15 s interval for changing the platform arrangement).

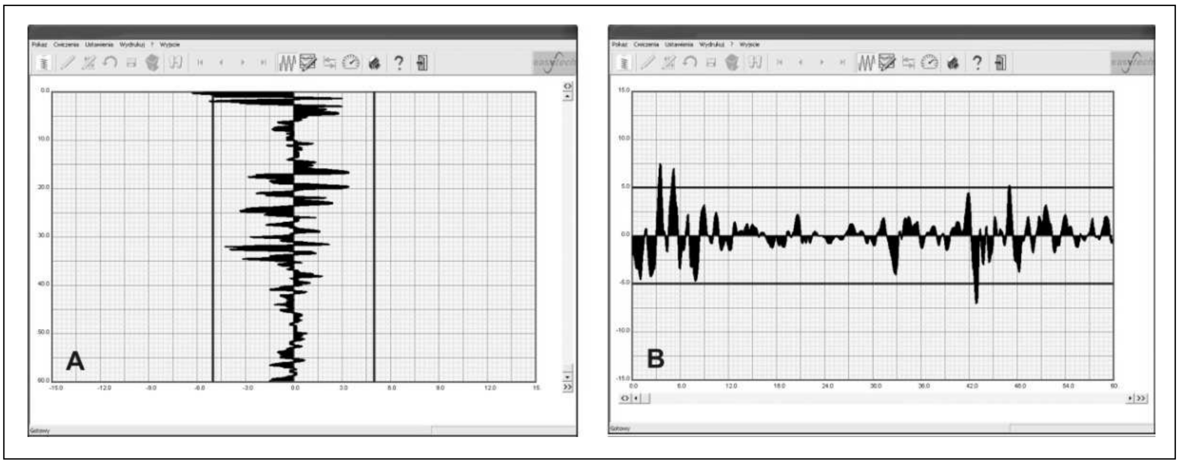

Figure 1. An example of a graphic record of the 1st trial course
A – frontal plane; B – sagittal plane

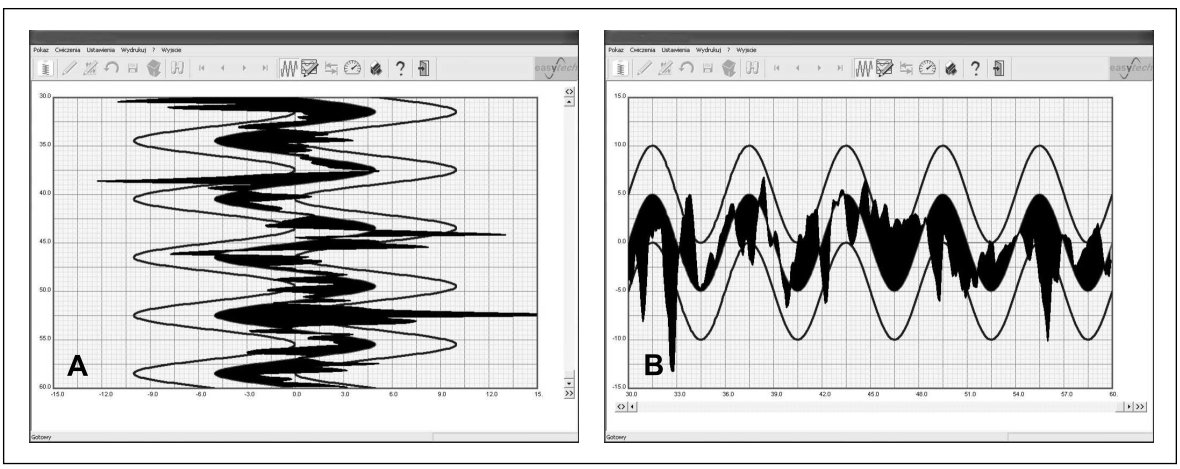

Figure 2. An example of a graphic record of the 2nd trial course
A – frontal plane; B – sagittal plane

Data analysis

The measurement results were initially devised using the basic methods of descriptive statistics. Arithmetic averages, minimum and maximum values, range and standard deviation were calculated. Normality of the distribution of the analyzed variables was verified using the Shapiro-Wilk test.

Due to the fact that only one of the analyzed variables (total area) in all trials and setting variations was normally distributed, it was decided to use nonparametric tests to determine the significance of differences between the calculated trials. For the purposes of determining the significance of differences between the two groups of students, we used the Kruskal-Wallis test, which is an extension of the Mann-Whitney U test when comparing more groups. After finding a statistically significant difference between the female students of a given field of study, in the case of the tested variable, post hoc multiple comparison was performed.

In order to determine the balancing precision, its indicator was calculated (balance precision indicator - BPI), indicating the percentage involvement of the external area (EA) in the total area (TA) of the surface, according to the formula: BPI = EA/TA) x 100. Calculations were performed using STATISTICA 10.0.

Results

According to the adopted methodology, the differences between the values of the individual parameters of stability, obtained in the three groups, were independently considered in two trial conditions: balancing with visual feedback (trial 1) and the balancing task (trial 2). Statistical significance of the obtained differences were verified with the Kruskal-Wallis test for multiple independent trials, and then post hoc multiple comparison was performed.

We analyzed the most representative variables characterizing the trial on the Libra platform, reflecting the essence of the undertaken study and the research questions. They are: stability index (SI), total surface area – characterizing the range of side sways in the frontal plane and anterior-posterior in the sagittal plane (TA), total external area (EA) beyond the area of test difficulty and the parameter characterizing the precision of the performed corrective movements – balance precision index (BPI). For all these stability parameters, their higher level is characterized by their lower values.

Maintaining the platform leveled with visual feedback about its current position (trial 1)

For all analyzed stability parameters, both in the frontal and sagittal planes, statistically significant differences between the two groups of students were noted.

In the frontal plane, the best results were by far obtained by the AWF-PE students. The TA values found for them were better by 27% than those achieved by CM, and by 28% compared to the AWF-PT students. The

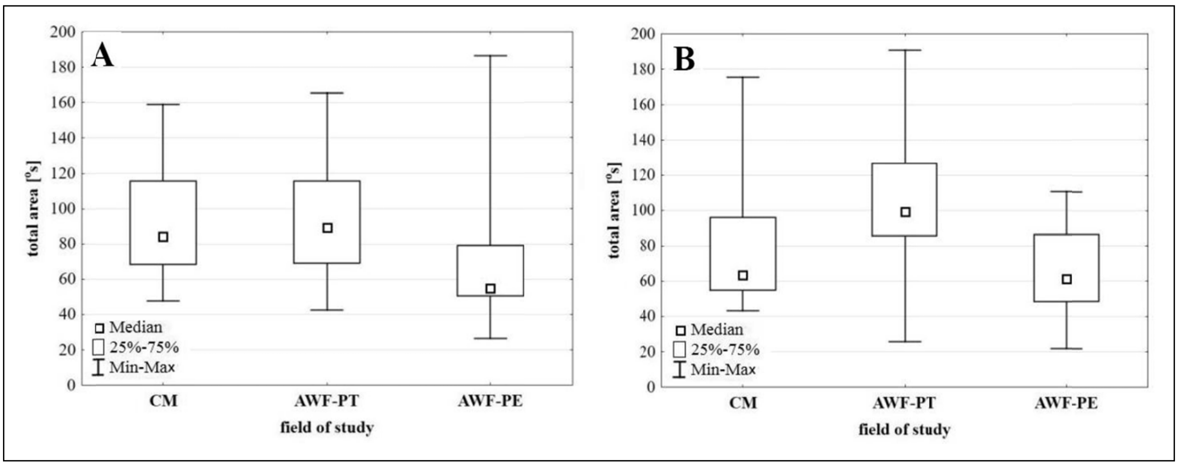

Figure 3. The median and gap in total area value during balancing on the platform in female-students' trial 1: UJ Collegium Medicum, field: obstetrics (CM), AWF, field physiotherapy (AWF-PT) and AWF, field physical education (AWF-PE). A – frontal plane; B – sagittal plane

Table 2. The results of ANOVA Kruskal-Wallis rank test regarding significance of intergroup differences and post hoc multiple comparisons: female-students of UJ Collegium Medicum, field of obstetrics (CM), AWF, field of physiotherapy (AWF-PT) and AWF field of physical education (AWF-PE), while balancing during trial 1 - frontal plane

parameter	group	$\bar{x}$	*s*	ANOVA Kruskal-Wallis rank			Multiple comparison test (*p*)			
				$\bar{x}$ rank	*H*	*p*	group	CM	AWF-PT	AWF-PE
SI	CM	4.1	1.9	55.91	17.36	**0.0002**	CM		1.0000	**0.0003**
	AWF-PT	4.0	1.7	54.32			AWF-PT	1.0000		**0.0017**
	AWF-PE	2.7	1.9	28.85			AWF-PE	**0.0003**	**0.0017**	
TA [°s]	CM	92.0	30.2	54.24	15.91	**0.0004**	CM		1.0000	**0.0013**
	AWF-PT	94.0	30.6	55.78			AWF-PT	1.0000		**0.0012**
	AWF-PE	67.6	32.3	29.65			AWF-PE	**0.0013**	**0.0012**	
EA [°s]	CM	4.2	5.3	58.36	16.97	**0.0002**	CM		0.6327	**0.0002**
	AWF-PT	2.4	3.1	49.98			AWF-PT	0.6327		**0.0220**
	AWF-PE	1.4	4.3	30.17			AWF-PE	**0.0002**	**0.0220**	
BPI [%]	CM	3.6	3.7	58.69	16.68	**0.0002**	CM		0.4643	**0.0002**
	AWF-PT	2.0	2.2	49.17			AWF-PT	0.4643		**0.0361**
	AWF-PE	1.1	2.6	30.62			AWF-PE	**0.0002**	**0.0361**	

SI – stability index; TA – total area; EA – external area; BPI – balance precision indicator.

Statistically significant differences are marked in bold p <0.05

Table 3. The results of ANOVA Kruskal-Wallis rank test regarding significance of intergroup differences and post hoc multiple comparisons: female-students of UJ Collegium Medicum, field of obstetrics (CM), AWF, field of physiotherapy (AWF-PT) and AWF field of physical education (AWF-PE), while balancing during trial 1 - sagittal plane

parameter	group	$\bar{x}$	*s*	ANOVA Kruskal-Wallis rank			Multiple comparison test (*p*)			
				$\bar{x}$ rank	*H*	*p*	group	CM	AWF-PT	AWF-PE
SI	CM	3.7	2.1	46.78	15.49	**0.0004**	CM		0.0618	0.1627
	AWF-PT	4.6	1.8	62.28			AWF-PT	0.0618		**0.0003**
	AWF-PE	2.7	1.3	33.35			AWF-PE	0.1627	**0.0003**	
TA [°s]	CM	80.7	34.9	43.97	16.07	**0.0003**	CM		**0.0086**	0.6997
	AWF-PT	103.4	32.0	63.93			AWF-PT	**0.0086**		**0.0004**
	AWF-PE	67.5	26.4	35.65			AWF-PE	0.6997	**0.0004**	
EA [°s]	CM	4.9	7.2	55.15	15.27	**0.0005**	CM		1.0000	**0.0010**
	AWF-PT	3.9	4.7	54.22			AWF-PT	1.0000		**0.0033**
	AWF-PE	1.1	1.8	30.10			AWF-PE	**0.0010**	**0.0033**	
BPI [%]	CM	4.6	4.8	57.37	17.17	**0.0002**	CM		1.0000	**0.0002**
	AWF-PT	3.2	3.4	51.97			AWF-PT	1.0000		**0.0066**
	AWF-PE	1.1	1.7	29.37			AWF-PE	**0.0002**	**0.0066**	

SI – stability index; TA – total area; EA – external area; BPI – balance precision indicator.

Statistically significant differences are marked in bold p <0.05

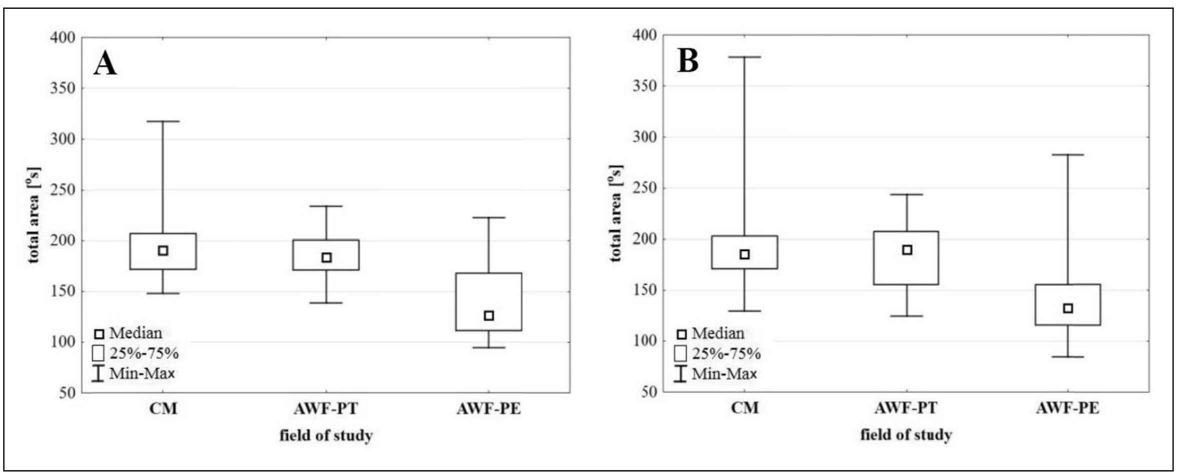

Figure 4. The median and gap in total area value during balancing task trial 2: UJ Collegium Medicum, field: obstetrics (CM), AWF, field physiotherapy (AWF-PT) and AWF, field physical education (AWF-PE). A – frontal plane; B – sagittal plane

differences between the fields of study: obstetrics and physiotherapy regarding TA as SI were small and not statistically significant (Fig. 3., Tab. 2).

There were, however, slight differences between the female representatives of these fields regarding balance precision indicator (EA and BPI). It definitely took the AWF-PT students much less time to cross the set difficulty threshold, resulting in the return to balance (Tab. 2).

The level of stability in the sagittal plane was practically the same among the physical education students, while it was higher and in the case of obstetrics students (the difference TA +12%), and lower in the physiotherapy students (the difference TA -9%). The relative difference in TA compared to the AWF-PE group was 16% for CM and 35% for the AWF-PT students (Fig. 3B; Tab. 3). The remaining balance precision parameters were similar to those obtained in the frontal plane in the AWF-PE group, but were slightly lower in the physiotherapy and obstetrics groups. Despite the higher total stability score (SI and TA) of the midwives in the sagittal plane relative to frontal plane, balance precision was still exceeded by the students of physiotherapy (Tab. 3).

Table 4. The results of ANOVA Kruskal-Wallis rank test regarding significance of intergroup differences and post hoc multiple comparisons: female-students of UJ Collegium Medicum, field of obstetrics (CM), AWF, field of physiotherapy (AWF-PT) and AWF field of physical education (AWF-PE), during balancing task trial 2 - frontal plane

parameter	group	$\bar{x}$	*s*	ANOVA Kruskal-Wallis rank			Multiple comparison test (*p*)			
				$\bar{x}$ rank	*H*	*p*	grupa	CM	AWF-F	AWF-WF
SI	CM	10.8	2.7	60.17	31.11	**0.0000**	CM		1.0000	**0.0000**
	AWF-PT	10.0	2.3	54.17			AWF-PT	1.0000		**0.0001**
	AWF-PE	6.7	2.5	22.63			AWF-PE	**0.0000**	**0.0001**	
TA [°s]	CM	192.1	30.7	60.54	34.15	**0.0000**	CM		1.0000	**0.0000**
	AWF-PT	183.4	24.3	54.78			AWF-PT	1.0000		**0.0000**
	AWF-PE	138.5	31.8	21.37			AWF-PE	**0.0000**	**0.0000**	
EA [°s]	CM	25.9	17.9	61.33	24.76	**0.0000**	CM		0.2075	**0.0000**
	AWF-PT	18.2	12.1	49.17			AWF-PT	0.2075		**0.0069**
	AWF-PE	9.5	11.5	26.65			AWF-PE	**0.0000**	**0.0069**	
BPI [%]	CM	12.6	6.1	61.21	22.16	**0.0000**	CM		0.1390	**0.0000**
	AWF-PT	9.3	5.1	47.87			AWF-PT	0.1390		**0.0247**
	AWF-PE	5.8	5.6	28.35			AWF-PE	**0.0000**	**0.0247**	

SI – stability index; TA – total area; EA – external area; BPI – balance precision indicator.

Statistically significant differences are marked in bold p <0.05

Table 5. The results of ANOVA Kruskal-Wallis rank test regarding significance of intergroup differences and post hoc multiple comparisons: female-students of UJ Collegium Medicum, field of obstetrics (CM), AWF, field of physiotherapy (AWF-PT) and AWF field of physical education (AWF-PE), during balancing task trial 2 - sagittal plane

Parameter	group	$\bar{x}$	*s*	ANOVA Kruskal-Wallis rank			Multiple comaprison test (*p*)			
				$\bar{x}$ rank	*H*	*p*	group	CM	AWF-PT	AWF-PE
SI	CM	10.6	3.2	58.23	27.68	**0.0000**	CM		1.0000	**0.0000**
	AWF-PT	10.0	2.6	55.65			AWF-PT	1.0000		**0.0000**
	AWF-PE	6.9	3.2	23.83			AWF-PE	**0.0000**	**0.0000**	
TA [°s]	CM	190.7	41.2	58.15	28.84	**0.0000**	CM		1.0000	**0.0000**
	AWF-PT	182.4	30.2	56.22			AWF-PT	1.0000		**0.0000**
	AWF-PE	141.0	39.8	23.29			AWF-PE	**0.0000**	**0.0000**	
EA [°s]	CM	24.8	17.3	59.19	23.51	**0.0000**	CM		0.9274	**0.0000**
	AWF-PT	19.6	12.5	52.38			AWF-PT	0.9274		**0.0012**
	AWF-PE	9.7	14.5	26.15			AWF-PE	**0.0000**	**0.0012**	
BPI [%]	CM	12.1	5.2	59.82	22.51	**0.0000**	CM		0.5336	**0.0000**
	AWF-PT	10.0	5.3	50.80			AWF-PT	0.5336		**0.0039**
	AWF-PE	5.5	5.8	27.04			AWF-PE	**0.0000**	**0.0039**	

SI – stability index; TA – total area; EA – external area; BPI – balance precision indicator.

Statistically significant differences are marked in bold p <0.05

Performing the balancing task with visual feedback about the current position of the platform (trial 2)

Similarly as in the case of the previous trial (1), where the task of the students was only to maintain the platform leveled, as in the case of the equivalent task (2), which consists of consciously controlling the platform in accordance with the emitted pattern, the physical education students dominated (Fig. 4A and B).

In the frontal plane, in the case of the TA parameter, the relative differences between the female students were similar to those observed in trial 1 and totaled 28% in the AWF-PE to CM relation, and for AWF-PE to AWF-PT it totaled 24% (Fig. 4A; Tab. 4). Compared to maintaining the platform leveled, controlling the position of the platform is a more difficult task, and therefore the parameters characterizing balance precision trial 2 were greater than the values for trial 1. In the best group - AWF-PE, the value of the BPI increased from 1.1% in the first trial and up to 5 8% in the second. Similar relationships were observed in the other groups, apart from the relative difference between AWF-PE and CM, which in this case (BPI) was 54%, while in relation to the AWF-PT group it totaled 38%. The differences in balance precision between the AWF-PT and CM groups were visible in this case, but did not prove to be statistically significant ($p = 0.139$) (Tab. 4).

The results obtained in the sagittal plane show very similar stability in both of the considered directions of tilting the platform. Also, in this case, the group that stood out 'in plus' compared to the others proved to be the physical education students (Fig. 4B). Their relative advantage over the physiotherapy colleagues (expressed by TA parameter) was 23%, and 26% in the case of the obstetrics students (Tab. 5). Similarly as in previous trials, there were no statistically significant differences between the AWF-PT and CM students, although slightly better balance precision can be observed in the sagittal plane of physiotherapy students ($p = 0.534$).

Discussion

Maintaining balance of the human body is a highly complex process which requires coordination of the musculoskeletal system with the central nervous system (CNS). Coordination of movements of individual body segments is essential to maintain an upright position, which stabilized, in turn, enables a person to perform voluntary movements. In this context, its high level is desirable in the representatives of all the three analyzed fields of study.

Most researchers focus on the control processes for both balance in terms of neurophysiology and biomechanics. In their work, they less frequently view balance as an inter-individual property conditioned by these processes. These issues are mostly devoted to the science of physical culture, and in particular anthropomotorics, which classifies balance as a specific motor coordination ability of fundamental importance for effective human motor behavior [6; 19].

Most frequently, stability parameters are determined by measurements performed on a stable surface. While the obtained results of these tests are extremely useful for determining a number of neurological dysfunctions, or evaluating the process of recovery after injury, its use in healthy people is limited. Maintaining an upright position on an unstable surface is more difficult and poses postural control mechanisms with more demands than on a stable surface. In this case, adjusting the position to a variable situation requires rapid and optimal control of the use of afferent information, the inlet of which is significantly reduced, particularly from proprioceptors [20].

In conditions of a stable surface, scientists are often forced to introduce additional external interference when trying provoke changes in the adaptive mechanisms to maintain balance, e.g. change of strategy. In our study, standing on the balance platform in the trial 1 conditions forced the participants to quickly adapt to the unstable surface, and in trial 2, maintaining stability required additional strategy changes from the ankle-joint to the hip-joint strategy.

Trials 1 and 2 were based on the same visual feedback, the differentiating factor for them was the difficulty of the task. Introduction of trial 2 was designed to check whether the relations between the studied variables stated in conditions of trail 1 in students of three fields of study would change. Therefore, we attempted to determine how significantly they are influenced by physical activity.

As expected, the chosen field of study undoubtedly has impact on the level of postural stability. Of course, the differences do not arise directly from the scientific interests of the women but from their previous and current physical activity. The relationship between the choice of field of study and the level of motor skills, especially in relationship to the students of physical education, was of interest to many previous authors [13-15, 17]. These works rarely touched upon issues of coordination abilities, especially the so-called. "gross motor-skill" which includes postural balance.

The results obtained in our study, both in trial 1 and 2, clearly show much better stability in the physical education students. Relatively, their statistically significant advantage over the weakest obstetrics group was: in trial 1, 27% - frontal plane, 16% - sagittal plane; in trial 2, 28% frontal plane, 26% - sagittal plane. A much higher level of stability in relation to their colleagues from their alma mater was observed by physiotherapy students. The relative advantage of the AWF-PE group in this case was: in trial 1, 28% - frontal plane 28%, 35% - sagittal plane; in trial 2, 24% - frontal plane, 23% - sagittal plane.

The results obtained by the students of physiotherapy, referring them to the nature of the AWF university, are very disturbing. They point to their far insufficient physical activity, and their slightly higher balance precision is a small consolation. The fact is that, in statistical terms, with the almost same age and somatic build, the level of postural stability of AWF students – physiotherapy field is no different from their CM colleagues - field of obstetrics. It should be noted that the nature of the AWF graduates of both fields will in the future require them to perform actions in a standing position, often in unstable positions. It is also important that the results obtained by the students of physical education oscillate between average and good, which classifies the results of the other study groups as weak [18].

Many authors believe that the results obtained on the balance platform do not only characterize the studied level of postural stability but also the speed of adapting to the conditions of an unstable surface as an indicator of the level of the subjects' coordination abilities [6, 11, 21-23]. In this broader context, the restoration of compulsory P.E. classes at universities should be postulated, and in the case AWF-PT, the realization of the curriculum program should be verified.

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Conclusions

1. Among the students of various fields of study there were no statistically significant differences with respect to all the tested parameters of postural stability. The group for which the stability significantly exceeded the others were physical education students. There were no differences in the level of stability among female obstetrics and physiotherapy students. The causes of the identified diversity should be seen in the level of physical activity of the women.
2. There were no significant differences in the level of stability within the student groups regarding the frontal and sagittal planes in maintaining an upright position on the platform or in the performance equivalent tasks by the studied students. The scale of the difference degree between the groups was similar irrespective of the direction of deflection of the platform.

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