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Postural Stability of Students of Pavol Jozef Šafárik University

Abstract

The objective of this study was to determine the point values of movement patterns using the FMS™ method and to compare them amongst various groups of students of Pavol Jozef Šafárik University in Košice (UPJS). The group consisted of students of P.J. Šafárik University ($n=30$, 21 women and 9 men). The average body height was 170,1 cm, average age was 20,9 years of age, average body weight without distinguishing gender was 65,8 kg and average BMI was 22,6. FMS™ testing was made up of 10 standard tests of which 7 tests had scores from 0 to 3 points. The presence of pain in predetermined movements was evaluated in three additional tests. The average overall score in the FMS™ test, evaluating the entire group regardless of gender, was 16.1 points. When comparing the results achieved in the tests amongst groups of subjects we demonstrated a statistically significant higher level in groups of men (FMSm = 2,78) than in groups of women (FMSf = 1,24; $p \leq 0{,}01$). When comparing the results between students of the "Sports and Health" area of study (FMSs = 2,33) and other students of UPJS (FMSu = 1,43), we demonstrated a statistically higher level in students of the sport field. Statistically significant differences between the studied groups were shown by analytical evaluation of scores achieved in each FMS system test. We have shown a higher statistically significant level in the average test score of the torso stability click test in the group of men (FMSm = 2,78) than in the group of women (FMSf = 1,24; $p \leq 0{,}01$; graph 1). We have also shown a statistically significant higher score in the torso stability click test in the student group SAR (FMSs = 2,33) than in the group of students of other UPJS faculties (FMSu = 1,43; $p \leq 0{,}01$ graph 1). We can conclude that our results are comparable with similar studies published abroad. Higher points of joint mobility and movement patterns of the lower extremities have been reported in females sample. For men, we observed a higher points value in the evaluation of trunk stability. Which we attributed to the development of muscles of the upper body of men as an expression of muskulinity contrary unhappiness with appearens in women (gynoid type) motivates to work on lower body. We contemplate that the above-mentioned reality influenced the point values of our sample. We are aware of the need for further research in this area with the aim of better understanding the factors underlying a given reality.

Keywords: FMS test, movement patterns, torso stability, joint mobility.

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Introduction

FMS™ Diagnostics (FMS) captures the basic movements, motoric coordination within movement patterns and the ability to perform basic movements without the need of complicated skills. The basic idea of FMS was to show motion patterns using a simple system of classification of movement assessment. The FMS system consists of a number of items for evaluation, in the case of isolated measurement, the FMS system becomes dysfunctional because the body is too complex for the movements to be isolated in the early stages. FMS is composed of seven movement tests, which require a balance of mobility and stability. Patterns, which are used, provide a clear basic performance, manipulative and stabilizing movements, by placing the subjects in a position where all weaknesses, imbalances, asymmetries and limitations become visible for trained health professionals and fitness trainers. The result of the test indicates the greatest deficiency of movement, limitations, possibly asymmetry and, ultimately, puts them in relation. Once you find an asymmetry or deficiency, you can use measurements that are more accurate [2].

The basis of any motion is a reflective muscle tone and thereon developed system of postural and righting reflexes, which are managed by the involvement of reticular formation, static-kinetic sensor and cerebellum. For complex systems of intentional movement (motoric system of movement, targeted motor skills), the basis is a motoric positioning system, which is controlled by the activity of the cerebral cortex, basal ganglia and cortical brains. All neural influences that cause muscle contraction are applied by means of motoneurons which are stored in the nuclei of cranial nerves and the spinal cord [10].

The knowledge of developmental kinesiology is according to [12] beneficial not only for the rehabilitation of movement disorders in paediatrics, but also has its irreplaceable role in the rehabilitation of adults and in therapeutic physical education. By looking at the position of axle organs (the head, torso, pelvis) in the adult patient and the means of one´s movement, we are subsequently able to determine for every individual the developmental stage which each deficiency originated in.

According to [12], poor quality of posture sooner or later brings vertebral difficulties. Knowledge of developmental kinesiology is therefore equipment necessary for general physical therapists dealing with rehabilitation of movement disorders but also for other physical education professionals not only in the area of diagnosis but also, notably, in therapy.

The concept of movement patterns, according to [6] in this context, means common functions of various muscle groups which hold the body and with which the body straightens against gravity, moves forward and carries out targeted movements. Movement patterns are coordinated and controlled in the central nervous system.

There are three types of motion according to [6]:

— reflex movement – the simplest motoric behavior. These reactions are rapid and involuntary,
— rhythmic movement – e.g. chewing, breathing, climbing, running. Features of reflex and deliberate negotiations are united,
— targeted movement – are targeted and one learns most of them. Their implementation improves with additional exercises

The Vojta Principle according to [6] describes the normal legitimate development of child movement and holding position (postural ontogenesis) in the first year of life and uses movement patterns, which are available to the child based on congenital movement programs, for diagnosis and therapy. Each person has a movement pattern available for individual development. Posture and movement are dependent on one another. Each change in body position, although slight, requires adaptation of posture and balance.

During the course of human phylogeny and ontogeny, basic movement programs that correspond to the generic human anatomical structures are made. These programs form a kind of kinetic matrix [11].

Movement programs and patterns subject to genetically programmed development – we do not need to learn how to grasp a toy, motion stereotypes thereon subject to the process of motoric learning – we have to learn how to administer an undercut in ball games [4].

Methods

Probands of the Study

The group consisted of 30 students of P.J. Šafárik University in Košice (UPJŠ). The average age of the studied group was 20,9 years of age, the average height was 171,0 cm and the average BMI was at the level of 22,6. The selection of students for the study was random, without taking into account gender and field of study, the only condition was that students of „Sport and Recreation" study programme (SAR) should make up at least half of the studied group. 21 women (average age: 20,1 years old, average BMI: 21,8) and 9 men (average age: 22,5 years old, average BMI: 24,2) were included in the studied group. In terms of UPJS, student representation, the studied group consisted of 9 students of SAR (average age: 21,3 years of age, average BMI 20,6) and 21 students of other UPJS faculties (average age: 20,6 years of age, average BMI: 22,2)

Methods of Measuring and Obtaining Empirical Data

The diagnosis of movement patterns was carried out using FMS™ tests. The testing took place during the winter and at the beginning of the summer semester of the academic year 2015/2016. We carried out the tests during academic lessons. The tests were carried out during morning and afternoon lessons.

The testing consisted of 7 FMS™ (FMS) tests evaluated with points – functional movement screen and three additional tests. In total, the FMS system consists of 10 tests. Tests, which are evaluated using points, follow each other in fixed order: deep squatting, stepping over obstacle, lunging, shoulder mobility , active leg raising from lying position, push-ups and rotary stability (Fig 1). Each of the mentioned tests was evaluated from 0 to 3 points where 0 indicates pain. There are three additional so-called clearing tests to identify the pain itself: „shoulder pain" test, „cobra" test and „turtle" test. We recorded only the value of „no pain" and „pain" into our notebook. The most successful attempt out of three attempts was evaluated. The sum of points in all of the tests indicated the final total score [13]. The maximal score, which can be obtained, is 21 points. The tests are carried out using the FMS™ set (Fig. 2).

The Functional Movement Screen ™ (FMS™) is a new tool used for testing and evaluating basic human movement patterns in order to identify restrictions or asymmetry that could predetermine the possibility of injury to the tested subject. Incorrect movement patterns can seriously compromise the effectiveness of training as well as overall fitness and health [13].

Figure 1. FMS tests

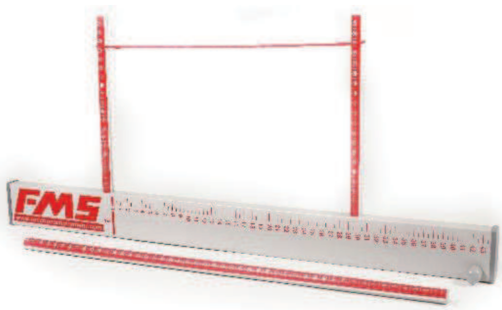


Figure 2. Testing set

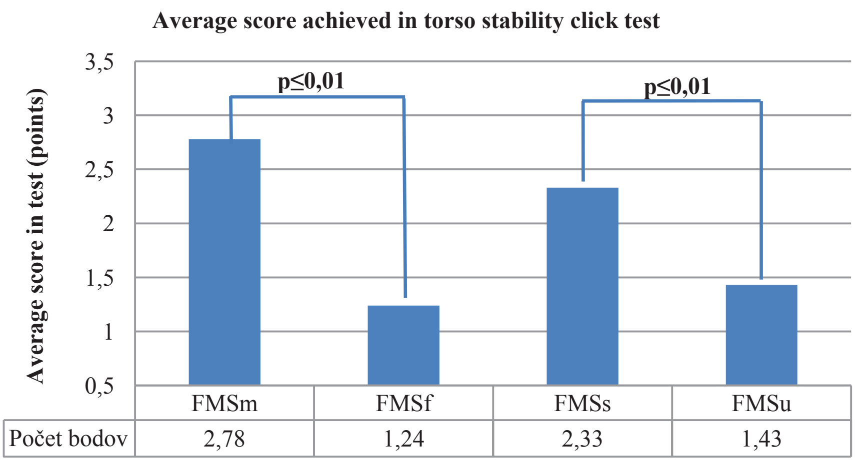
Methods of Processing and Evaluation of Results

During the processing the results we used standard descriptive data of the studied group and we used a nonparametric statistical method for independent files – the Mann-Whitney U Test for evaluating the statistical significance of differences in between the groups.

Results

The overall average score, while looking at the studied group regardless of gender, is 16,10 points. When comparing the total score of genders, the average total score of women was at the level of 16,14 points and in the group of men at the level of 16,11 points. When comparing the results between the genders, we were not able to prove any significant differences at any of the monitored levels of statistical significance (p=n.s.).

When comparing the average total score of SAR students (SAR=16,70) with students of other faculties (IF=16,00), we note a slightly higher score in the group of SAR students. However, this difference did not show statistical significance in any of the monitored levels.



Legend:
FMSm (average test score in group of men)
FMSf (average test score in group of women)
FMSs (average test score in group of SAR students)
FMSu (average test score of other UPJS faculties)

Graph 1. Comparison of the average score in the torso stability click test of the genders and of groups of UPJS students

Source: own research.

We were able to prove statistically significant differences between the studied groups by analytical comparison of scores achieved in FMS system tests. We have shown a significantly higher level in the average score of the torso stability click test in the group of men (FMSm=2,78) than in the group of women (FMSf=1,24; $p \leq 0{,}01$; graph. 1). We have also shown a statistically significant higher score in the torso stability click test in the group of SAR students (FMSs=2,33) than in the group of students of other UPJS faculties (FMSu=1,43; $p \leq 0{,}01$ graf 1).

Table 1. Average values, comparison of the genders, comparison of field of study of students

	Average values of all subjects	Average values of all women	Average values of all men	Average values of SaR students	Average values of female SaR students	Average values of male SaR students	Average values of students without SaR students	Average values of female students without SaR students	Average values of male students without SaR students
Score	30	21	9	9	3	6	21	18	3
Age (years)	20,88	20,11	22,50	21,33	20,66	21,66	20,63	20,00	23,66
Height (cm)	170,00	166,29	177,87	174,88	167,33	178,66	167,25	166,07	176,33
Weight (kg)	65,80	60,52	77,00	72,11	58,00	79,16	62,25	61,07	76,00
Deep squat	2,40	2,38	2,44	2,44	2,66	2,33	2,38	2,33	2,66
Hurdle step	2,06	2,19	1,77	2,22	2,66	2,00	2,00	2,11	1,33
In-line sidestep	2,73	2,85	2,44	2,66	3,00	2,50	2,76	2,83	2,33
Shoulder mobility test	2,83	2,95	2,55	2,66	2,66	2,66	2,90	3,00	2,33
Active leg lift	2,40	2,52	2,11	2,33	2,33	2,33	2,42	2,55	1,66
Torso stability click test	1,70	1,23	2,77	2,33	1,66	2,66	1,42	1,16	3,00
Rotational stability	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00
The total score	16,13	16,14	16,11	16,66	17,00	16,50	15,90	16,00	15,33

Source: own research.

Discussion

It is possible to achieve a maximum of 21 points in diagnosis using FMS. A score below 14 points, according to previous studies [1], [3] indicates a prediction of a higher risk of injury in the near future. This is why the diagnosis using FMS tests rewarding and may be considered as a kind of injury prevention, whether of clients, students or the entire population doing sports. A wide scale of exercises for improving movement patterns exists, which includes sequential steps for applying in case of particular problematic movement patterns.

In our research, the students achieved an overall score of 16,13 points. In the overall average score, SaR students reached a value of 16,66 points and students of other faculties 15,9 points. We assume that the difference is caused by an active dedication of SAR students to sports The study where 209 young active individuals [9] were tested.(108 women, 101 men in the ages of 18–40 years of age) resulted in a total FMS score of 15,70 points (women 15,60 points; men 15,80 points) without a significant difference between the genders, [8] gives an FMS score amongst middle-aged men and women, who were divided according to age; women in the range of 20–39 years of age had the highest total FMS score. Lenková [5] (n = 26) report an average total score of 15,50 points.

In table no. 1, the values of each gender are given. In our research, we have not dealt with the differences in points between the genders. Other studies [7], [8], [9] have dealt with the difference between the genders. They have not found any significant difference between the sexes and there weren't any significant differences between sex and adolescence.

We can say that in our studies, we have met with clearly better joint mobility among the female sex and also with higher point values in women when evaluating th movement patterns of the lower extremities (Table 1). In men, the opposite is true. Worse joint mobility dominated and heir torso stability was at a better level than in women. Similar results were also recorded by [5].

When comparing the results, we found that the overall average score of SaR students 16,66 is by 0,76 points better than that of students of other faculties15,90 points.

SaR students achieved a better score compared to students of other faculties in these tests (the first value is of SaR students): deep squat 2,44/22,38, hurdle step 2,22/2,00, torso stability click test 2,33/1,42.

Students of other faculties achieved a better score compared to SaR students in these tests (the first value is of other university students): in-line sidestep 2,76/2,66, shoulder mobility test 2,90/2,66, active leg lift in lying position 2,42/2,30.

No subject reported pain in any of the evaluated tests, therefore no proband scored 0 points. In the pain evaluation test, 3 subjects reported pain. It was reported in pain test of shoulder of dominant hand. Pain was reported only by SaR students. Students of other faculties did not report any pain in the pain evaluation tests. This phenomenon can be attributed to a probable active sports history of probands where there is a presumption of over-using the given limb in active sports.

We can conclude that our results are comparable with similar studies published abroad. Higher points of joint mobility and movement patterns of the lower extremities have been reported in females sample. For men, we observed a higher points value in the evaluation of trunk stability. Which we attributed to the development of muscles of the upper body of men as an expression of muskulinity contrary unhappiness with appearens in women (gynoid type) motivates to work on lower body. We contemplate that the above-mentioned reality influenced the point values of our sample. We are aware of the need for further research in this area with the aim of better understanding the factors underlying a given reality.

Potential factor determining differences according to [14] can be a maximum average value of the whole body of average woman is about 60% of the maximum average volue of average man. The average strenght of the upper body is in the range from 25 to 55% of the average strenght of the men.

For the completeness of information, we present the minimum and maximum values in the tests o all UPJS students in Table 2.

Table 2. minimal and maximal values achieved by all students of P.J. Safarik University

Test All subjects	Minimal value	Maximal value
Deep squat	1	3
Hurdle step	1	3
In-line sidestep	1	3
Shoulder mobility test	2	3
Active leg lift in lying position	1	3
Torso stability click test	1	3
Rotational stability	2	2
Total score	10	19

Source: own research.

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Stabilność postawy studentów Uniwersytetu im. Pavla Jozefa Šafárika

Streszczenie

Celem niniejszego badania było określenie wartości punktowej wzorców ruchowych przy użyciu metody FMS™ i porównanie ich dla różnych grup studentów Uniwersytetu im. Pavla Jozefa Šafárika w Koszycach (UPJS). Grupa składała się ze studentów Uniwersytetu im. P.J. Šafárika (n=30, 21 kobiet i 9 mężczyzn). Średni wzrost wynosił 170,1 cm, średnia wieku wynosiła 20,9 lat, średnia waga bez podziału na płeć wynosiła 65,8 kg, a średni BMI wynosił 22,6. Testowanie FMS™ składało się z 10 standardowych testów, z których 7 miało punktację od 0 do 3 punktów. Obecność bólu przy zaplanowanych ruchach oceniano w trzech dodatkowych testach. Średni wynik ogólny w teście FMS™, oceniający całą grupę bez uwzględnienia płci, wyniósł 16,1 punktów. Porównanie wyników testów grup kierunkowych statystycznie pokazuje, że grupy męskie osiągnę-

ły w nich wyższy poziom (FMSm=2,78) niż grupy żeńskie (FMSf=1,24; $p \leq 0,01$). Porównując wyniki studentów kierunku studiów sport i zdrowie (FMSs=2,33) z pozostałymi studentami UPJS (FMSu=1,43), zademonstrowaliśmy statystycznie wyższy poziom studentów kierunku sportowego. Statystycznie ważne różnice między badanymi grupami ukazano za pomocą analitycznej oceny wyników osiągniętych w każdym teście systemu FMS. Wykazaliśmy statystycznie wyższy, ważny poziom średniego wyniku testu stabilności tułowia w grupie mężczyzn (FMSm=2,78), niż w grupie kobiet (FMSf=1,24; $p \leq 0,01$). Pokazaliśmy również znacząco wyższy statystycznie wynik w teście stabilności tułowia w grupie studentów SAR (FMSs=2,33) od tego osiągniętego przez studentów innych wydziałów UPJS (FMSu=1,43; $p \leq 0,01$). Możemy zatem wnioskować, że nasze wyniki są porównywalne z wynikami podobnych badań publikowanych za granicą. U badanych grup żeńskich odnotowano wyższą punktację ruchliwości stawów i wzorców ruchowych kończyn dolnych. U mężczyzn zaobserwowaliśmy wyższe wartości punktowe przy ocenie stabilności tułowia, co przypisaliśmy pracy nad rozwojem mięśni górnej części ciała u mężczyzn jako oznace męskości w przeciwieństwie do niezadowolenia z takiego wyglądu u kobiet (typ kynoidalny), co motywuje do pracy nad dolnymi partiami ciała. Analizujemy możliwość wpływu wyżej wymienionego faktu na wartość punktową badanej przez nas grupy. Mamy świadomość potrzeby prowadzenia dalszych badań zmierzających do lepszego zrozumienia czynników leżących u podstawy danych realiów.

Słowa kluczowe: test FMS, wzorce ruchowe, stabilność tułowia, ruchliwość stawów.