Fizjoterapeuta – predyspozycje zawodowe. Poziom gibkości

Physiotherapist – occupational predispositions. Level of flexibility

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Streszczenie

Wstęp. Możliwie wysoki poziom sprawności funkcjonalnej jest nie tylko podstawą dobrostanu człowieka, ale odgrywa też istotną rolę w pełnieniu ról społecznych, w tym funkcji zawodowych. Wśród zawodów, gdzie sprawność fizyczna jest istotnym elementem jakości wykonywanej pracy, jest zawód fizjoterapeuty. Jedną ze składowych sprawności fizycznej jest gibkość. W zawodach cechujących się zmiennością pozycji oraz różnym obciążeniem wysiłkiem właściwy poziom gibkości wydaje się mieć szczególne znaczenie.
Cel pracy. Celem badań było określenie poziomu ruchomości (gibkości) tułowia wśród studentów fizjoterapii. Postanowiono również zbadać w jakim stopniu takie zmienne jak płeć, wiek, parametry morfologiczne, przeszła oraz aktualna aktywność fizyczna mają związek z prezentowanym poziomem gibkości.
Materiał i metody. Zbadano 341 osób: 289 kobiet (84,25% ogółu) i 52 mężczyzn (15,25%). Średnia wieku w badanej grupie wynosiła: 20.26 lat (SD=1.69) dla kobiet; 19.85 lat (SD=1.73) dla mężczyzn. Byli to studenci kierunku fizjoterapia.
Zebrano dane dotyczące wieku, przeszłości sportowej oraz aktywności fizycznej – według kwestionariusz Baecke. Wykonano pomiary antropometryczne oraz trójpłaszczyznowy pomiar gibkości kręgosłupa.
Wyniki. Odnotowano słabe związki parametrów morfologicznych z gibkością – tylko u kobiet. Aktywność fizyczna silnie różnicuje poziom gibkości u kobiet w płaszczyźnie strzałkowej ($p<.05$) i poprzecznej ($p<.001$; $p<.002$), podobnie przeszłość sportowa: płaszczyzna strzałkowa: $p<.001$ i poprzeczna strona lewa ($p<.05$). U mężczyzn tylko przeszłość sportowa różnicowała gibkość w płaszczyźnie poprzecznej dla strony prawej ($p<.05$)
Wnioski. Poziom gibkości jest zróżnicowany indywidualnie, szczególnie w płaszczyźnie strzałkowej. Płeć, wiek oraz parametry morfologiczne u młodych, dorosłych są słabo powiązane z gibkością. Przeszła oraz aktualna aktywność fizyczna wykazują korzystny wpływ na sprawność funkcjonalną tułowia.

Słowa kluczowe:

sprawność funkcjonalna, gibkość tułowia, aktywność fizyczna, trójpłaszczyznowa ocena gibkości, zawód fizjoterapeuty

Abstract

Background. Possibly high level of functional efficiency is not only the foundation of human welfare, but it also plays an important role in fulfilling social functions, including professional functions. Among professions in which physical fitness is an important element of the quality of work stands out the profession of physiotherapist. Flexibility is one of the components of physical fitness. In those professions, which are characterized by volatility of positions and different effort load, the appropriate level of flexibility seems to be of particular importance.
Aim of the study. The aim of the study was to determine the level of mobility (flexibility) of the trunk among physiotherapy students. It was also decided to investigate how such variables as gender, age, morphological parameters, past and current physical activity are related to the present level of flexibility.
Material and methods. 341 people have been examined: 289 women (84.25% of the total) and 52 men (15.25%). The average age of the study group was: 20.26 years (SD = 1.69) for women; 19.85 years (SD = 1.73) for men. All of these persons were physiotherapy students. Following data have been collected: age, past sports and physical activity – according to the Baecke questionnaire. Anthropometric measurements and three – plane measurement of the flexibility of the spine have been also made.
Results. There have been weak relationships between morphological parameters and flexibility – only in women. Physical activity strongly differentiated the level of flexibility among women in a sagittal plane ($p <.05$) and a transverse plane ($p <.001$; $p <.002$), a similar situation is with past sports: a sagittal plane: ($p <.001$) and a lateral plane on the left side ($p <.05$). In men, only past sports differentiated flexibility in a transverse plane on the right side ($p <.05$).
Conclusions. The level of flexibility varies individually, especially in a sagittal plane. Gender, age and morphological parameters in young adults are poorly associated with the flexibility. Past and current physical activity have a positive influence on the trunk functional efficiency.

Key words:

functional efficiency, trunk flexibility, physical fitness, three – plane measurement of the flexibility, physiotherapy profession

Instroduction

Possibly high level of functional efficiency is not only an autotelic value, which forms the basis of human welfare [1, 2, 3]. It also plays an important role in fulfilling different types of social functions, including professional functions. The importance of the level of that efficiency in specific professions is different. However, there are professions in which the quality of services provided to others, to a significant extent, may depend not only on the level of professional and social competence, but also on the level of widely understood physical fitness. Among professions in which physical fitness is an important element of the quality of work stands out the profession of physiotherapist [4, 5]. According to the World Confederation of Physiotherapy: "Physiotherapy means providing services to people and society in order to develop, maintain and restore maximum movement and functional ability throughout life" [6]. A very wide range of interests of professional physiotherapists naturally must take into account, among other components, an element of physical fitness which is at least sufficient for the profession [7, 8]. Concern about the quality of the provision of these services in Poland has been also reflected in the standards of education of students at this faculty [9]. The social importance of this problem is emphasized by the number of people already engaged in this profession, as well as those who start studies at this faculty. It is estimated that every year in Poland there are about 13 thousand new physiotherapy students [10]. Regardless of understanding of the term of physical fitness, there is general agreement about the fact that flexibility is one of its components [11]. It is defined as the ability to achieve the optimum (highest possible) range of motion [12]. A measure of flexibility is the range of motion (ROM) in a joint or a joint complex [13]. It is a key element of the concept of HRF (Health – Related Fitness) [14, 15, 16, 17]. In those professions, which are characterized by volatility of positions and different effort load, the appropriate level of flexibility seems to be of particular importance. This was the premise to undertake research presented in this paper.

Aim of the study

The aim of the study was to determine the level of mobility (flexibility) of the trunk among physiotherapy students. It was also decided to investigate how such variables as gender, age, morphological parameters, past and current physical activity are related to the present level of flexibility.

Material and methods

341 people have been examined: 289 women (84.25% of the total) and 52 men (15.25%). Sex ratio was corresponding with students at this faculty. Two selection criteria have been adopted: voluntariness and purposefulness – they were physiotherapy students from

Medical University of Silesia in Katowice. People who have had contraindications to perform the test due to a history of injury or pain have been excluded from the study. The average age of the study group was: 20.26 years (SD = 1.69) for women; 19.85 years (SD = 1.73) for men.
The study included three stages of evaluation. The first stage was to collect data concerning age of the respondents, past sports and to fill out the physical activity Baecke questionnaire (SEWL) [18]. The second stage included anthropometric measurements. The third stage consisted of three – plane measurement of the spine flexibility.
Past sports of the respondents were classified in binary form, taking into account two possibilities: typical (average), and above – average – defined as the systematic training in an organized manner, for at least one year.
The Baecke physical activity questionnaire is an example of a tool used for physical activity self – reporting. It consists of three questions about profession, sports and everyday locomotion by foot and/or by bicycle. In addition, it contains 13 statements relating to the activity in three areas: work, sport and leisure time – with the exception of sports activities.
Answers about the profession, possible sport activity and proposed answers to the questionnaire statements are scored on a scale of 1 to 5, which allows to express the level of physical activity in numerical values. This makes it possible to estimate the level of professional activity (WI – work index), sports (SI – Sports index) and in leisure time (LTI – leisure time index). By summing the three indicators, an overall index of presented (habitually) activity: HPA – habitual physical activity index is obtained. This questionnaire is used in various types of population studies because of its simple, understandable structure (answers in the form of an adjective) and ease of indicators calculation. This tool has been repeatedly validated, also by the method of doubly labeled water [19, 20, 21].
Anthropometric measurements in the study group included: body height – with the stadiometer, linear measurements of the length of limbs and trunk, as well as the circuits of the waist and hips. For anthropometric measurements, inextensible tape with the accuracy of ± 0.5 cm was used. Average length measurements of limbs and trunk length measurements were used to calculate indicators: WDT – trunk length index; WDKKG – upper limbs length index; WDKKD – lower limbs length index; WMK – between the limbs index. The size of the indicator is calculated from the ratio of the average length and height of the body multiplied by 100. The circuits waist and hips were used to calculate the WHR (WHR – waist/hip index).
Flexibility was measured in three planes. Measurements in sagittal plane:

in a standing position – test "fingers – floor" (PP) [22,23], in a flat sitting position – "sit and reach" test (SAR) [23,24]. Measurements were made using flextester, taking as the “0” value the plane of the feet. Values above this plane were considered as negative, below – as positive. Flexibility in the frontal plane (PC) is the difference in distance from the end of the middle finger to the ground: in a standing position astride (straddle shoulders width) and in a position of the maximum side slope [23,24,25]. Measurements of these planes are made with an accuracy of 1 cm. In the transverse plane (PP), flexibility was measured according to the Knapik method – using Saunders inclinometer (twist of the torso in the forward slump: in a standing position astride – with the stabilization of the pelvis) [23]. In this case the accuracy was 1o.

All of the tests were carried out three times, for statistical purposes average values from three measurements were used. Standardization of measurements concerned: the same object, the same equipment, the same time of the day (forenoon hours) and a permanent team of investigators performing measurements.

The reliability of the measurements was checked by calculating the Alpha – Cronbach coefficient {AC}. For particular tests AC was as follows: PP: AC=.992; SR: AC=.994; PCL: AC=.989; PCP: AC=.987; PPL: AC=.980; PPP: AC=.984.

All of the procedures associated with the study were performed in accordance with the Helsinki Declaration of 1975, modified in 1983.

Statistical analysis

Descriptive statistics of the studied variables (median – Me, medium – x; standard deviation – SD) were made. For variables: flexibility and activity, 95% confidence interval (95% CI) was calculated.

Relationships between variables were calculated using the Pearson correlation. Comparisons based on gender were made using the U Mann – Whitney (UMW). Differences between groups – due to the current activity quartiles and past activity – were calculated using one – way ANOVA. The adopted level of statistical significance was: $p < 0.05$.

Results

The first step of analysis – it was to perform descriptive statistics of studied parameters and to explore the relationships with age and differences based on gender. Statistical significance with age revealed only a correlation of flexibility in a sagittal plane in women, WI in both gender and LTI in men. Statistically significant differences (gender as a differentiating variable) concerned only transverse planes – on the left side, where a greater range of motion (flexibility) has been observed in men. Statistically significant higher level of SI in men does not have a bearing on the HPA, however, p was above assumed level of statistical significance (table 1).

Table 1. Descriptive statistics of the studied variables, correlations with age and differences based on gender

Parameter	Variable	Gender	Me / x (SD)	95% CI	Correlation with age	Differences Based on gender (TEST UMW)
Morphological parameter	WHR	F	0.75 / 0.75 (0.05)		-.098	.0000**
		M	0.85 / 0.85 (0.06)		-.045	
	WDT	F	32.60 / 32.46 (1.70)		.076	.3645
		M	31.52 / 31.88 (1.24)		.094	
	WDKKG	F	43.77 / 43.72 (1.82)		-.254	.6420
		M	44.00 / 42.97 (2.09)		-.098	
	WDKKD	F	51.75 / 51.48 (1.89)		.162	.3621
		M	52.72 / 51.85 (1.73)		.034	
	WMK	F	84.52 / 84.63 (4.05)		-.267	.3050
		M	83.69 / 83.00 (5.83)		-.093	
Flexibility	PP {cm}	F	11.00 / 10.93 (6.58)	10.16 – 11.70	-.282*	.0501
		M	8.67 / 9.32 (6.61)	7.44 – 11.20	-.035	
	SAR {cm}	F	11.67 / 11.62 (7.27)	10.77 – 12.47	-.288*	.0687
		M	8.67 / 9.94 (7.60)	7.78 – 12.10	-.243	
	PCL {cm}	F	31.33 / 31.42 (7.99)	30.46 – 32.39	.248	.0776
		M	34.00 / 34.39 (9.67)	30.33 – 37.20	-.039	
	PCP {cm}	F	31.42 / 31.31 (8.13)	30.33 – 32.29	.208	.0513
		M	34.33 / 33.83 (8.56)	31.34 – 36.31	-.294	
	PPL {°}	F	75.33 / 75.72 (15.74)	73.86 – 77.59	-.101	.0204*
		M	83.17 / 80.66 (15.14)	76.36 – 84.96	-.146	
	PPP {°}	F	75.13 / 75.71 (15.57)	73.86 – 77.55	-.059	.0771
		M	80.17 / 79.19 (14.28)	75.13 – 83.25	-.102	
Activity	WI	F	2.38 / 2.28 (0.50)	2.22 – 2.34	.214**	.6806
		M	2.25 / 2.26 (0.42)	2.14 – 2.37	-.438**	
	SI	F	2.25 / 2.40 (0.94)	2.29 – 2.51	-.029	.0005**
		M	2.99 / 3.13 (1.42)	2.72 – 3.53	-.121	
	LTI	F	3.25 / 3.25 (0.73)	3.17 – 3.34	-.105	.2924
		M	3.25 / 3.16 (0.71)	2.96 – 3.36	-.325*	
	HPA	F	8.07 / 7.93 (1.64)	7.74 – 8.12	-.002	.0563
		M	8.40 / 8.54 (2.12)	7.94 – 9.14	-.276	

*p<.05; **p<.001

Description: F – females, M – males, WHR – waist/hip index; WDT – trunk length index; WDKKG – upper limbs length index; WDKKD – lower limbs length index; WMK – between the limbs index; PP – „fingers – floor" test; SAR – flexibility test in sitting position; PCL – frontal plane, slope side: left; PCP – frontal plane, slope side: right; PPL transverse plane, slope side left; PPP transverse plane, slope side: right; WI – work index; SI – sports index; LTI – leisure time index; HPA – habitual physical activity index

The analysis of the relationships between examined indicators of morphological parameters and flexibility measurements revealed only weak correlations in women. Positive correlations: WDKKG – SAR, negative correlations: WDKKD – PCL and WDKKD – PCP. The results are shown in table 2.

Table 2. Correlations of morphological parameters with the flexibility

Parameter	Gender	Flexibility					
		PP	SAR	PCL	PCP	PPL	PPP
WHR	F M	-.159 .298	-.136 .097	-.267 .086	-.169 .036	-.174 .094	-.043 .092
WDT	F M	.190 -.051	.147 -.054	.099 -.063	.003 -.047	.181 .005	.191 .006
WDKKG	F M	.212 0.053	.296* .260	.032 .058	.041 .048	-.051 .168	.185 .147
WDKKD	F M	-.216 .117	-.261 .083	-.279* -.247	-.296* .128	-.129 .088	-.128 .089
WMK	F M	.262 .041	.349* -.063	.187 .057	.210 .037	.043 -.166	-.046 -.186

Description: F – females, M – males, WHR – waist/hip index; WDT – trunk length index; WDKKG – upper limbs length index; WDKKD – lower limbs length index; WMK – between the limbs index; PP – „fingers – floor" test; SAR – flexibility test in sitting position; PCL – frontal plane, slope side: left; PCP – frontal plane, slope side: right; PPL transverse plane, slope side left; PPP transverse plane, slope side: right.

Relationships between physical activity and flexibility were tested by comparing the results of flexibility tests (dependent variables) according to HPA quartiles (grouping variable). Quartile limits were for women: I - 7.931, III - 8831; for men - I - 7.375, III - 10.0. The levels of differences are presented in table 3.

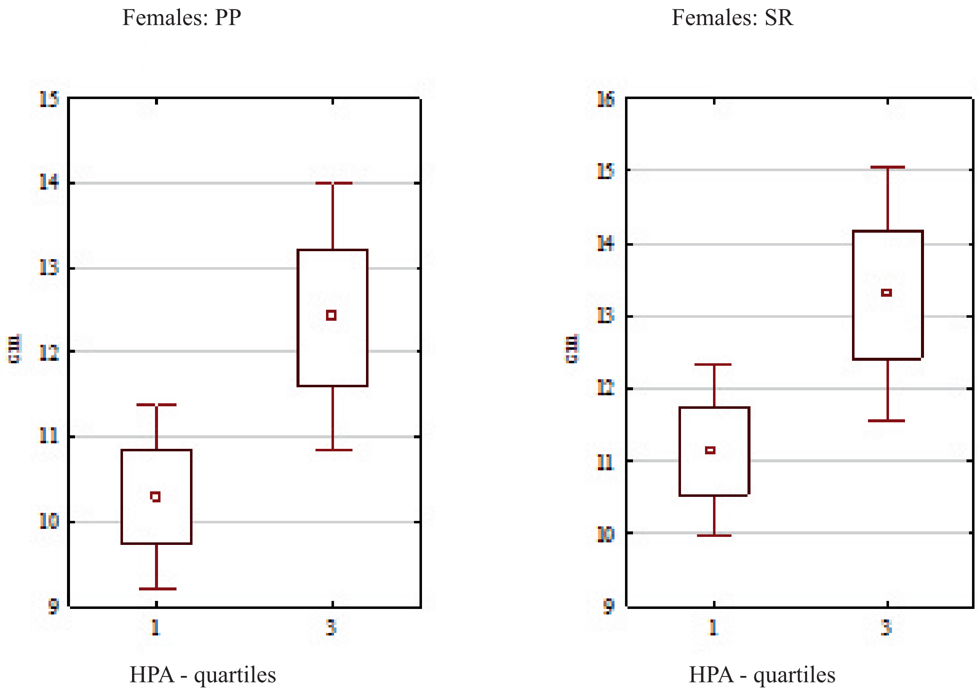
Tabela 3. Aktywność fizyczna a gibkość tułowia: porównanie kwartyli HPA

Level of statistical significance		Flexibility					
	Gender	PP	SAR	PCL	PCP	PPL	PPP
p	F M	.0279* .3333	.0403* .4101	.0403* .4101	.0995 .5631	.0004** .4519	.0018** .0756

*p<.05; **p<.001

Description: F – females, M – males, WHR – waist/hip index; WDT – trunk length index; WDKKG – upper limbs length index; WDKKD – lower limbs length index; WMK – between the limbs index; PP – „fingers – floor" test; SAR – flexibility test in sitting position; PCL – frontal plane, slope side: left; PCP – frontal plane, slope side: right; PPL transverse plane, slope side left; PPP transverse plane, slope side: right.

Figures 1 and 2 present differences for sagittal and transverse planes.



Ryc.1. Differentiation of flexibility in a sagittal plane due to HPA quartiles: women

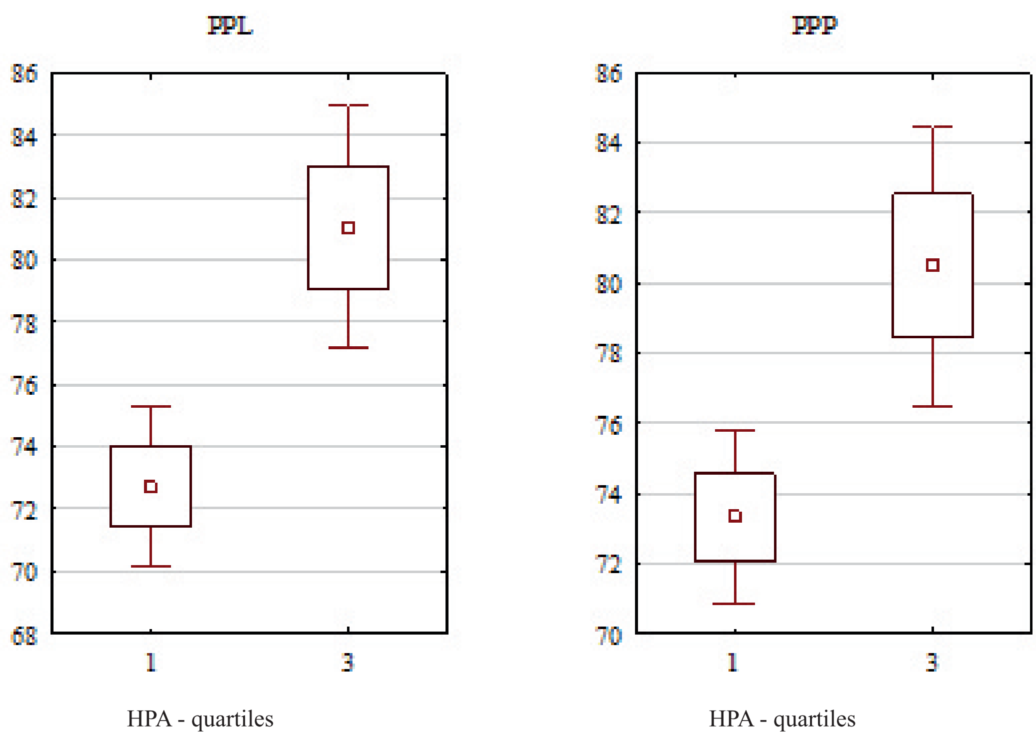


Fig.2. Differentiation of flexibility in a transverse plane due to HPA quartiles: women

Past sports declared 162 women (56% of the total) and 32 men (64% of the total). Comparison of the level of flexibility – due to past sports (ANOVA) is presented in table 4.

Table 4. Comparison of flexibility: past sports as an independent variable

Flexibility test	Gender	Past sports		p
		No x (SD)	Yes x (SD)	
PP {cm}	F	9.29 (6.74)	12.20 (6.20)	.0002**
	M	7.69 (6.40)	11.08 (6.33)	.0753
SAR {cm}	F	9.96 (7.26)	12.91 (7.05)	.0006**
	M	8.49 (7.50)	11.65 (7.33)	.1510
PCL {cm}	F	31.45 (7.90)	31.40 (8.10)	.9549
	M	31.82 (7.32)	36.39 (10.94)	.1197
PCP {cm}	F	31.25 (8.09)	31.37 (8.21)	.9063
	M	32.02 (7.24)	35.57 (9.19)	.1673
PPL {°}	F	73.37 (15.99)	77.54 (15.37)	.0290*
	M	75.02 (16.18)	84.13 (13.82)	.0415*
PPP {°}	F	73.98 (15.00)	77.03 (15.96)	.1080
	M	73.67 (16.23)	83.37 (11.86)	.0207*

*p<.05; **p<.001

Description: F – females, M – males, WHR – waist/hip index; PP – „fingers – floor" test; SAR – flexibility test in sitting position; PCL – frontal plane, slope side: left; PCP – frontal plane, slope side: right; PPL transverse plane, slope side left; PPP transverse plane, slope side: right.

Discussion

Contemporary science, including areas related to health, is based on the reliability of conducted research (Evidence – Based Medicine). Aspiration to minimize measurement errors results in increasing preference for laboratory studies. However, some research directions, in particular on variables related to the larger population, require the use of methods and techniques, leveling natural limitations for laboratory studies. Limitations of laboratory tests mainly concern two aspects: the number of respondents and a certain "artificiality" of measurement conditions. They are expensive and time consuming [26]. It also indicates some caution regarding generalization of the results. The lack of these limitations is an asset of non – laboratory tests and trials, on condition of maintaining standards of research and consequent reliability of measurements.

The dilemma: laboratory – non – laboratory tests also applies to different aspects of motor skills, where behavioral variability and complexity of movements itself play an important role. In the case of flexibility, strong argument in favor of laboratory measurements is the specificity of this aspect of motor skills – range of motion in various joints can vary significantly [13], which is the source of objections that a global flexibility measure by using motor test may constitute too big generalization [27, 28]. However, considering this dilemma in terms of functionality - the motor effect, heterotelic motor skills tests seem to be an asset. AC coefficients calculated in this study indicate good reliability of the flexibility tests [29].

Analysis of descriptive statistics indicates a small or medium differentiation of results for frontal plane and transverse plane, and a very large differentiation in sagittal plane (table I). In sagittal plane large individual differences are clearly marked, the plane of this clearly marked large individual differences and it confirms the correctness ascertained in previous studies [23, 30, 31].

Reported weak negative correlations between flexibility in sagittal plane and age in women (table I) may have the meaning of a symptom, which indicates flexibility decline with the passing years, which is a natural consequence of the involution processes. In presented results, indicators values and the age range of the respondents require in this case careful interpretation. Similarly, positive correlations WDKKG – SAR and negative: WDKKD – PCL and WDKKD – PCP in women (table 2) can indicate certain compounds between proportions of body building and received motor effects (test results), which in some way interfere the target of measurement – flexibility. In addition, the lack of any correlations between flexibility, age and morphological parameters in men may suggest stronger influence of biological factors on flexibility in women than in men. However, in the literature, unequivocal evidence of this hypothesis was not found unequivocal evidence of this hypothesis, therefore, it requires further research.

Comparison of respondents according to activity quartiles (table 3), revealed differences in flexibility in sagittal plane (PP, SAR) and transverse plane (PPL, PPP) in women – in favor of more active women. In men, there were no differences. Increased flexibility – as a result of interventions, which involve the introduction of various activities in women, indicates high plasticity of this feature in women [32, 33, 34]. However, analysis of the impact of past activity on the current level of flexibility (table 4) suggests a greater plasticity of women in this regard. The problem of translocation effect has been investigated by Knapik et al [35]. These authors noted the positive impact of increased (oversized) activity in youth on the level of flexibility in the later decades of life in men. Considering the lack of studies of this problem in women, these results may suggest dimorphic differences regarding the pace of flexibility involution. In addition to the biological conditions, an important role can be also played by dimorphic differences concerning preferred forms of activity [36].

Interpretation of the test results in the context of quality could give rise to discussion. Comparison of average test results of flexibility in sagittal plane with the results of other students from Polish universities presented by Żukowska [31], or with croatian results [30] indicate their relatively higher level. However, "norms" or reference values represented by different centers can be contested. On the one hand, increasing range of motion provides a greater potential for mobility, which from the perspective of function is desired. On the other hand – from the health care point of view, there is no conclusive evidence for the line linking between flexibility and health [26]. A number of research indicate risks of excessive range of motion in joints or groups of joints, leading to injuries and disability [37, 38]. Johns and Knapik suggest that both too much and too little flexibility increases the risk of injury [39, 40], while Gordon and Bloxam indicate health benefits from improved flexibility of back muscles and tendons [41]. McConnell observes that mobility limitations may predispose to frequent injury and may also negatively affect the quality of movements [42]. The key to the solutions for these dilemmas is the optimality range of motion, which requires further population size research, which may be inconclusive, taking into account a number of internal and external variables. The spine is a specific biomechanical chain which global mobility is the result of a particular "links" [22].

Adopted in this study, functional perspective and the global nature of the measurement limit the possibility of detailed analysis relating to the motor segment. Earlier studies, which confirmed the accuracy of flexibility testing indicated that their performance, in addition to a number of "external" variables, has been also significantly influenced by other structures of the musculoskeletal system [43]. Crucial importance is attributed to the relations between the processes of mobilization and stabilization [44, 45]. Disorders of these relationships can cause an increased risk of injury. According to the authors, taking into account the age of the respondents, as well as their career prospects, the highest possible level of flexibility seems to be desirable.

The results of the studies, despite higher average values among women in sagittal plane, there were no statistically significant differences – compared with men, which may result from the proportion of the number of respondents. Greater range of motion in this plane in women is typical [46]. However, the greater physical sport passivity in women (table 1) should be taken into account. Sports activity usually requires a greater range of motion than the standard, which could be the cause of statistically significant differences in favor of men in PPL (in a population dominated by right – handed).

It is difficult to directly prove the existence of direct links of one of the components of physical fitness with the quality of provided services in the future, in this case – provided by physiotherapists. Especially when the potential nature of these compounds is taken into account. In this case induction proceeding seems to be necessary. Flexibility is considered to be one of the key components of physical fitness. Compounds between physical fitness and welfare have been also repeatedly confirmed. All of these three components (physical, mental and social) are related to each other [47]. The quality of each of the numerous factors which may affect well – being, has not only autotelic but also heterotelic values.

Conclusions

In order to summarize it can be concluded that:

1. The level of flexibility varies individually, especially in sagittal plane.
2. Gender, age and morphological parameters are poorly related to flexibility in young adults.
3. Past and current physical activity has a positive effect on the functional efficiency of the trunk.

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