High physical activity vs. quality of the trunk position and the efficiency of core muscles among young males

Wysoka aktywność fizyczna a jakość ustawienia tułowia i wydolność mięśni posturalnych u młodych mężczyzn

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Abstract

Introduction: Physical activity is considered to be one of the keystones of a healthy lifestyle and an indispensable condition for correct body posture. The purpose of the study was to check the body posture of young males with above-average physical activity and how the position of the trunk changes after extending the arms forward. The frequency and intensity of back pain among males in the study were also analyzed.

Material and methods: The study involved 50 young, healthy males, whose high daily physical activity was confirmed by the IPAQ questionnaire. Body height and weight were checked, and BMI was calculated. The position of the trunk in three planes was examined using the ultrasonic Zebris Pointer system. The examination was performed twice: in the habitual standing position and in the position taken from the Matthiass test: standing position with the arms in front of the trunk (90o). The data was prepared in the Statistica v13 program.

Results: The male participants were characterized by an incorrect depth of physiological curvatures of the spine and asymmetry of the position of the shoulder and pelvic girdles in the frontal plane. Extending the arms forward in a standing position resulted in flatter thoracic kyphosis, rounder lumbar lordosis and tilting the trunk backwards. Periodic pain sensation in the lumbar spine was reported by approximately 60% of participants. It was a mild pain that did not require painkillers. There were no significant relationships between the quality of the trunk position and pains in the lumbar region.

Conclusions: High physical activity turned out to be insufficient to ensure correct body posture and efficiency of core muscles. Postural education should be a permanent element of health promotion programs aimed at increasing the quality of life.

Keywords: body posture, physical activity, back pain

Introduction

Back pain is one of the most common health problems of our time. It causes reduced efficiency and frequent absenteeism at work, and its chronic consequences reduce the quality of life. One of the risk factors for back pain is incorrect standing and sitting position [1]. Systematic physical activity and attention to muscle strength and endurance are recommended as a way to prevent back pain, which helps to maintain the correct body weight and posture [2, 3].

Practicing physical activity adjusted to age and level of fitness is recommended by doctors as a way to reduce the risk of developing civilization diseases, such as obesity, cardiovascular diseases, diabetes, osteoporosis, injuries and other musculoskeletal disorders. Research shows that the habit of running an active

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lifestyle developed in adolescence is conducive to maintaining higher functional efficiency and better quality of life in old age [4]. It should be emphasized that regular, moderate physical activity has a particularly beneficial effect [5]. Particularly high physical activity, as well as a sedentary lifestyle, increases the risk of back pain [6].

There is no doubt that physical activity, body posture and quality of life go hand in hand. Nowadays, taking care of your physique and practicing sports is becoming trendy. However, the slogan "taking care of your physique" means trying to maintain a healthy body weight rather than the quality of body posture. Young people rarely perform exercises aimed at improving the positioning of the body in space in a standing position, while sitting, walking or running. There is a belief that being "fit" is enough to stay healthy.

The purpose of the study was to assess the quality of body posture of young males with above-average daily physical activity. The position of the trunk in a free standing position and in a standing position with arms extended forward (position taken from Matthias's test) were compared. This is a functional position in which the core muscles work to maintain a neutral trunk position. The researchers looked for an answer to the question whether high physical activity, not combined with postural education, is sufficient to maintain the proper position of the trunk. The incidence and intensity of back pain among males in the study were also analyzed.

Material and methods

50 students of the University of Applied Sciences in Tarnów were invited to participate in the study. The condition for inclusion in the study group was the willingness to participate in the project, good general health, no injuries to the musculoskeletal system within 6 months before the study, high level of daily physical activity confirmed by the result of the "International Physical Activity Questionnaire" IPAQ (questionnaire available at: http: / /www.sdp.univ.fvg.it/sites/default/files/IPAQ_English_self-admin_long.pdf accessed on: 23/08/2020). The age of the participants ranged between 19–30 years.

The basic features of the somatic structure of the participants were assessed. Body height was measured using a calibrated anthropometer (measurement accuracy up to 1 mm), body weight using a TANITA scale (measurement accuracy up to 0.1 kg). Based on the collected data, the value of the BMI index was calculated.

The three-dimensional position of the trunk was assessed using an ultrasonic system ZEBRIS Pointer [7]. The analysis covered: the position of the pelvis in the sagittal, frontal and transverse planes, the position of the shoulders in the frontal plane, the inclination of the pelvis in relation to the shoulders in the frontal plane, the distance between the right and left scapula from the back plane, the difference in the distance between the scapulae and the back plane, the depth of thoracic kyphosis and lumbar lordosis, sacrum inclination, balance of the trunk in the sagittal and frontal planes, alignment of the spine in the frontal plane, rotation of the pelvis in relation to the shoulders.

The participant stood in a habitual position, with the back facing the measuring device, at a distance of about 60–70 cm from it. In order to eliminate errors resulting from unintentional movements of the participant during the measurement, a belt with a reference sensor was put on the pelvic girdle. The study was conducted twice: in the habitual standing position with the arms hanging freely along the body, and in the standing position with the arms raised in front of the body. This position had to be maintained for the entire duration of the study (approximately 2 minutes). This position was taken from the Matthiass test, which examines the efficiency of postural muscles [8]. The study was supplemented by the assessment of the intensity of pain in the lower spine region. For this purpose, the VAS scale [9] and the Laitinen scale [10] were used.

The analysis of collected data was carried out in the Statistika v13 program. Basic descriptive statistics were used: mean, median, minimum and maximum value, standard deviation. As the variables in most cases did not have the characteristics of a normal distribution (Shapiro-Wilk test), or the variances were not homogeneous (F test), the significance of differences between the measurements was estimated using the non-parametric Wilcoxon test. The significance level $\alpha=0.05$ was adopted.

Results

Body posture

In the habitual standing position, the normal thoracic kyphosis was most often observed among males in the study, while slightly fewer participants had flat and the least round thoracic kyphosis. After lifting the arms forward, the incidence of shallowing thoracic kyphosis increased significantly. In the second study, both normal and round thoracic kyphosis were observed slightly less frequently (Table 1).

Almost half of the participants, in the first study, were diagnosed with flat lumbar lordosis, 17 of them had normal curvature of the lumbar region, while round lumbar lordosis affected 20% of the participants. In the second study, the incidence of normal curvature of the spine in the lumbar region decreased by 10% (Table 2).

The correct balance of the torso in the sagittal plane in the habitual standing position was found among 34 subjects. 16 males were characterized by excessive backward tilt. In the position with the arms extended forward, 96% of the participants were diagnosed with excessive backward tilt, and only 2 out of 50 participants had a proper trunk balance. None of the participants were found to have tendency to stand with the body tilted forward (Table 3).

Table 1. The quality of thoracic kyphosis in habitual posture (first examination) and in posture with arms forward (second examination)

Thoracic kyphosis	Term of the study	Number (n)	%
Flat	**First**	**17**	**34%**
	Second	23	46%
Normal	**First**	**19**	**38%**
	Second	15	30%
Round	**First**	**14**	**28%**
	Second	12	24%

Table 2. The quality of lumbar lordosis in habitual posture (first examination) and in forward posture (second examination)

Lumbar lordosis	Term of the study	Number (n)	%
Flat	First	**23**	**46%**
	Second	25	50%
Normal	First	**17**	**34%**
	Second	12	24%
Round	First	**10**	**20%**
	Second	13	26%

Table 3. Sagittal trunk inclination in the frontal plane in the habitual posture (first examination) and with the arms forward (second examination)

Sagittal trunk inclination	Term of the study	Number (n)	%
Backward tilt	First	**16**	**32%**
	Second	48	96%
Normal	First	**34**	**68%**
	Second	2	4%

The first study showed that 64% of participants had their left side of the pelvis higher than the right side. One person had an evenly positioned pelvis in the frontal plane. The second study showed a higher position of the left side of the pelvis found among 72% of the participants (Table 4).

Both studies showed a higher position of the left shoulder compared to the right one more often. This difference was more pronounced in the habitual standing position (Table 5).

A right side (more often) and left side tilting of the trunk was observed among the vast majority of the participants. Extending the arms forward did not significantly affect this feature of body posture (Table 6).

Lateral bending of the spine was diagnosed in every fifth participants in the habitual standing position. After extending the arms forward, the position of the spine in the frontal plane improved in 2 participants. Most of the diagnosed lateral bends were left-sided (Table 7).

The quantitative analysis shows that shifting the arms forward resulted in a statistically significant reduction in pelvic rotation, a reduction in the distance between the scapulae and the back plane, shallowing of the thoracic kyphosis, deepening of the lumbar lordosis, tilting the trunk backwards and a change in the inclination of the sacrum (Table 8).

Table 4. Position of the pelvis in the frontal plane in the habitual posture (first examination) and with the arms forward (second examination)

Frontal pelvis position	Term of the study	Number (n)	%
Evenly	**First**	**1**	**2%**
	Second	0	0%
Right side higher	**First**	**17**	**34%**
	Second	14	28%
Left side higher	**First**	**32**	**64%**
	Second	36	72%

Table 5. Position of the shoulders in the frontal plane in the habitual posture (first examination) and with the arms forward (second examination)

Frontal shoulders pozition	Term od the study	Number (n)	%
Right side higher	**First**	**9**	**18%**
	Second	19	38%
Left side higher	**First**	**41**	**82%**
	Second	31	62%

Table 6. Lateral trunk inclination in the frontal plane in the habitual posture (first examination) and with the arms forward (second examination)

Lateral trunk inclination	Term of the study	Number (n)	%
Evenly	**First**	**1**	**2%**
	Second	2	4%
Right tilt	**First**	**28**	**56%**
	Second	29	58%
Left tilt	**First**	**21**	**42%**
	Second	19	38%

Table 7. Lateral bending of the spine in the habitual posture (first examination) and with the arms forward (second examination)

Lateral bending of the spine	Term of the study	Number (n)	%
Normal	**First**	40	80%
	Second	41	82%
Bending to the right	**First**	2	4%
	Second	1	2%
Bending to the left	**First**	8	16%
	Second	8	16%

Table 8. Position the trunk in habitual posture (first examination) and in posture with the arms forward (second examination)

Variable	Term of the study	Mean	Me	Min	Max	St. Dev.	p
Pelvic rotation [°]	**First**	5,18	3,15	0,40	34,20	6,14	0,006*
	Second	2,71	2,40	0,00	10,20	2,06	
Pelvic to shoulders inclination [°]	**First**	2,28	2,15	0,00	6,90	1,47	0,469
	Second	2,71	2,05	0,00	11,00	2,40	
Right scapula distance [mm]	**First**	46,10	48,50	11,00	67,00	12,21	<0,001*
	Second	25,52	26,50	-7,00	60,00	14,88	
Left scapula distance [mm]	**First**	42,36	42,00	-2,00	71,00	14,02	<0,001*
	Second	22,60	21,50	-20,00	58,00	15,39	
Scapula distance difference [mm]	**First**	9,08	8,00	0,00	36,00	7,73	0,881
	Second	9,40	6,00	0,00	34,00	9,39	
Thoracic kyphosis [°]	**First**	37,06	39,40	0,00	59,50	11,80	0,001*
	Second	33,50	33,85	0,00	55,10	12,33	
Lumbar lordosis [°]	**First**	20,28	22,35	0,10	37,70	9,04	0,008*
	Second	22,09	22,25	0,00	37,90	8,94	
Sagittal trunk inclination [°]	**First**	2,85	2,50	0,00	7,00	1,74	0,022*
	Second	4,28	3,95	0,10	12,60	2,83	
Sacral angle [°]	**First**	15,04	15,55	0,00	29,90	7,30	<0,001*
	Second	12,54	11,65	0,00	27,60	6,98	
Frontal pelvic position [mm]	**First**	8,47	5,75	0,00	31,60	8,06	0,190
	Second	10,51	6,70	0,50	27,60	8,25	
Frontal shoulders position [mm]	**First**	11,67	10,85	0,20	35,90	8,53	0,200
	Second	10,15	7,75	0,10	35,00	8,66	
Lateral trunk inclination [°]	**First**	0,81	0,60	0,00	3,60	0,74	0,907
	Second	0,80	0,70	0,00	2,80	0,68	
Lateral spine bending [°]	**First**	1,73	0,00	0,00	14,00	3,65	0,717
	Second	1,53	0,00	0,00	13,00	3,46	
Pelcic to shoulders rotation [°]	**First**	2,82	2,40	0,00	8,60	2,27	0,341
	Second	2,31	1,60	0,10	7,20	2,13	

*statisticalyy significant difference

Lower back pain

The mean value of pain intensity among males in the study expressed in the VAS scale was 1.82 (Tab. 9). There was no significant correlation between the severity of pain and the quality of body posture, or somatic features (linear Pearson correlation).

During the course of the study, 5 males experienced mild pain in the lumbar spine. One of the participants felt strong pain. Almost half (48%) of the participants admitted that back pain occurs periodically, while 40% of the participants did not complain of any pain symptoms. Four of the participants stated that they often feel pain in the spine, and 2 of the participants felt pain very often. Three out of four participants admitted that they do not use painkillers. On the other hand, a quarter of the participants use them temporarily. 64% of the participants declared that they did not feel the need to limit their physical activity due to back pain. Pain forced 30% of the participants to partially limit their physical activity, while pain that hindered work occurred periodically in 3 subjects.

Table 9. Lower back pain intensity expressed on the VAS scale

Variable	n	Mean	Me	Min	Max	St. Dev.
VAS scale	50	1,82	1,00	0,00	7,00	2,15

Discussion

Despite high physical activity, in a free standing position, only slightly more than 1/3 of the participants had the correct depth of thoracic kyphosis and lumbar lordosis. The asymmetry of the position of the pelvis and shoulders was noted in most of the participants. Extending the arms forward in a standing position resulted in flatter thoracic kyphosis, rounder lumbar lordosis and tilting the trunk backwards. When assessing the trunk position, 12% of males experienced back pain, while 60% admitted that they experienced such pain periodically. Usually, this pain is mild and does not require painkillers. There were no significant relationships between the quality of the torso position and the discomfort of the lumbar spine in the group participating in the study.

The research conducted by Derewiecki et al [11] confirms the relationship between low physical activity and back pain. In other studies, conducted with participation of a group of school children in Brazil, a link was documented between a high frequency of lower back pain and bad body posture as well as wrong habits related to performing daily activities [12].

Most schoolchildren and teenagers have knowledge about the adverse health effects of a bad body posture. Despite this, most of the participants do not try to maintain the correct sitting or standing position on a daily basis [13]. Meanwhile, body posture abnormalities in children and adolescents are a global problem. Faulty posture is more common in young people with chronic diseases such as asthma. It is worth noting that also in this group, in addition to treating the underlying disease, great emphasis should be placed on correcting body posture and appropriately adapted physical activity [14].

As numerous studies show, practicing sports alone or regular amateur physical activity does not ensure correct body posture. Young football players have a more symmetrically positioned pelvis, compared to their untrained peers, but also greater asymmetry of the waist and shoulder triangles [15]. Adolescents who practice volleyball tend to have shallow lumbar lordosis and deep thoracic kyphosis [16]. On the other hand, regular yoga practice seems to have a beneficial effect on the symmetry of posture [17].

Body posture largely depends on the work performed and daily habits. For example, postural defects are particularly common in children and adults who play musical instruments [18, 19]. The features of the somatic structure also largely model the figure. In children with excess body weight, deepening of lumbar lordosis and changes in the body balance in the sagittal plane are observed [20].

The conducted research and analysis of the literature show that changes in the pro-health education programme should be considered in order to make it more effective. It is necessary to find ways to more effectively motivate children, adolescents and adults to use the knowledge about the importance of correct body posture for health in practice. It is necessary to convince the public that working on the habit of correct posture is the responsibility of people of all ages. Systematically practiced physical activity, which includes elements of shaping the habit of correct posture, should be treated as one of the main pillars of health promotion and maintaining the highest possible quality of life in old age.

Conclusions

For young, healthy, physically active males, a disturbance in the depth of the physiological curves of the spine is characteristic, as well as the asymmetry of the position of the shoulder and hip girdles in the frontal plane.

Extending the arms forward in a standing position promotes flat thoracic kyphosis, round lumbar lordosis and tilting the trunk backwards.

Pain in the lumbar spine periodically experiences about 60% of young males. This pain is usually not very intense and does not require the use of painkillers. There are no significant relationships between the quality of the trunk position and the pains in the lumbar spine among young, healthy males.

High physical activity is not enough to ensure correct body posture and efficiency of core muscles. Postural education should be a permanent element of health promotion programs aimed at increasing the quality of life.

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Streszczenie

Wstęp: Aktywność fizyczna jest uważana za jeden z filarów zdrowego trybu życia i nieodzowny warunek prawidłowej postawy ciała. Celem pracy było sprawdzenie, jaka jest postawa ciała młodych mężczyzn o ponadprzeciętnej aktywności fizycznej i jak zmienia się ustawienie tułowia po wyciągnięciu ramion w przód. Analizie poddano również częstotliwość i nasilenie bólu kręgosłupa u badanych mężczyzn.

Material i metody: Badaniu poddano 50 młodych, zdrowych mężczyzn, których wysoką codzienną aktywność fizyczną potwierdzono wynikiem kwestionariusza IPAQ. Zbadano wysokość i masę ciała, obliczono wskaźnik BMI. Ustawienie tułowia w trzech płaszczyznach zbadano za pomocą ultradźwiękowego systemu Zebris Pointer. Badanie wykonano dwukrotnie: w pozycji stojącej nawykowej oraz w pozycji zaczerpniętej z testu Matthiassa: pozycja stojąca z ramionami ułożonymi przed tułowia (90o zgięcia). Dane opracowano w programie Statistica v13.

Wyniki: Dla badanych mężczyzn charakterystyczna była nieprawidłowa głębokość krzywizn fizjologicznych kręgosłupa oraz asymetria ustawienia obręczy barkowej i biodrowej w płaszczyźnie czołowej. Wyciągnięcie ramion w przód w pozycji stojącej powodowało spłycenie kifozy piersiowej, pogłębienie lordozy lędźwiowej i odchylenie tułowia ku tyłowi. Okresowe odczuwanie bólu kręgosłupa lędźwiowego zgłosiło około 60% badanych. Był to ból o nieznacznym nasileniu, który nie wymagał zażywania środków przeciwbólowych. Nie zaobserwowano znaczących zależności pomiędzy jakością ustawienia tułowia a dolegliwościami odcinka lędźwiowego.

Wnioski: Wysoka aktywność fizyczna okazała się niewystarczająca do zapewnienia prawidłowej postawy ciała i wydolności mięśni posturalnych. Edukacja posturalna powinna być stałym elementem programów prozdrowotnych, mających na celu zwiększenie jakości życia.

Słowa kluczowe: postawa ciała, aktywność fizyczna, ból kręgosłupa