

## **Body posture investigation in athletes – middle-distance and long-distance races**

### **Investigarea posturii corporale la atleți, probe de semifond-fond**

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#### **Abstract**

*Background.* Body posture develops gradually, after repeated experiences, as a result of maintaining the same positions and executing the movements in the same way, in similar situations.

*Aims.* The study aims to highlight the views of former performance athletes in middle-distance and long-distance races on the relation between training and body posture.

*Methods.* The questionnaire was applied to 32 former middle-distance and long-distance runners aged between 19 and 23, who had given up on sports activity 1-3 years before. We applied a 15-item questionnaire with multiple pre-coded answers. Applying the mirror test required the subjects to objectively consider their own posture.

*Results.* In 167 cases, a correct posture was indicated, and only in 25 cases, the posture was reported as inadequate for frontal plane examination. Pearson's correlation coefficient ( $r$ ) is 0.72, at a significance threshold of 0.01, which indicates a strong correlation between the ideal body posture and the body posture examined in frontal plane. Concerning lateral examination, the subjects identified 91 nominations for correct positions at the level of various segments and 69 situations that did not correspond to the correct posture. The relation between the ideal body posture and the body posture examined in sagittal plane is strong:  $r=0.79$  and  $p=0.01$  significance threshold.

*Conclusions.* The results obtained allow us to continue our research and to use athletics means as a factor that favors maintaining normal posture and achieving sports performance.

**Key words:** athletes, body posture, middle-distance – long-distance

#### **Rezumat**

*Premize.* Postura corpului se dezvoltă treptat, în urma unor experiențe repetate, ca rezultat al menținerii pozițiilor și a executării mișcărilor, în situații asemănătoare.

*Obiective.* Studiul are drept scop evidențierea opiniilor foștilor atleți de performanță, în probele de semifond-fond, cu privire la relația dintre antrenament și postura corporală.

*Metode.* Au fost supuși chestionării un număr de 32 de foști alergători de semifond-fond cu vârsta cuprinsă între 19-23 de ani, care au renunțat la activitatea sportivă de 1-3 ani. Am aplicat un chestionar cu 15 itemi, cu răspunsuri multiple precodificate. Aplicarea testului în oglindă a necesitat din partea subiecților obiectivitate în vederea examinării posturii.

*Rezultate.* Au fost identificate 167 de situații ce indică o postură corectă și doar 25 ce nu corespundea cu postura corectă, la examinarea în plan frontal. Coeficientul de corelație ( $r$ ) Pearson este de 0,72, la un prag de semnificație de 0,01, ce indică o relație puternică între postura corporală și postura examinată în plan frontal. La examinarea din lateral, subiecții au identificat 91 de nominalizări pentru poziții corecte la nivelul diferitelor segmente și 69 de situații care nu corespund posturii corecte. Legătura dintre postura corporală și postura corporală examinată din lateral este puternică:  $r=0,79$  și pragul de semnificație  $p=0,01$ .

*Concluzii.* Rezultatele obținute ne îndreptățesc să ne continuăm cercetarea și să utilizăm mijloacele atletismului ca pe un factor care să favorizeze menținerea posturii normale și obținerea performanței sportive.

**Cuvinte cheie:** atleți, postură corporală, semifond-fond.

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## Introduction

In the international specialized literature, there are numerous studies regarding the body posture, for various sports branches. The conclusion is that children should be encouraged to practice sport, as it is a stimulating factor for the correction of spine abnormalities, taking into account that most of them are actually postural or functional misalignments (Santonja, 1996).

Several studies have assessed the spine in several sports populations, such as: swimmers (Pastor, 2000; Obayashi et al., 2012), gymnasts (Ohlen & Wredmark, 1989; Kums et al., 2007; Kruse & Lemmen, 2009), professional soccer players (Sainz de Baranda et al., 2001; Ribeiro et al., 2003) and amateur soccer players (Wodecki, 2002), weight lifters (Lopez-Minarro et al., 2007), tennis players (Barczyk-Pawelec et al., 2012). There have also been studies done on samples from other sports disciplines (Hellstrom et al., 1990; Boldori et al., 1999; Ferrer, 1998; Uetake et al., 1998; Wojtys et al., 2000; Neto Junior et al., 2004; Shiller & Ebersson, 2008; Lopez-Minarro et al., 2008; Rajabi et al., 2008; Bubanjan et al., 2012). The aforementioned studies found alterations in the spinal structure, such as sagittal postural deformities and lumbar pain, both with a rather high incidence.

After assessing the spine in sagittal plane on a sample of 82 female gymnasts aged between 7 and 15, the author (Martinez, 2004) found an increase in the lumbar curvature; in swimmers, a high rate of spinal alterations was identified, with various abnormalities depending on the swimming style (Pastor, 2000). Another study on 78 professional soccer players found normal values of the spine in sagittal plane, though the maximal trunk flexion and the asthenic position indicated a kyphotic attitude (Sainz de Baranda, 2001). Uetake et al. (1998) assessed the spine in sagittal plane in a sample of 380 athletes. After comparing the groups, they demonstrated that the group of soccer players had lower kyphosis rates than the average, as well as normal limits concerning lordosis. In one of his works, Ashton-Miller (2004) started by wondering whether intense training could lead to hyperkyphosis in young athletes, mostly in immature athletes, because of mechanical overloading, lack of age-appropriate recovery and training duration.

As for the spinal morphology in canoeists and runners, the latter had significantly higher values for dorsal kyphosis compared to canoeists. No significant differences were found between the two samples of athletes concerning lumbar lordosis (Lopez-Minarro et al., 2009).

Thus far, in many studies, the authors concluded that it was necessary to elaborate a postural exercise routine in order to get a normal body posture and to ensure the harmonious growth of all structures, in order to consolidate the spine (Obayashi et al., 2012).

In this paper, we tried to identify the relation between sports training and the body posture by investigating both the opinions and the postures of former middle-distance and long-distance runners. We also tried to use the results obtained in a subsequent research, with the purpose of demonstrating the effectiveness of athletics means in maintaining a harmonious posture or in correcting an abnormal posture, thus leading to sports performance.

## Hypothesis

By knowing the opinions of former performance athletes (middle-distance and long-distance runners) and the body posture influenced by their sports activity, new approaches can be discovered regarding the use of athletics-specific exercise routines for maintaining or correcting the body posture.

## Objectives

The purpose of the study is to underline the opinions of former middle-distance and long-distance performance runners regarding the relation between training and body posture.

For this study, we proposed the following objectives:

- Identifying possible joint pain;
- Assessing the body posture by using the mirror test, as well as the examination in frontal and anterior-posterior plane;
- Identifying the factors with a possible negative impact on the body posture;
- Identifying the need of a kinesiotherapist during the regular medical check-up;
- Identifying the coach's attitude on the use of certain exercises for the correction of the body posture.

## Material and methods

### *Research protocol*

#### a) *Period of the research*

The research took place in the period January–June 2012, in the following cities: Iași, Tg. Mureș and Bucharest. The questionnaire for the opinions was self-administered during the study period or during the summer session.

#### b) *Subjects and groups*

The research sample comprised a relatively small number of subjects (N=32, 15 females and 17 males), considering the small number of middle-distance and long-distance runners who ended their activity 1-3 years before, at both junior and senior level.

We mention that – in conformity with the Helsinki Declaration, the Amsterdam Treaty and Directive 86/609/EEC – we obtained the necessary license from the Ethics Commission within the National University of Physical Education and Sport in Bucharest, from the Faculty of Physical Education and Sport in Iași, from the University of Medicine and Pharmacy in Iași, as well as from the “Petru Maior” University in Târgu Mureș, for our research on human subjects and for the informed consent of the subjects included in the research.

#### c) *Tests applied*

*The posture questionnaire* (Rusu, 2009) was self-administered, and the subjects were asked to show honesty and objectivity in the self-assessment.

The working instrument had two parts: the independent variables (age, gender, race practiced, duration and level of athletics practice, time elapsed since giving up on sports activity) and the dependent variables (influence of posture on sports results, regular medical check-ups, disorders, injuries and pain throughout the sports career, efficiency in training and competition, self-assessment of posture in frontal and sagittal plane, factors that may

influence posture, presence of a kinesiologist, as well as the coach's attitude). The questionnaire comprised 15 items with dichotomous, pre-coded and open questions. The investigation of posture in the two planes (frontal and sagittal) was performed with the mirror test, recommended by the American Chiropractic Association.

#### d) Statistical processing

For result processing, we used SPSS (Statistical Pack for Social Science) version 15.0 for Windows, and for the graphs, Microsoft Office Excel 2003. For the mirror self-assessment, we applied Pearson's correlation test, with a 0.05 significance threshold. In addition, we represented all answers to the items as percentages.

## Results

Item no. 1. *Do you believe that the body posture influences sports results?* The subjects – former performance athletes, who answered the questionnaire – unanimously agreed that the body posture had an influence on sports results. 56.3% of them had practiced athletics for 5-10 years, while 28.1% had been active for 11-16 years.

Item no. 2. *How many medical check-ups did you have throughout a competition year?* The medical check-up was seen as a point of interest for the respondents (84.4%), and they stated that they had two of them (39.4%) or as many as needed (42.4%). Only 18.2% of the respondents reported just one check-up throughout the entire competition year.

Item no. 3. *Who was present during the check-up?* The coach was directly interested in the health state of the athletes he trained, given that 53.1% of the former middle-distance and long-distance runners indicated that he was present, alongside the medical nurse (43.8%) and the sports physician. Hence, we can conclude that the coach works together with the sports physician and that he is aware of the results of regular medical check-ups.

Item no. 4. *Were you diagnosed with any condition throughout your sports career?* During their sports career, 21.9% of the former athletes stated that they had undergone investigations for various conditions, while 78.1% did not refer to any such conditions.

Item no. 5. *In case you were, what was the diagnosis?* The filter-question was addressed only to the seven subjects who answered "yes" to the previous question. They mentioned the following diagnoses: pneumonia, tweaked meniscus, swelling of the knee, calcaneus fracture, disc herniation, sprains and tachycardia.

Item no. 6. *What prevented you from achieving top efficiency during training or competitions?* The lack of top efficiency during training or competitions was reportedly due to the following factors: injuries (54.9%); bad state of the sports facility (40.6%); bad weather (21.9%) and muscle pain (18.8%).

Item no. 7. *By the time you resumed your sports activity, had you ever experienced any of the states below?* During their active years as athletes, the subjects experienced the following types of pain: spinal pain (31.3%); knee pain (40.6%); shoulder pain (3.1%); ankle pain (50%). 25% did not report any kind of pain.

Item no. 8. *How was training in the period you experienced pain?* When they were in pain, 12.5% said that training was the same; 37.5% said it was easier; 9.4% said

it was harder; 9.4% took a break; 34.4% said training was adjusted to pain, 12.5% said this was not the case.

Item no. 9. *When you look at yourself in the mirror, do you believe you have a normal body posture?* Of the 32 subjects, 29 (90.6%) considered that they had a normal body posture, without a detailed introspection on the position of certain body segments.

Item no. 10. *The mirror test – examination in frontal plane.* The application of the test required objectivity from the subjects for a frontal examination of the six sub-items. The following data were recorded (Fig. 1): 84.40% of the subjects had the shoulders on the same line; 90.60% had the head on the spinal axis, without deviations in frontal plane; 84.40% had approximately the same space between the arms and the body; 90.60% had the hips on the same line; 87.50% had the knees on the same line; 84.40% had the malleoli on the same line.

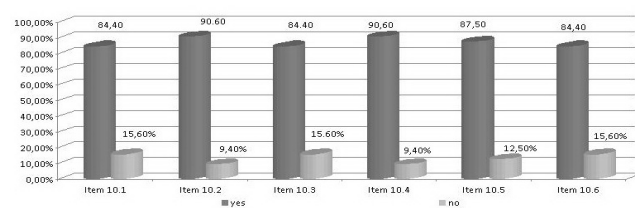


Fig. 1 – Representation of answers for self-examination in frontal plane.

Pearson's correlation coefficient ( $r$ ) between the variables ideal body posture and posture examined in frontal plane is 0.72, with a significance threshold of  $p=0.01$ , which indicates a strong correlation between the two variables. Hence, if the posture is normal in frontal plane, the tendency is for the body posture to be ideal. The same variables applied to athletes who practiced middle-distance races indicate  $r=0.55$ , 0.01 significance threshold and a direct proportionality relation. Applied to former long-distance runners, Pearson's correlation is not significant, which indicates that there is no relation between the two variables.

Item no. 11. *The mirror test – examination in sagittal plane.* After self-examination, the subjects reported, in 58.6% of the cases, that the head was on the spinal axis; the chin was parallel to the floor for 62.1% of the subjects; 48.3% reported the shoulders to be on the same line; the abdomen was flat for 62.1% of the subjects, while the lumbar area presented a slight frontward curvature for 82.8% of the subjects (Fig. 2).

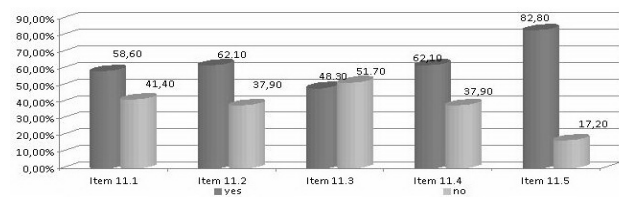


Fig. 2 – Representation of answers for self-examination in sagittal plane.

The relation between the variables ideal body posture and body posture examined in sagittal plane was determined

by applying Pearson's correlation to the entire group of subjects. We obtained  $r=0.79$  and a significance threshold  $p=0.05$ , hence a strong correlation and direct proportionality. In the case of former middle-distance and long-distance runners, Pearson's correlation is also significant for the same variables, with a significance threshold of  $p=0.05$ . The relation is of direct proportionality: if the examination in sagittal plane indicates a normal posture, then the body posture is ideal.

Item no. 12. *Have you noticed any alteration in the body posture compared to the period when you were an active athlete?* 30 subjects (93.8%) answered affirmatively, as a consequence of the high incidence of pain during that period.

Item nr 13. *In your opinion, which of the following factors can have a negative influence on the body posture?* We recorded 87 nominations, among which the most frequent were the hump-backed position and unilaterally carrying the bags (21.8%), closely followed by the incorrect technique (20.7%) and by the incorrect position on the chair (19.5%). The lowest score was ascribed to weight-lifting training (16.1%). The respondents indicated as elements with the highest negative influence the habits acquired, followed by the technique and the weight-lifting training.

Item no. 14. *In order to identify in time the deviations from the normal body posture, do you believe a kinesiologist should also be present during the medical check-up?* In 93.75% of the cases, the athletes agreed that a kinesiologist should be present during the regular medical check-up.

Item no. 15. *In your opinion, what would the coach say about you suggesting certain exercises to correct the body posture?* The subjects said that the coach would be indifferent (15.6%), open (75%), or malicious (9.4%). The coach's attitude is very important in the relationship with the athletes, and it should be based on respect and trust.

## Discussion

All the respondents agree that the body posture influences sports performance; 90.6% consider that they have a normal body posture, while 93.75% agree that a kinesiologist should be present during the regular medical check-up. It is also worth mentioning that 75% of the subjects agree that the coach's attitude would have been open to using exercises to correct the body posture.

Regarding the analysis of the medical check-up attendance depending on the level at which they practiced performance sport (local, national, international), we can state that local athletes tended to have only the two regular check-ups recommended by the coach, compared to national-level athletes, who had such check-ups whenever they considered it necessary. International athletes – because of their centralized individual practice and the permanent collaboration of the team of specialists – did not require additional check-ups, as they benefitted from permanent medical assistance.

Concerning the situations that limited the participation in training and competitions after getting diagnosed with various conditions, we cannot confirm or deny the influence of athletics in this sense without consulting anamnesis from a specialist, as well as the evolution of that condition,

monitored by the individual's physician.

For maximal efficiency in training and competitions, the limiting factors had a functional nature (54.9% injuries), and athletes attended the events under stress.

Taking into account that our subjects had been middle-distance and long-distance runners, we can state that the prevalence of pain in the ankles (50%), knees (40.6%) and spine (31.3%) is related to the type of sports practiced. The running stride specific to middle-distance and long-distance races is characterized by ampler vertical oscillations than speed races, which involves higher flight and more loading for lowering the amplitude, through a resistant muscle strain. The landing shocks are also felt by the spine (Radu, 2012). In the middle-distance and long-distance races, postural conditions are associated with the repetitive character of the running and with certain specific exercises executed while tired, which lead to more loading of the spine in the immature athlete (Shahrokhi et al. 2011). At the same time, spinal pain may be a source of the previous habits, which may cause dysfunctions for the rest of the individual's life (Briggs et al., 2007).

After getting an idea on how training took place when athletes experienced various types of pain, we conclude that the prevalence of pain was taken into consideration, thus making training easier for 37.5% of the athletes and adjusting it for 34.4%.

Regarding self-examination in frontal plane, the subjects identified 167 situations that indicated a correct posture and 25 situations showing deviations from the ideal posture. In sagittal plane, 91 nominations were made for the correct position of various segments and 69 situations were identified as presenting abnormalities. Compared to the examination in frontal plane, the examination in sagittal plane revealed more cases that did not correspond to a balanced posture.

Within the training of middle-distance and long-distance runners, there is not enough attention paid to the development of the abdominal back, shoulder and arm muscles. Consequently, a lack of balance occurs between the muscles of the lower limbs and the muscles of the upper trunk, which leads to spinal overloading during exercise. This lack of balance also leads to spinal conditions, such as scoliosis, kyphosis or lordosis.

In the opinion of Lichota et al. (2011), the level of anterior-posterior spinal curvatures depends on numerous factors, such as: somatic type, gender, lifestyle and physical activity.

A rapid and asymmetrical growth during the teenage years, combined with other elements that influence the body posture starting with childhood (carrying school backpacks, the hump-backed position, an incorrect position when sitting in the bench and inappropriate benches for age and height, an incorrect position on the chair, an uncomfortable bed, a big pillow, etc.), in the presence of weak muscles and low muscle tone, are important causes that may influence the development of spinal deformities (Bogdanovic & Marcovic, 2010).

## Conclusions

1. The results of this research indicate that the posture of middle-distance and long-distance runners has a 100% influence on sports outcomes, while top efficiency in



training and competitions is influenced by the health state, as well as by injuries and muscle pain: 54.9% and 18.8%, respectively.

2. The deviations from the ideal body posture reflect an increased prevalence in sagittal plane, compared to those in frontal plane; the causes include the hump-backed position, unilaterally carrying the bags, incorrect technique and incorrect position on the chair.

3. The data obtained from this research may be considered a starting point in improving the training means aimed at achieving sports performance and preventing postural deformities, thus maintaining a correct posture in middle-distance and long-distance runners.

### Conflicts of interests

Nothing to declare.

### Contribution of authors

Făgăraș Pia-Simona – contribution to administering the questionnaire in Târgu Mureș and to elaborating the design for the SPSS database, version 15.0.

Vanvu Gynetta – contribution to administering the questionnaire in Iași and to elaborating the graphs in Microsoft Excel for Windows 2007.

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