

WELLNESS AND SUCCESS IN SPORT
CHAPTER XI

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*Description of foot longitudinal arch burdened with its weight
on the basis of male population at the age between 4 and 18
in the light of projection moire*

Before a human foot gained the present agility, similarly to a hand, it had gone through a long-lasting process of evolution. The human's hallux lost its capacity to place itself in opposition. Transversely and longitudinally arched foot takes the body weight on calcanean tuber and two proximal ends of instep bone. In the process of the posture stabilization, lower limbs mainly adjusted to the function of supporting the weight during locomotions and to a vertical position.

The passive-active system functions well in rhythmic work when it is subject to alternate contractions and decontractions, when there is time for regeneration. The muscular system ensuring full efficiency of a foot works in its specific lifting system. While in motion, some muscles contract in a concentric way by bending a joint, whereas other muscles strain in an eccentric way, concentrating the bent. In order to make the movement smooth, the cooperation of the third group of muscles is necessary. These muscles perform a static function as well as the function of controlling the first two groups of muscles, e.g. the bending movement in the talocrural joint. The bending movement is made by a triceps muscle of calf which contracts in a concentric way, whereas extensors strain in an eccentric way. It is possible thanks to reciprocal innervation. In a vertical motionless position muscles are under influence of constant isometric burden, hence we experience a quick escalation of fatigue processes. The foot is mechanically better adjusted to static-dynamic work than to the static one.

In the case of a correct foot, the arch consists of five longitudinal arches converging towards the rear part, and three transverse arches. All the components of the longitudinal arch in individual development show a similar tendency. The longitudinal arch can be noticed from the earliest years. The height of its construction increases in the direction of the medial margin of a foot, and despite the fact it is burdened with its body weight, this system is usually prominent (Demczuk-Włodarczyk 2003). The foot arch of a several-year-old child completely differs from the arch of an adult person. The foot of the several-year-old child with panniculus adiposus and weak muscular system is seemingly flat. From the 3rd-4th year of life the arch begins the process of gradual formation showing its architecture.

Factors which bring about negative effects as regards feet are among others the following: pathological states of circulatory system, inflammations, degenerative changes of bones, neurological diseases, non-observance of rules concerning feet protection, hygiene, and selection of shoes.

The research carried out by Więclaw (2003) showed the correlation between a general degree of physical development, constitution type and sex of the research subjects, and indexes determining the state of the foot arches.

The research aims at the determination of the course of changes in the foot longitudinal arch on the basis of male population at the age between 4 and 18 of the Warmińsko-Mazurski region.

SUBJECTS AND RESEARCH METHODOLOGY

The research covered the population of 8966 males at the age between 4 and 18 from randomly selected nursery and other schools in the Warmińsko - Mazurski region, table 1. The statistical analysis covered only these research results where the doctor did not diagnose any considerable posture defects.

The research methodology covered the measurement of the feet longitudinal arches (Ky, Clarke's). For the purpose of the assessment, the attitude towards a computer assessment of posture, with the application of projection moire technique - Posturometer M, was used. The research methodology and technique were in agreement with generally adopted rules (Mrozkowiak 2008). The obtained results in the form of dimensional, graphic image allowed describing in numbers the parameters subject to research. The obtained research results were prepared statistically, determining the average value, standard deviation, variability coefficient, minimum and maximum value. The distribution of variables was normal.

ACHIEVED RESULTS

The research results have been presented graphically. Diagram 1 presents the course of changes in average values of Clarke's coefficient with reference to longitudinal arch of the left and right foot for male sex and for both sexes, diagram 2 – Ky coefficient.

The curve reflecting average values of Clarke's angle of the left foot shows a constant growing tendency from the 4th year of life: 26.95 degrees up to the 12th year of life: 38.04 degrees, then up to the 14th year of life its value starts decreasing: 33.43 degrees, and in the 18th year of life it takes the maximum value of 41.38 degrees. The average values of the right foot in the 4th year of life show a value which is very similar to the one of the left foot: 27.19 degrees, and in the following year the level of arching insignificantly statistically decreases and next it increases up to the 12th year of life taking the following value: 35,06 degrees. In the 14th year of life it lowers its level to: 28.53 degrees, next it increases up to the 15th year of life and lowers insignificantly up to the 16th year of life, and then in the 18th year of life it assumes the maximum value of 36.2 degrees.

The curve reflecting the average values of Clarke's angle in the population of both sexes is very similar to the curve of respective male population in the age bracket subject to the analysis.

The curve reflecting the average values of Ky coefficient for the left foot shows a constant growth of arch from the 4th year of life: 0.57 to 0.34 in the 12th year of life, next in the 14th year of life it reaches the highest value: 0.41, and then it falls to 0.32 in the 15th

year of life, and in the 18th year of life it increases to the level of 0.42. The average values for the right foot in the 4th year of life are at the following level: 0.6 and they constantly lower their value up to the 15th year of life: 0.36, and then they grow up to the 18th year of life: 0.46.

The curve reflecting the average values of Ky coefficient in the population of both sexes is very similar to the curve of respective male population in the age bracket subject to the analysis.

DISCUSSION

The research carried out by Lizis and collaborators (1996) showed that the average Clarke's angle measured with the plantographic method in 6-year-old boys was at the level of 31.2 degrees for the right foot, and 32.6 degrees for the left one. In the group of 7-9-year-old boys Hagel (2006) noted Clarke's angle of the right foot at the level from 55 and from 54 to 42 degrees in the case of 13.33% of the children subject to research, and from 41 to 20 degrees in the case of 73.34% of the subjects, as regards the left foot respectively 6.6%, 13.33% and 80.01%. In the group of 10-12-year-old boys she noted Clarke's angle of the right foot respectively: 0%, 18.75%, 81.25%, in the left foot: 0%, 25.0%, 75.0%. Asienkiewicz (2001) noted in the case of 35 boys aged 12 the average arch of the right foot at the level of 38.6 degrees and of the left one at the level of 36.83 degrees. Matuszewska (2001) noted in the population of 10-year-old boys Ky coefficient of the right foot within the standard range in the case of 18% of the subjects, in accord with the standard in the case of 58%, above the standard in 24%. In the left foot respectively: 10%, 62%, 28% of the subjects. The research carried out by Makarczuk and Dudkiewicz (2004) shows that longitudinal arch of the left foot, measured by Ky coefficient, more often holds lower values than in the case of the right foot at the age of 17 and 18. The longitudinal arch measured by Clarke's angle does not show any significant increase with age. Also, a significant increase in the frequency of occurrence of lowered and flat feet was noticed (in accord with Ky) between the 12th and 13th year of life. The research carried out by Ignasiak (1995) and Lizis (2000) shows that between the 12th and 14th year of life occurs a temporary, puberal arrest of the foot arch development. The research carried out by Makarczuk and collaborators (2003) shows that in the case of boys the right feet display lowered longitudinal arches more often than the left feet.

The research carried out by Kasperczyk and collaborators (1999) confirms the hypothesis that the intensive development of medial longitudinal arch of foot falls in the period short after assuming of erect position and in the following years. Annual average increments of Clarke's angle showing the lifting of longitudinal arch for children at the age from 3 to 6 are over 5 degrees, for the age from 7 to 10 only a little over 1 degree. The research does not confirm the belief that platypodia is a common phenomenon. 129 persons, 20%, were regarded in danger of platypodia, and about 10% of persons had flat feet.

The research carried out by Więclaw B. (2004) showed that longitudinal foot arch of village children described by Clarke's angle coefficient and Ky coefficient presented with average values fell in the range of values regarded as physiological in contrast to children from Szczecin where average values were lower in relation to the range of correct values. Moreover, among village children there was a higher percentage of correctly arched feet

than in the case of children living in towns. The research also showed sexual dimorphism confirmed by Student's t-test with reference to the average values of Ky coefficient.

CONCLUSIONS

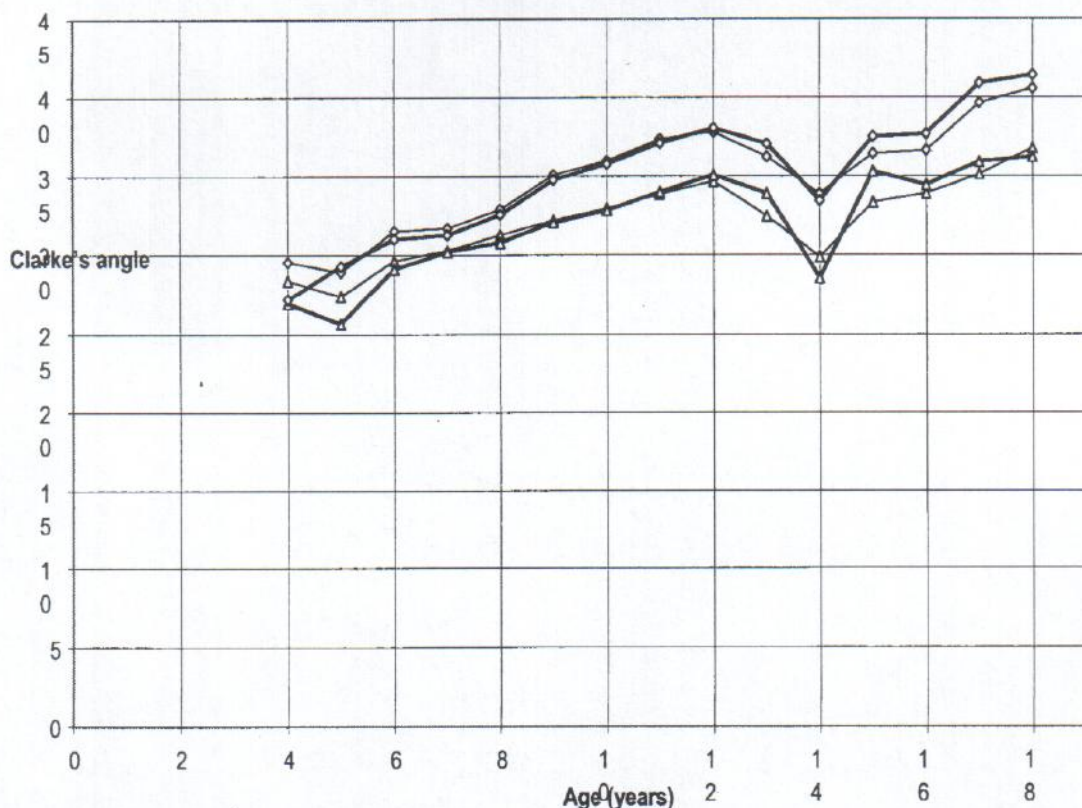
1. The foot longitudinal arch in the case of boys measured by means of Clarke's angle increases from the 4th to the 12th and from the 14th to the 18th year of life. In the period of sexual maturation from the 12th to the 14th year of life the feet arch is subject to lowering.
2. The longitudinal arch of the right foot in the case of boys measured by means of Ky coefficient increases to the 15th year of life; next, up to the 18th year of life it shows a steady rising tendency.
3. The left foot arch measured by means of Clarke's angle has a greater value than the one of the right foot. The right foot arch measured by means of Ky coefficient is greater than the left foot arch.

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Diag. 1 Course of changes in average values of Clarke's angle in male population and both sexes at the age from 4 to 18 (n) M=8699, 18503



Diag. 2 Course of changes in average values of Ky coefficient of feet in male population and both se at the age from 4 to 18 (n) M=8699, 18503

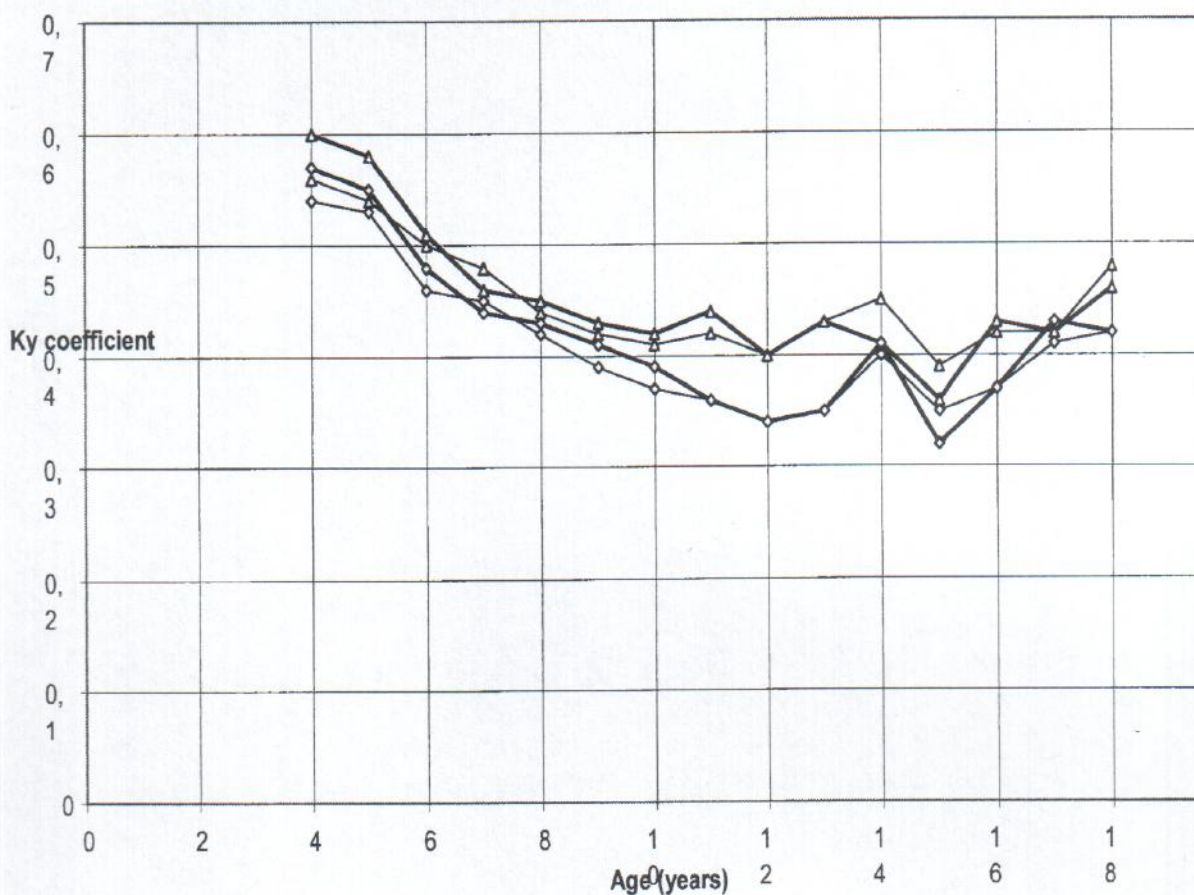


Table 1 Human material, age, body weight and height

Age	Quantity	B.W.	B.H.
4	104	19,5	109,5
5	206	20,1	113,0
6	263	21,7	118,4
7	597	23,21	127,93
8	1255	28,0	130,23
9	1677	31,34	134,47
10	1542	35,11	139,84
11	901	42,48	145,37
12	549	43,61	151,7
13	462	48,45	157,52
14	436	54,25	165,42
15	355	59,82	169,81

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Description of foot longitudinal arch burdened with its weight on the basis of male population at the age between 4 and 18 in the light of projection moire

Age	Quantity	B.W.	B.H.
16	83	58,8	167,7
17	123	64,0	171,0
18	146	70,0	175,4
In total		8699	

Source: own research

Legend:

B.W. – average value of body weight

B.H. – average value of body height

ABSTRACT

Introduction. In the case of a correct foot, the arch consists of five longitudinal arches converging towards the rear part, and three transverse arches. All the components of the longitudinal arch in individual development show a similar tendency. The longitudinal arch can be noticed from early years. Determination of the course of changes in the foot longitudinal arch on the basis of male population at the age between 4 and 18 of the Warmińsko-Mazurski region. The research covered the population of 8966 males at the age between 4 and 18 from randomly selected nursery and other schools in the Warmińsko - Mazurski region. The research methodology covered the measurement of the feet longitudinal arches (Ky, Clarke's). For the purpose of the assessment, the attitude towards a computer assessment of posture, with the application of projection moire technique - Postuometr M, has been used. The research results have been presented graphically. Diagram 1 presents a course of changes in average values of Clarke's coefficient with reference to longitudinal arch of the left and right foot for male sex and for both sexes, diagram 2 – Ky coefficient.

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