

## THE EVALUATION OF METATARSUS, PRETARSUS AND ANTERIOR CARRYING ZONE OF THE FOOT IN PEOPLE OF OLD AGE

### ОЦІНЮВАННЯ СТРУКТУРИ ПЕРЕДПЛЕСНА, ПЛЕСНА ТА ПЕРЕДНЬОЇ НЕСУЧОЇ ЗОНИ СТОПИ ЛЮДЕЙ ПОХИЛОГО ВІКУ

EWA DEMCZUK-WŁODARCZYK, IWONA KRYSIAK, EWA BIEĆ,  
BOZENA OSTROWSKA

*The Academy of Physical Education in Wrocław, Department of Kinesiotherapy*

The involutional changes that take place in human organism as a result of growing older involve all parts of the body. Among them, causing painful sensations is disarrangement of foot's structure. It is widely believed that deformations and ailments connected with feet are a result of longitudinal platypodia. Additionally, it is believed that longitudinal and transverse plantar arch connect architecturally to form inseparable whole. What this amounts to is that an alteration in one segment entails an alteration in some other segment. Whereas, our own observations let us believe that malformations in the region of pretarsus and anterior carrying zone, with properly developed longitudinal arch, are the most common cause of pain in feet. The aim of this research is to analyse and evaluate particular segments of a foot, and determine which part of a foot is particularly responsible for old man's discomfort. Material and research method.

The research involved a 33-person-group aged between 55-57, consisting of 18 women and 15 men. The evaluation of feet's morphological structure was conducted by means of biostereometric method /Demczuk-Wlodarczyk 1998/. The general characteristic was performed on the basis of foot's length, width and contact area with surface. Longitudinal plantar arch of the foot was assessed on the basis of foot's five longitudinal plantar arches' course, and according to Demczuk's typology/ 1993/. Transverse plantar arch of the foot was evaluated on the basis of the way press power remains on the level of metatarsus' bones. Anterior carrying zone was evaluated by walking intensity with which toes adhere to the ground and measurements of the angle of hallux valgus and varus deformity of the fifth toe. The architecture of a foot was evaluated in conditions with no bodyweight burden and with load of bodyweight.

#### Study's results

##### General characteristics of the foot.

Findings of the general characteristics of a foot are presented in tab. 1. They make it necessary that with or without load, all characteristic features of a foot's architecture are evenly formed. The exception is substantially bigger value of the angle of hallux

The values of standard deviations show that there are considerable individual differences of findings in both studies.

Comparison of values of parameters in two different static-dynamic conditions, shows that the values of features under investigation undergo changes. This applies to right foot, height of its I and IV longitudinal plantar arch. As for the left foot, changes concern its length, zonula adherence to the ground as well as height of I and IV longitudinal plantar arch of a foot. It is not feasible to evaluate particular segments of a



foot relying on statistical analysis conducted in this way. Therefore, longitudinal and transverse arch's structure and anterior carrying zone were subjected to individual evaluation.

Table 3

*Characteristics of morphological structure of the feet in people of old age*

Feature		Relief from load		load		Test-t
		x	SD	x	SD	
Right foot	Width	95,63	6,52	95,45	7,68	0,398
	Length	232,42	15,41	237,51	14,13	1,001***
	surface	2028,2	292,76	2159,7	320,75	0,000
	arch I	14,12	4,30	11,24	4,29	1,52***
	Arch II	10,42	4,30	8,84	3,59	0,004
	Arch III	7,27	3,71	5,91	3,48	0,003
	Arch IV	3,45	2,94	1,54	1,88	2,235***
	Arch V	0,91	1,94	0,424	1,27	0,034
	Alfa	18,62	9,77	16,46	10,19	0,007
	Beta	18,58	5,02	17,93	5,73	0,236
Left foot	width	98,97	6,87	100,5	6,13	0,024
	length	233,39	11,67	236,48	11,66	9,78***
	surface	2283,4	326,47	2483,1	306,94	5,313***
	arch I	13,61	4,45	10,39	3,90	2,583***
	Arch II	10,33	3,78	8,03	3,31	4,06***
	Arch III	6,45	3,42	4,91	2,82	0,002
	Arch IV	3,09	2,74	1,454	1,67	0,000
	Arch V	1,06	1,80	0,333	1,20	0,004
	Alfa	18,83	7,0	17,11	7,79	0,049
	Beta	18,98	4,96	18,2	4,88	0,106

\*\*\* p > 0,001

Characteristics of longitudinal arch of the foot

The results of longitudinal arch's analysis are depicted in fig. 1

93.9% of examined population had correct architecture of longitudinal arch of the foot. Functional platypodia was detected only for two feet, which constitutes 6.1%. No instances of hollowed feet were found.

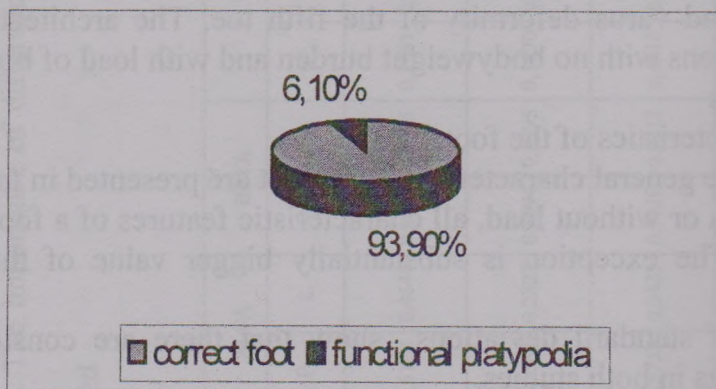


Fig. 1. Characteristics of frequency with which types of longitudinal arch occur in percentage

Characteristics of transverse arch of the foot

See fig. 2 for the results.



Transverse platypodia occurred in 54% of examined people- 23.2% in the case of women, 22.8% in men.

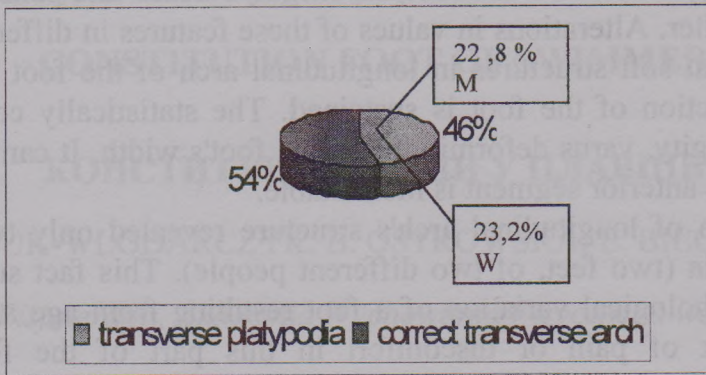


Fig.2. Characteristics of frequency with which transverse platypodia occurs , in percentage

Characteristics of anterior carrying zone of the foot.

See fig. 3 and 4 for the results.

A high pci-enlarge ufuldci people /72.7%-fig. 3/ had an enlarged angle of hallux's valgus. Very frequently, second toe loses partial or full contact with ground.

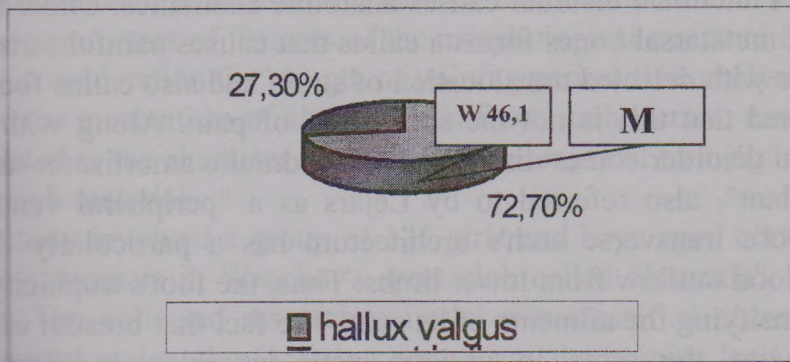


Fig.3. Characteristics of frequency with which hallux valgus occurs, in percentage

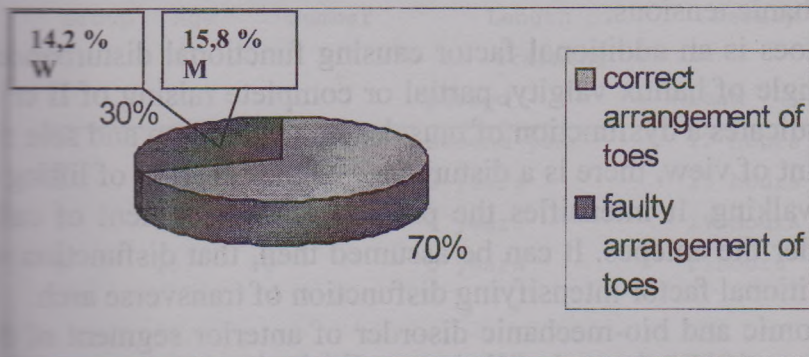


Fig.4. Characteristics of frequency with which defects within anterior carrying zone occur, in percentage

Discussion of findings



Randomly selected for examination group enabled to evaluate architecture of feet belonging to people of geriatric age. Mean values of analysed features of feet show that as a result of putting a strain on the foot, its length, surface and some plantar arches of longitudinal vault alter. Alterations in values of these features in different static-dynamic conditions prove that soft structures in longitudinal arch of the foot function well, and that amortising function of the foot is sustained. The statistically constant values are angles of hallux valgity, varus deformity of V toe, foot's width. It can be assumed, then, that the whole foot's anterior segment is more stable.

The evaluation of longitudinal arch's structure revealed only two occurrences of functional platypodia (two feet, of two different people). This fact suggests that it was some kind of morphological variation of a foot resulting from age and not from foot malformation. Lack of pain or discomfort in this part of the foot confirms this presumption. Results gathered from the individual investigation do not confirm opinion that longitudinal platypodia is a defect of feet typical for people of advanced age.

Alterations in foot's architecture can be observed in the pre-pes area. They are a consequence of a shift of strain onto the middle heads of metatarsal bones. It affects a large percentage of examined people, women as well as men. This translocation of strain onto the middle heads of metatarsal bones deprived of synovial bursas along with protective layer of panniculus adiposus leads to disturbances of the function of foot's mechanic amortizator. Functional disorder causes anatomic anomalies. Under the surface of the middle heads of metatarsal bones forms a callus that causes painful sensations. Among the examined people with detected translocation of strain had also callus found in the feet. It can be presumed that this is not the sole cause of pain. Along with mechanic amortizator's functional disorder comes disturbance of hydraulic amortizator - amortizator formed by "venous plant", also referred to by Lejars as a "peripheral venous heart". Disarrangement of foot's transverse arch's architecture has a particularly detrimental effect on the venous blood outflow from lower limbs. Thus, the foot's trophicity becomes disturbed, thereby intensifying the ailments of its sole. The fact that breadth of examined population's feet remains the same in various static-dynamic conditions suggests existence of fixed functional and anatomic alterations in the range of transverse arch. It appears, then, that the most frequent cause of pain in feet is fore-step being affected by badly distributed mechanic tensions.

Malposition of toes is an additional factor causing functional disturbances of feet. Enlargement of the angle of hallux valgity, partial or complete raising of II or II and III toe over the ground indicates a dysfunction of muscles on the dorsum and sole side. From the biomechanical point of view, there is a disturbance of the function of lifting the strain from antepes while walking. It intensifies the process of development of calluses and painful sensations under the antepes. It can be assumed then, that disfunction within the anterior area is an additional factor intensifying disfunction of transverse arch.

Functional, anatomic and bio-mechanic disorder of anterior segment of the foot is the most frequent cause of painful sensations for of people's feet at geriatric age.

### Conclusions

1. Discomfort felt by people of advanced age results from deformities within anterior segment of the foot.
2. Involutional changes resulting from ageing of organism do not disturb the architecture of foot's longitudinal arch's.



## LITERATURE

1. Demczuk E./1993/FizykoterapiaT1No2.
2. Demczuk-Wlodarczyk E./1998/FizykoterapiaT6Nol-2.

## CONSTITUTION FOOT OF SWIMMER

## КОНСТИТУЦІЯ СТОПИ У ПЛАВЦІВ

E. DEMCZUK-WŁODARCZYK, B. OSTROWSKA, E. BIEC, E. BOEMER

*Wydział Fizjoterapii, Akademia Wychowania Fizycznego we Wrocławiu*

Proper anatomic structure of the foot is a prerequisite for foot's correct functioning. During ontogenesis, various egzogamic factors exert their effect on foot architecture. Understanding the mechanisms of this effect makes it also possible to influence foot's development in a beneficial way, as well as prevent any malformations. There is a prevalent opinion that a long-lasting static work of feet constitutes the cause for their deformity. While, in fact, the examinations of feet conducted on people training swimming proved that intensive dynamic work, in conditions of strain put on feet, also leads to alterations in particular segments of feet architecture. The aim of this study is to analyse the parameters of features of the morphological structure of child swimmers feet, taking into consideration the length of training period. The analysis will make it possible to evaluate the mechanism of alterations in foot's architecture; mechanisms of alterations that are related to the character of work and the length of training.

## Research material

The study involved a group of 125 girls and boys aged between 12 and 15. All of them were swimmers in Wrocław's sport club called "Juwenia", systematically training swimming. The collected research material was classified according to age of people under examination, length of training period, and the training load.

Tab. 1. The characteristics of research material

Group	Age	Number	Length of training period	Weekly training load
1	12	29	Second year	12 hours
2	13	33	3 years	15 hours
3	14	33	4 years	17 hours
4	15	30	5 years	21 hours

A biostereometric method / Demczuk-Wlodarczyk 1998/ was applied to evaluation morphological structure of feet. From the total parameters of foot, its length, width and arch was analysed. Longitudinal arch was evaluated by analysing the course of five longitudinal plantar arches of the foot over the base and according to Demczuk /1993/ method. Transverse arch was evaluated on the basis of distribution of pressing force on heads of metatarsus bones. Anterior carrying zone was assessed on the basis of