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THE ANTHROPOLOGICAL PROFILE OF A WORLD LADY CHAMPION IN MODERN GYMNASTICS

VLADIMÍR V. NOVOTNÝ

(Institute of Sports Medicine, Faculty of Medicine, Charles University, Prague).

The results of an anthropological examination of sportsmen provide always an interesting view of a selected part of the population representing a group of persons with a good functional efficiency and proper bodily constitution. While certain fields of sports are being paid attention to more frequently, we do not know anything about some others from the point of view of sports anthropology. Among those recent sports fields, of whose influence upon the organism we do not know much ranges also modern gymnastics, though it has already seen two world championships.

Modern gymnastics is a specifically female branch of sports in which not only the performances are concerned, but also the expression of joy coming from movement, and the creation of a musical work of movement. In the sense of sports, a good performance in modern gymnastics requires mastering of the elements of sports gymnastics, ballet and rhythmics, in the sense of music, creation of an exacting entity with all its music components, which means not only with rhythm, but also with the character of music, harmony, melodics, dynamics, and tempo. The assessment of performances in modern gymnastics consists thus not only in the appreciation of how the different sports elements have been mastered but also in the appreciation of the impression a lady gymnast has exercised from the aesthetic point of view.

Frow what has been said it is evident that modern gymnastics enables the optimal prominence of women's advantages in this sense, and that both the bodily structure of the top lady champions and particularly that of the world lady champion in this field of sports will in general be extraordinarily instructive.

The 2nd World Championship in modern gymnastics which took place in Prague in 1965 provided the possibility to obtain these items of knowledge that were hitherto unknown. The complex examinations carried out gave not only the first picture of the morphological and functional characters of the best world lady champions in modern gymnastics, but also valuable information from both the anamnestic and traumatologic points of view. We have submitted these results arranged in a survey to the World Congress of Sports Medicine in Hanover in 1966. (Martinovská A., Novotný V., Tamassyová E., Trefný Z., 1966). The results of the anthropological examination, particularly as carried out in view of the bodily structure of the world's most successful lady gymnast — world champion — are summed up in this work.

METHODICAL

On the occasion of the 2nd Modern Gymnastics World Championship held in Prague in 1965, a precise anthropological examination was carried out on the world's 35 best lady champions in gymnastics coming from ten countries (Belgium, Czechoslovakia, Finland, Cuba, Hungary, Germ. Dem. Rep., Fed. Rep. of Germany, Poland, Austria, U.S.S.R.) in the anthropological laboratory of the Institute of Sports Medicine, Prague. The relatively low number of persons examined is given by the small number of champions in general. For each country there are only three persons admitted to compete. This was the reason why we added to the set also some substitutes with almost equivalent efficiency.

(1) Sports anamnesis

(2) Somatometric examination:
- (a) anthropometry of the 28 body characters (Martin R., Saller K., 1957),
- (b) the establishment of relative values of the body characters measured and the calculation of proportional indices, (Martin R., Saller K., 1957),
- (c) the determination of the amount of fat in the body as well as of the weight of active body mass, (Pařízková, 1962; Novotný V., 1964),
- (d) typological estimation by means of morphosomatograms (Correnti V., 1959), and by means of the indices of Rohrer, Pignet, Kaup, and Seitz.

  In Rohrer's and Kaup's indices, also our arrangement of the index was used utilizing the weight of the active body mass instead of the total weight.

(3) Somatoscopic examination:
- (a) an objective estimation of the posture (Jaroš M., 1958),

(b) an estimation of the development of muscles.

(4) Somatographic examination:

(a) photosomatogram in 4 projections (Novotný V., 1966),

(b) photosomatogram in the state of maximum anteflexion and retroflexion of the backbone, and its goniometric evaluation (Novotný V., 1966),

(c) cyrtogram (Nováková M., 1960),

(d) plantogram and its mathematical evaluation (Novotný V., 1965), and examination of the foot arch by means of the pedobarographic method (Choděra J., 1959).

RESULTS

The anamnestic and somatometric results are shown in Table I.

(1) Sports anamnesis:

H. M. (Czechoslovakia) aged 19, won the title of lady champion of the world (champion absolute and for gymnastic instruments). Equally the age of all lady participants in the world championship was relatively low, 22 $^1/_2$ years on the average. In relation to the efficiency no statistically significant difference in the age was found between the most and least successful lady competitors.

The world lady champion attained her success after a seven years' competition activity in modern gymnastics. This time made in all participating lady gymnasts not fully 5 years on the average. Statistical treatment showed that ladies in the leading places had a markedly longer period of previous competition activity ($p < 0,01$) as compared with the ladies in the last places.

(2) Somatometric examination:

(a) *The body height* of the world lady champion was very small (158,6 cm) in relation to the population of girls not going in for sports of her country (163.2 cm) as well as in relation to ladies going in for other sports. The small body height of all examined gymnasts bears evidence of the fact that, at present, only girls with a small stature do well in modern gymnastics.

TABLE I

Anthropometric characters of the outstanding world lady competitors in modern gymnastics
The Prague World Championship 1965

	World lady champion		Participants in the world championship (N = 35)			
	Absolute values	Relative values	$M \pm S_{\bar{x}}$	S	V per cent	Relative values
Years of competition activity	7		4.9 ± 0.57	3.31	67.59	
Age	19		22.5 ± 0.60	3.56	15.82	
Body height	158.6		161.9 ± 0.75	4.43	2.74	
Body weight	53.5	33.7	54.8 ± 0.75	4.46	8.14	33.8
Weight of active body mass	48.1	30.3	48.6 ± 0.70	4.15	8.54	30.0
Fat (per cent)	10.2		11.3 ± 0.65	3.83	33.90	
Body height when sitting	86.6	54.6	86.4 ± 0.44	2.58	2.99	53.4
Length of upper extremity	70.1	44.2	70.6 ± 0.38	2.22	3.14	43.6
I ength of lower extremity	83.7	52.8	86.7 ± 0.65	3.86	4.45	53.6
Biacromial breadth	36.8	23.2	35.6 ± 0.22	1.28	3.60	22.0
Bust	24.8	15.7	24.7 ± 0.22	1.29	5.22	15.3
Chest depth	16.2	10.2	16.4 ± 0.17	0.98	5.98	10.1
Bicristal breadth	27.3	17.2	27.6 ± 0.22	1.31	4.75	17.0
Bitrochanteric breadth	31.3	19.7	31.0 ± 0.18	1.05	3.39	19.1
Chest circumference mesosternally						
medium	81.5	51.4	82.5 ± 0.54	3.20	3.88	51.0
inspiration	87.0	54.9	87.3 ± 0.56	3.32	3.80	53.9
exspiration	76.8	48.5	78.0 ± 0.60	3.53	4.53	48.2
Difference of inspiration—exspiration	10.2		9.3 ± 0.42	2.51	27.00	
Chest circumference xiphosternally						
medium	73.6	46.5	73.4 ± 0.51	3.03	4.13	45.3
inspiration	80.8	51.0	79.2 ± 0.62	3.69	4.66	48.9
exspiration	72.0	45.5	70.8 ± 0.57	3.38	4.78	43.7
Difference of inspiration—exspiration	8.8		8.3 ± 0.35	2.08	25.10	
Belly circumference	72.4	45.7	71.9 ± 0.57	3.35	4.66	44.4
Gluteal circumference	91.7	57.8	91.7 ± 0.51	3.01	3.28	56.6
Arm circumference p. (relaxed)	24.8	15.6	24.6 ± 0.27	1.58	6.42	15.2
(during cubital flexion)	27.3	17.2	26.9 ± 0.31	1.81	6.73	16.6
Difference of relaxation — flexion	2.5		2.3 ± 0.12	0.71	30.90	
Forearm circumference p.	22.8	14.4	22.8 ± 0.21	1.26	5.53	14.1
Thigh circumference p.	58.3	36.8	56.0 ± 0.45	2.68	4.79	34.6
Calf circumference p.	34.9	22.0	35.1 ± 0.35	2.10	5.99	21.7
Foot length	23.2	14.6	23.6 ± 0.13	0.74	3.14	14.6
Indices						
I of thorax	153.1		150.7 ± 1.84	10.87	7.21	
I of trunk breadth	85.1		86.9 ± 0.65	3.83	4.41	
I of pelvis breadth	87.3		89.2 ± 0.57	3.35	3.76	
I of upper extremity circumference	108.8		107.7 ± 0.61	3.62	3.36	
I of lower extremity circumference	59.8		62.7 ± 0.49	2.89	4.61	

The body weight was proportional to the body height. It too was very small, and its values of 53.5 kg in the world lady champion and 54.8 kg in all examined lady gymnasts respectively testify that the ladies were extraordinarily slim. They are the lowest values of body weight in general, which we had ever had the possibility to find in sportsmen for numerous years of their examination on the whole.

The circumference of the chest, the third basic anthropometric value, could not be high under such circumstances. It was also low in its absolute value (mesosternally 81.5 cms, xiphosternally 73.6 cms), and adequate in its relative value. The difference between maximum inspiration and exspiration, however, was remarkable and turned a great surprise with its values of 10.2 cms in the world lady champion, and 9.3 cms on the average in all ladies of that field, because it was one of the highest we had ever measured in sportswomen in general.

A detailed anthropometric examination was in its absolute values proportional to the results of the basic anthropometric examination, and in its relative values corresponded to the usual values. In the world lady champion we could observe a relatively higher length of the upper bodily segment, a higher length of the upper extremities, a shorter length of the lower extremities, a higher biacromial breadth, as well as higher values of the circumferences of the gluteus, thigh and arm. A relative wide difference exists between the value of the arm relaxed and in flexion in the elbow (2.3 cms). It suggests certain, though not extraordinary hypertrophies of the musculature in this region.

The statistical treatment of the results of anthropometric examination showed that there is no significant difference in ladies of the first and the last six places as far as the studied characters of the body are concerned. Solely the value of the chest circumference (mesosternal) during exspiration was markedly higher ($p < 0.01$) in the successful champions as compared with the unsucessful ones.

(b) *Proportional indices* complete the results of anthropometric examination.

The chest index d stingu shed itself both in the world lady champion (I = 153.1) and in all lady gymnasts (I = 150.7) for its high value. This is the result of a noteworthy predominance of the transversal dimension over the sagittal dimension of the chest.

The trunk breadth index (I = 85.1) was lower in the world lady champion than was the average value found in all lady gymnasts (I = 86.9), which is evidence of a striking predominance in breadth of the upper half of the trunk over the lower half.

The pelvis breadth index (I = 87.3) agrees both in the world lady champion and in all women (I = 89.2) fully with the values common in girls of our population not going in for sports. The upper extremity circumference index of the world lady champion (I = 108.8) is very close to the values of that index in normal population. The average values of that index are lower in all lady gymnasts (I = = 107.7), and suggest a comparatively small circumference of the arm as related to the forearm. The lower extremity circumference index of the world lady champion (I = 59.8) is remarkably lower than the average value of this index in all examined lady gymnasts (I = 62.7) as well as in the normal population. It bears witness to proportional predomination of the circumference of the thigh over that of the calf.

Statistical treatment of the significance of differences in the values of the given indices showed that there was no significant difference in any of the indices as between the best and the worst lady competitors.

(c) *The body fat* and the quantity of active body mass are indicators indispensable for the appreciation of development of the body. The best lady of the world in gymnastics had only very little body fat (10.2 per cent) and did not differ essentially in this sense from the average value established in all women (11.3 per cent). The weight of the active body mass is comparatively high in relation to the girls of the normal population not going in for sports, especially in the relative value, not only in the world lady champion (48.1 kgs — 30.3), but also as concerns the average values of all lady gymnasts (48.6 kgs — 30.3). The distribution of subcutaneous fat in the world lady champion and in all the lady gymnasts we had examined during the world championship as compared with the usual Czechoslovak population of girls not going in for sports and approximately of the same age is evident from Fig. 1.

Statistical treatment of the significance of differences, as far as the quantity of body fat and the weight of the active body mass are concerned,

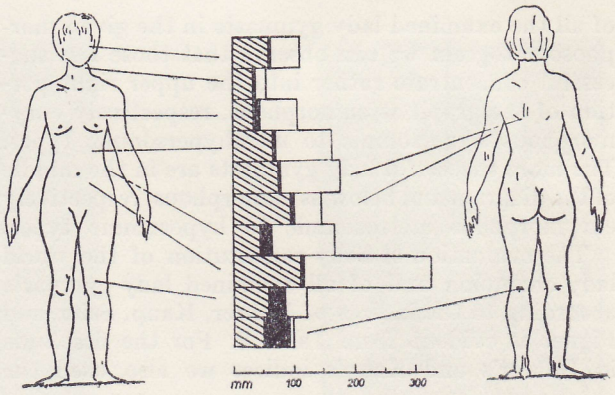

FIG. 1.
Distribution of subcutaneous fat in the world lady champion (lined), in all lady gymnasts (black), in girls not going in for sports (white).

between the first and the last six lady competitors in the world championship showed that, even in this sense, no significant difference between these could be established. All lady gymnasts had very little body fat and their active body mass was adequate and rather more than that.

(d) *The somatotype* of the world lady champion in modern gymnastics evaluated by means of Corr n i's morphosomatogram corresponds to the eumorphous, metrosomnic type. In Fig. 2 indicating the position

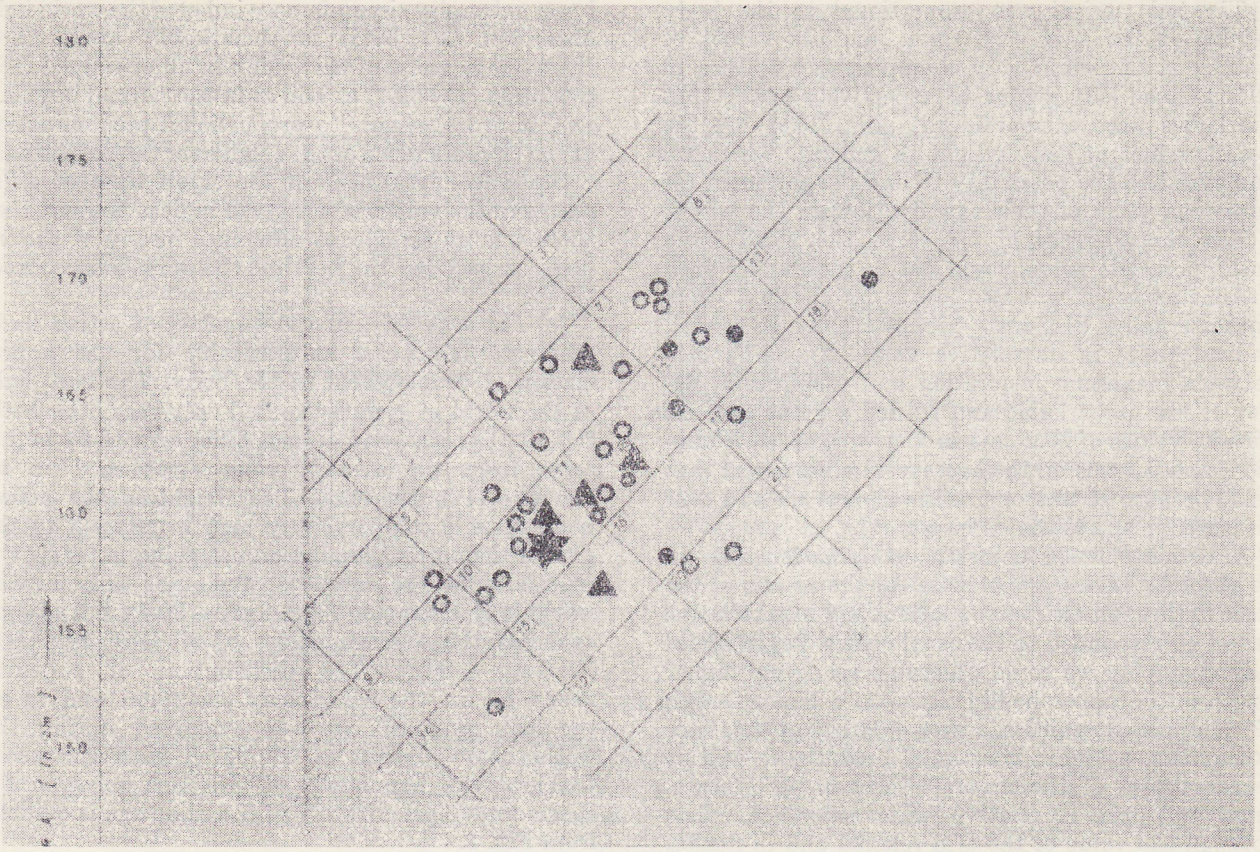

FIG 2. .
Classification of lady participants in the world modern gymnastics championship in Correnti's morphosomatogram. An asterisk denotes the world lady champion, a triangle the most successful ones, small circles denote the other lady competitors

of all the examined lady gymnasts in the given morphosomatogram we can observe that those less successful concentrate rather into the upper right portion of the graph as eumorphous, respectively eurymorphous hypersomnic to ultrahypersomnic types. The more successful lady gymnasts are in the middle of the diagram and below as eumorphous, respectively eurymorphous metrosomnic to hyposomnic types.

The evaluation of body constitution of the world lady champion and of all examined lady gymnasts according to the indices of Rohrer, Kaup, Seitz, and Pignet is evident from Table 2. For the first time in Rohrer's and Kaup's indices we also used the conversion to the weight of the active body mass. This method permits a more reliable appreciation of the existing indices in that it distinguishes the ratio of body fat and active body mass to body weight.

There was no statistically significant difference between the values of the respective indices, of successful and unsuccessful competitors.

TABLE 2

Indices of body structure of the world lady champion (A), and average values of indices of the best world lady competitors in modern gymnastics (B).

(Modern Gymnastics World Championship, Prague, 1965)

Index	A	B
Rohrer	1.356	1.293
Rohrer (ATH)*	1.218	1.142
Kaup	2.144	2.089
Kaup (ATH)*	1.926	1.821
Seitz	33.920	34.757
Pignet	23.6	24.3

(3) Somatoscopic examination:

(a) *The appreciation of the posture* is very important in modern gymnastics as posture is one of the criteria according to which performances are evaluated in this field of sports. It seems, therefore, necessary that the posture of lady competitors in modern gymnastics should be very good. The results of the world lady champion's examination have confirmed this assumption, yet examinations of the other women competitors have not furnished unambiguous results in this respect. White almost in all cases the postures of the head, the shoulders, the chest, and the abdominal integument were without any defects, there were some more frequent defects observable in the posture of the trunk in the frontal plane. Surprisingly frequently could be seen a higher angle of inclination of the pelvis, increased lumbar lordosis, and traces of equalization of thoracal kyphosis. The frequency of findings in the different parts when evaluating the posture is evident from Table 3.

A classical example of some of the mentioned defects of posture in a pair of particularly excelling

TABLE 3

Results of somatoscopic evaluation of the posture of the best world lady competitors in modern gymnastics (per cent)

(Modern Gymnastics World Championship, Prague, 1965)

Result of evaluation / Evaluated parts	Posture			
	perfect	good	bad	quite bad
Head, neck	74.3*	25.7	0	0
Chest, shoulders	85.7*	14.3	0	0
Abdomen, pelvis	45.7*	48.6	5.7	0
Curve of backbone (antero-post.)	34.3*	57.1	8.6	0
Position of trunk (in frontal plane)	60.0*	34.3	5.7	0
Lower extremities	77.2*	20.0	2.8	0

* classification of the world lady champion

lady gymnasts competing for the title of world champion is presented in Figs. 3a) and 3b).

There was no statistically significant difference between the most and least successful lady gymnasts concerning their posture.

(b) *Appreciation of the development of musculature* was comparatively simple. All lady gymnasts were very slim, and, though the subcutaneous fat layer was very thin, the muscular relief was not more striking, with the exception of the abdominal muscles. Only during cubital flexion of the arm we could observe a certain hypertrophy of the m. biceps brachii, and during volitional increased tension of the muscles even hypertrophies of the mm. pectorales, mm. glutei, and mm. quadriceps femoris could be recorded. Such hypertrophies of musculature

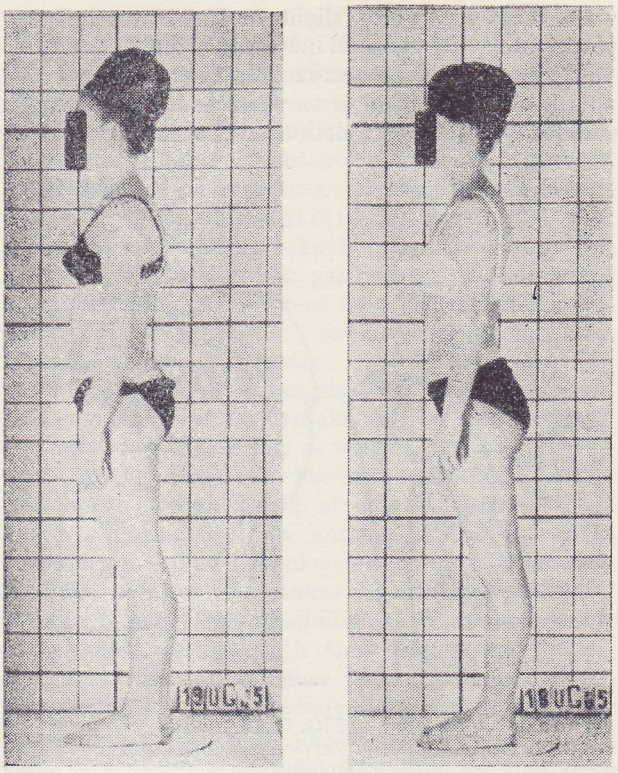

FIG. 3.
An example of the posture of two lady competitors who belonged to the best during the world championship.

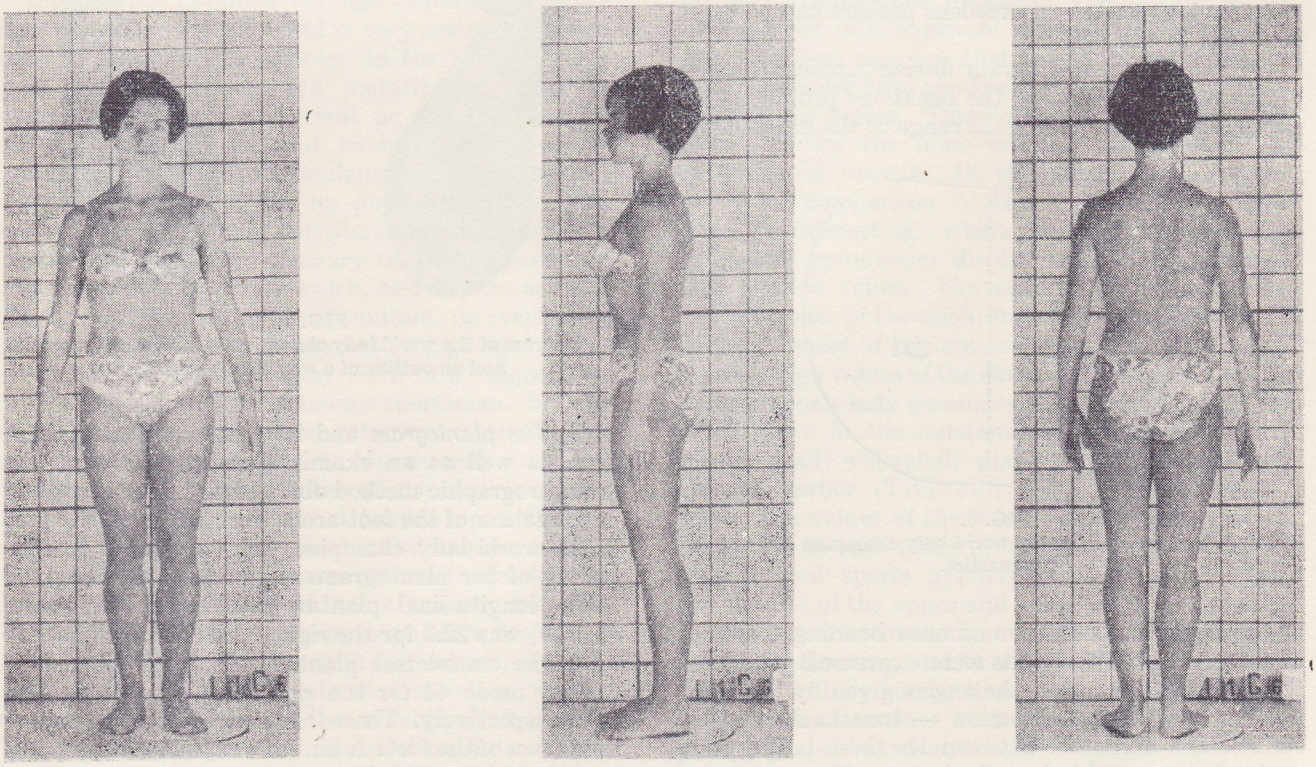

FIG. 4.
Photosomatogram of the world lady champion in modern gymnastics.

were, however, quite slight and somatoscopically perceivable only through increased attention.

(3) Somatographic examination:

(a) *The pohotosomatogram* of all examined persons enabled practical completion of the results of both

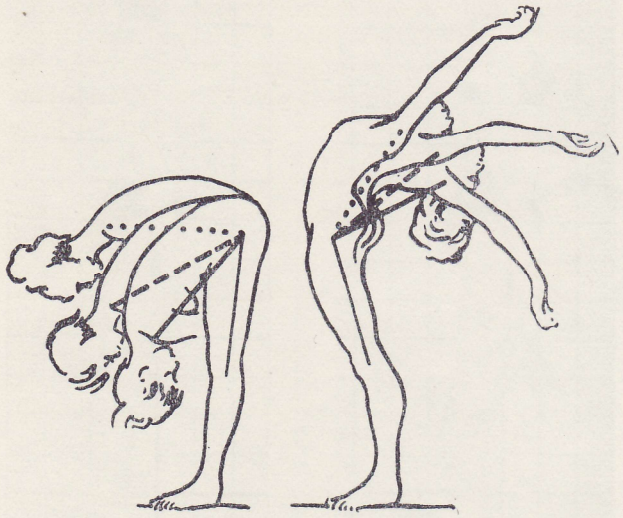

FIG. 5.
Schematical illustration of varying possibilities of movability of the backbone during maximum ante- and retroflexion in the world lady champion (full line), in all examined lady gymnasts (dashed line), in girls not going in for sports (dotted line).

somatometric and somatoscopic examinations, and thus created the first document of its kind about the best lady competitors of the world in modern gymnastics. Figs. 4a), b), c) show the photosomatogram of the world lady champion. A harmonic body development as well as an excellent posture can be very well seen in the figures.

(b) The photosomatogram during *maximum anteflexion and retroflexion* of the backbone provided the possibility of determining the range of the movability

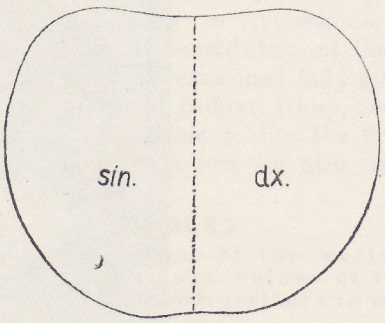

FIG. 6.
Cyrtogram of the chest in the world lady champion in modern gymnastics.

of the backbone during maximum bending forward and backward. The results were expressed goniometrically with the aid of the angles given by the connecting lines of the akromion — tronchanterion — tibiale. The difference between the best lady gymnast of the world (anteflexion = 36 per cent, retroflexion = 101 per cent), the average of all lady gymnasts (anteflexion = 53.4 per cent, retroflexion = 114.7 per cent), and the young girls not going in for sports (anteflexion = 84.6 per cent, retroflexion = 131.5 per cent) is observable from the schematic illustration in Fig. 5.

The statistically significance of these differences is very important ($p < 0.001$).

(c) *The cyrtogram of the chest* confirmed objectively the somatoscopic finds in that it showed no striking asymmetries in the shape of the chest of the examined gymnasts. Some slight, physiological asymmetries were recorded practically in all cyrtograms. A relative predominance of the transversal chest dimension over the sagittal equivalent did not appear distinctly. Naturally, cyrtograms were being taken in the xiphosternal plane, while the somatometric measurements were taken in the mesosternal plane. Fig. 6 shows the cyrtogram of the chest of the world lady champion.

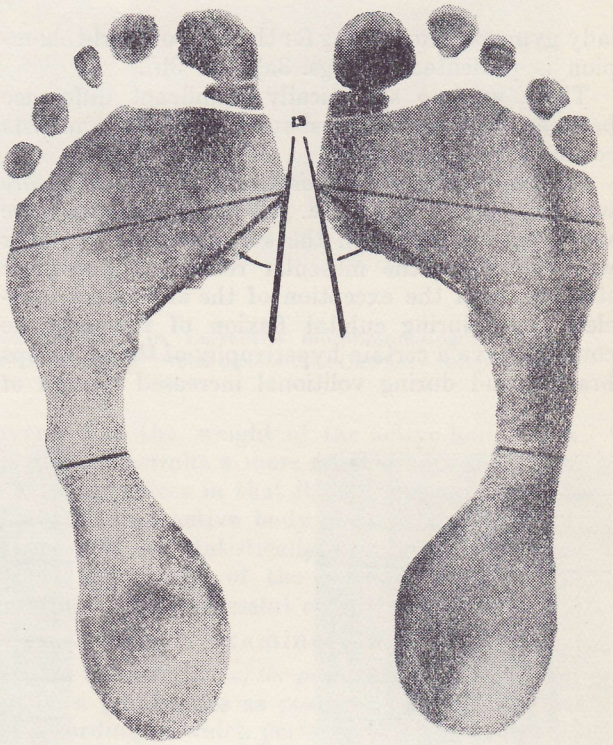

FIG. 7.
Plantogram of the world lady champion in modern gymnastics and an outline of a way of its evaluation.

(d) *The plantogram* and its mathematical evaluation, as well as an examination by means of the pedobarographic method objectified the somatoscopic examination of the foot arch. Formation of the feet of the world lady champion was very good. A photocopy of her plantograms is presented in Fig. 7.

The longitudinal plantar arch index (Chippaux, Šmiřák) was 22.7 for the right, and 24.3 for the left foot. The transversal plantar arch index (Schwatz, Clarke) made 44 for the right, and 42 for the left foot, respectively. These results indicate a normal formation of the foot. A hint of a slight arch lowering could only be stated for the left, standing foot according to the transversal plantar arch index which was

at the lower normal line. 91.4 per cent of all lady gymnasts had a complete longitudinal plantar arch, the others displayed only a light lowering. 65.7 per cent of all persons examined had a complete tranversal plantar arch, but only one lady gymnast exhibited a flat foot.

The results are given in the form of a survey in Table 4.

TABLE 4

Results of evaluation of the foot arch according to the plantograms of the best world lady competitors in modern gymnastics (per cent)

(Modern Gymnastics World Championship, Prague 1965)

Method of evaluation / Result of evaluation	Longitudinal plantar arch		Transversal plantar arch	
	Foot		Foot	
	right	left	right	left
Normal	91.4*	97.2*	65.7*	65.7*
Slightly flat	8.6	2.8	31.5	34.3
Flat	0	0	2.8	0

* classification of the world lady champion

The statistical treatment of the results, in the sense of the significance of differences between the most and the least successful lady gymnasts, did not indicate any significant differences in the foot formation.

DISCUSSION

Information obtained through examination of the best sportsmen in the world is very instructive, and not only for scientific workers. In the time of ever-increasing automation and motorization, an ever larger number of persons will be affected by consequences of the lack of exercise. These shortcomings, very frequently endangering one's health, may easily be overcome by physical culture and sports. This involves not only the competition activity in sports, but rather, contrary to that, systematic and purposeful exercises which, also in this modern life full of automation, may maintain, or eventually increase the efficiency of man until a high age.

A model on which we may learn in a unique way in this sense is the outstanding sportsman. In him we may observe correlations between certain performances and body structure, on him we may study the influence of a long-term, often at the utmost border of man's possibilities situated burden upon the organism. The results of such observations are important once again not only for sportsmen, their selection and the further increase of their efficiency, but also for the common, not exercising population for whom the former provide the possibility of determining the most suitable individual physical exercises. So far we have lacked such works that would permit us studies of this kind. The only model of an outstanding sportsman from whom we could reliably learn about the influence of running on the organism, was most probably the world champion E. Zátopek (Hornof Z., Kremer M., 1952). An ideal opportunity for gaining new experience in this sense are the Olympic games. However, the environment of the Olympic games puts many obstacles in the way, and so we find in the relevant literature only individual original results. Here belong, e.g., the works of Kohlrausch (1930), Correnti (1964), Hirrata (1966). A number of sports branches, however, are not included in the Olympic games, and so we cannot learn anything about them not even on such occasions. One of them is the exclusively female sports branch, modern gymnastics.

During the world championship in modern gymnastics we have tried to make use of the person of the world lady champion as well as of other topping world lady gymnasts for the sake of obtaining a certain model for this field of sports. The fact that modern gymnastics has not been studied so far either from the anthropological, or from the sports medicine point of view makes the discussion difficult. We have only the possibility of comparing some examination results with those established in the best sportswomen of other sports branches. From the available studies, the lady competitors in sports gymnastics examined by us during the Prague World Championship in 1962 seem to be the most suitable material for comparison.

With their very low body height and weight, the lady competitors in modern gymnastics are almost identical with those in sports gymnastics. In sports lady gymnasts, the amount of body fat was not determined. If a comparison in this sense were possible, probably a differentiation would occur in the sense of a higher quantity of the active body mass of lady competitors in sports gymnastics. If we compare the bust values of modern and sports lady gymnasts, we can see that the thorax is distinctly larger in sports lady gymnasts, especially as concerns its relative values. These findings are particularly influenced by the more essential development of the thoracal muscles. Of the other anthropometric values, a comparison of the abdominal circumference is interesting, where the lady competitors in modern gymnastics display both higher absolute and relative values. The case is similar with the circumference of the thigh, and the vice versa with the circumferences of the arm and forearm. The comparatively high values of the chest index find an analogy even in sports lady gymnasts. The high values of the chest index in the outstanding sportswomen (lady rowers and volleyball players) were mentioned already earlier (Titlbachová S., Novotný V., 1966). The values of the trunk breadth indices stand very close to each other in lady competitors in both modern and sports gymnastics. Contrary to that, the indices of the upper and lower extremity circumference bears testimony to a relatively lower circumference of the arm, and to a higher circumference of the thigh of lady competitors in modern gymnastics.

The task of another work will be to draw a complete and perfect comparison of lady competitors, in modern and sports gymnastics. Even now it is evident that, although they are very close to each other in body type, the demands and methods of

training as well as the pursued aims differ greatly, this difference being very clearly recorded in our results.

In this work no mention has been made about certain additional results of the examination that have already been published before (Martinovská A., Novotný V., Tamassyová E., Trefný Z., 1966). Out of these results, the value of the hand clasp making 30 kps (for the world lady champion 32 kps), the same average value in all lady gymnasts 29 kps/27 kps, and the strength of the dorsal musculature (making 100 kps in the world lady champion, the average value in all gymnasts being 77 kps), were connected immediately with the treatment of the anthropological profile. Equally neccessary for the completion of the total picture is the vital capacity value determined spirografically. The latter was 3.600 ml (BTPS) in the world lady champion, which equals 129.1 per cent of the pertinent value, the average value in all lady gymnasts being 3.820 ml (BTPS), which equals 125.2 per cent of the relevant value.

When evaluating the results of the examination we frequently encountered during statistical treatment the fact that there were no significant differences found between the best and the worst lady competitors. On the one hand, this is the result of the fact that the competitors virtually did not differ much, on the other hand, of the fact that many of those possessing optimum physical requirements for excelling had not yet mastered satisfactorily the required demands as regards the sports and musical elements.

The world lady champion paid main attention to in our work was a typical example of a woman going in for some kind of sports activity in an outstanding way. Her body development was harmonic, the adequate quantity of the body fat and active mass corresponded to an appropriate development of muscles. Also the posture was perfect. In most of the anthropometric values, she stood more closely to average values measured in all lady gymnasts than to extraordinary values. We know that an extraordinary sportsman need not necessarily be an ideal model. We have often in this connection pointed out numerous shortcomings resulting from one-sided long-term sports training. In this work we have also mentioned some individual less favourable findings. They will still have to be paid attention to in the future.

With respect to the fact that in modern gymnastics the aesthetic aspect of the sports performance is highly estimated, the lady gymnasts strive for the possible highest culture of movements. Thus the elements of modern gymnastics are occupying an outstanding place in sports branches for ladies, on the way to an optimum physical development.

SUMMARY

This report comprises the results of an anthropological examination of a lady champion in modern gymnastics, as well as of other outstanding lady competitors coming from 10 countries that participated in the Modern Gymnastics World Championship Prague 1965. The detailed description contains the results of anthropometric examination, as well as those of the quantity of body fat, active body mass, typological classification, the posture and development of muscles, the movability of the backbone during maximum ante- and retroflexion, the cyrtogram of the foot, and the condition of foot arch by means of the plantogram and pedobarographic methods. The results are illustrated in tables and figures. The discussion treats characteristic findings in the world lady champion and the other lady competitors in modern gymnastics, and contains a brief comparison with lady competitors in sports gymnastics. Both the results and the discussion are arranged so that they may contribute not only to the selection of suitable lady competitors and to the prevention of a one-sided sports activity, but that they may also draw attention to the universal significance of the advantages of this specifically female sport for a favourable physical development.

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Doc. Dr. V. Novotný, C.Sc.
Katedra tělovýchovného lékařství
fakulty všeobecného lékařství, Praha