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## ANTHROPOLOGICAL RESEARCH OF THE PARTICIPANTS OF CZECHOSLOVAK SPARTAKIADE (ČSS) 1975

### INTRODUCTION

In the last decades, living standard of the inhabitants in Czechoslovak Socialist Republic increased markedly. This increase demonstrates the improvement of the socio-economic and health conditions, which are important factors for the physical condition of our children, youth and adults.

The basic outside parameters of the physical condition are stature, body mass and chest circumference.

Besides the smaller local studies of the physical condition, wide national researches play an important role. The first extensive transversal research has been carried out by J. Matiegka in 1895. The results of it formed the basis for the reliable reconstruction of the secular trend in the basic somatometric characteristics and thus also a valuable starting point for comparison in the future.

In the years 1951, 1961 and 1971 important national studies have been organized and their results interpreted by V. Fetter and his collaborators. Normal values of the growth have been ascertained, able to serve as points of orientation especially for the school physicians, pediatricians and teachers, in the judgement of the physical condition and development of children and youth.

In addition to it, the results of the anthropological measurements carried out among the participants of the Ist, IInd and IIIrd National Spartakiades in the years 1955, 1960 and 1965 are of great value. V. Fetter, as the organizer of this research utilized the massive concentration of the adult population from all regions of Czechoslovakia and obtained the data about the actual state and

development of the basic body characters in the adult population.

Transversal anthropological research of the participants of the Czechoslovak Spartakiade 1975 (further on only ČSS 1975) is a logical continuation of the studies mentioned above. The data about stature, body mass and chest circumference characterize the physical condition of the healthy adult population and the standards thus obtained make it possible to be compared with the preceding studies. An analysis of the data enables to evaluate ethnic characteristics of the population and to estimate the effect of the secular trend.

### MATERIAL AND METHOD

Scientific consultation in the anthropological research of the ČSS 1975 was guaranteed by J. Suchý and J. Machová was put in charge of the organization. Regional instructors for each region in ČSR were chosen. They organized and issued instructions for the trainers, who became blanks and measurement means to be used during the training in the Physical Training Organizations.

Regional instructor in Prague and Middle-Bohemian Region was J. Machová, in the South-Bohemian Region M. Menzelová, in the West-Bohemian Region M. Janěček, in the North-Bohemian Region M. Žižková, in the East-Bohemian Region V. Ryba and in the North-Moravian as well as South-Moravian Region J. Klementa.

The measurements have been carried out during May (and partly in June) in the Physical Training Organizations, mostly before the District Spartá-

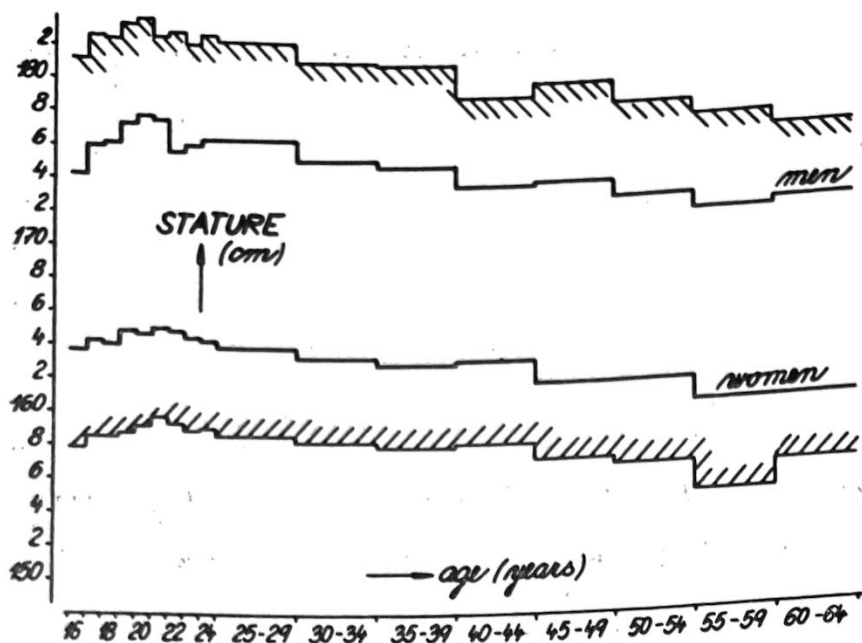


FIG. 1.  
Stature as a function of the age. In the vertical axis mean value of the dimension is given, for both sexes. Upper curve shows mean + S. D. for men, lower one shows mean - S. D., for women.

kiades. Part of the data has been obtained by measuring of the participants in the dressing places of the Strahov Stadium during the training of the principal performance in the last days of June and some first days of July of 1975. All measurements were performed with an agreement of the Research Council of the Czechoslovak Union for Physical Education (ČSTV).

8,012 participants of the ČSS 1975 were measured at all, among them 2,936 males and 5,076 females (1,663 male adolescents and 1,833 female adolescents; 1,273 men and 3,243 women). In Bohemia 5,789 participants were measured (2,101 males and 3,688 females), in Moravia 2,233 participants (835 males and 1,388 females). Also some active participants in the age over 65 years were measured (12 men and 10 women in the age from 65 to 69 years and 4 men and 1 woman in the age from 70 to 74 years. It seems to give evidence on the good physical condition and physical activity of Czechoslovak people.

The data have been analyzed statistically up to the highest age category of 60-64 years, both for men and women. In comparison with the previous measurements, number of men measured in the highest age categories decreased moderately, while the number of women in these categories increased. This finding can be interpreted as a consequence of an increasing interest of women to keep in good condition their body fitness up to the higher age as well as their better collaboration in the research.

In addition to the personal data (age, name, place of birth, domicile, occupation), stature (M 1), body mass (M 71) and chest circumference in the normal position (M 61) were observed in each proband.

The data thus obtained have been evaluated statistically in the Biometry Department (Head: S. K o m e n d a) of the Institute of Medical Physics, Medical Faculty of the Palacký University in Olomouc, in the collaboration with the Institute of Biology of the Child and School Hygiene (Head: J. K l e m e n t a), Paedagogical Faculty of the Palacký University. The basic statistical characteristics were summarized in the tables and diagrams.

#### STATISTICAL ANALYSIS OF THE ANTHROPOLOGICAL DATA

Observed values of the three anthropological dimensions mentioned above were classified into the categories according to the age and sex. Data have been controlled, punched into the tape and the following statistical characteristics calculated by means of the computer C 8206 (separately for each category of age and sex):

- (1) Size of the category (number of probands),  $n$
- (2) Mean value of the body dimension  $X$ ,

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i$$

- (3) Variance of the body dimension  $X$ ,

$$s_x^2 = \frac{1}{n-1} \sum_{i=1}^n (x_i - \bar{x})^2$$

- (4) Standard deviation of the body dimension  $X$ ,

$$s = \sqrt{s_x^2}$$

- (5) Mean error of the body dimension  $X$ ,

$$m = \frac{s}{\sqrt{n}}$$

TABLE 1

Stature		Men			Czech countries
ČSS 1975					
Age	n	$\bar{x}$	s	$\pm m$	min.—max.
16	464	174.2	6.98	0.324	153.0—192.0
17	832	175.9	6.63	0.230	155.0—195.0
18	367	176.3	6.33	0.331	160.0—197.0
19	101	177.4	5.98	0.595	162.0—191.0
20	47	177.9	5.98	0.872	167.0—193.0
21	23	177.7	5.01	1.046	169.0—186.0
22	55	175.6	7.35	0.991	163.0—196.0
23	64	175.9	6.24	0.780	163.0—191.0
24	47	176.4	6.47	0.943	160.0—194.0
25—29	224	176.4	6.11	0.408	155.0—193.0
30—34	168	175.2	6.13	0.473	159.0—190.0
35—39	159	174.9	6.31	0.500	159.0—190.0
40—44	145	173.5	5.44	0.452	160.0—195.0
45—49	108	173.8	6.19	0.595	159.0—190.0
50—54	74	172.8	5.74	0.667	154.0—184.0
55—59	24	171.8	5.89	1.202	157.0—181.0
60—64	34	172.2	4.58	0.785	164.0—180.0

TABLE 2

Stature		Women			Czech countries
ČSS 1975					
Age	n	$\bar{x}$	s	$\pm m$	min.—max.
16	605	163.6	5.77	0.235	144.0—179.0
17	861	164.1	5.72	0.195	149.0—191.0
18	367	164.1	5.67	0.296	149.0—178.0
19	128	164.8	6.15	0.544	150.0—177.0
20	132	164.5	5.57	0.485	149.0—178.0
21	136	165.0	5.36	0.460	150.0—176.0
22	136	164.8	5.65	0.485	153.0—180.0
23	137	164.5	5.41	0.462	152.0—179.0
24	135	164.2	5.29	0.456	153.0—178.0
25—29	746	163.9	5.34	0.195	148.0—182.0
30—34	605	163.2	5.15	0.209	145.0—179.0
35—39	416	162.8	5.04	0.247	149.0—180.0
40—44	295	162.9	5.03	0.293	150.0—178.0
45—49	198	161.6	4.77	0.339	150.0—173.0
50—54	111	161.7	5.04	0.479	150.0—175.0
55—59	50	160.2	5.42	0.766	147.0—172.0
60—64	18	160.2	3.67	0.865	153.0—168.0

- (6) Minimal and maximal value in the group of the observations of the body dimension  $X$ , in the considered category,

$$x_{\min}, x_{\max}$$

- (7) Product-moment correlation coefficient of every pair ( $X$ ,  $Y$ ) of body dimensions followed up,

$$r_{XY} = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^n (x_i - \bar{x})^2 \cdot \sum_{i=1}^n (y_i - \bar{y})^2}}$$

#### STATURE

In the evaluation of the stature in adult participants of the previous Spartakiades, the changes between the corresponding 5-years intervals were followed up above all.

The progressive secular trend was demonstrated by the arithmetical means. Stature has been increased, its increment having been in correspondence to the rule of Mexican anthropologist S. Genoves, according to which the stature increases by 1 cm each ten years. Comparison of the mean statures of the participants of ČSS 1975 with that obtained in the IIIrd National Spartakiade shows, that the stature became higher in all age categories, during the last ten years.

The values of stature in men and women from 16 to 64 years are summarized in *Tables 1* and *2*. In *Tables 3* and *4*, the results from the year 1975 are compared with that from the years 1955, 1960 and 1965 (see also *Fig. 1*).

Men grow to 21 years. The highest stature (177.9 cm) in average is found to be present in 20

years. The increment between 16 and 20 years equals 3.7 cm. From the age category of 21 years, continuously decreasing mean stature can be found in men (with the small fluctuations in the age categories of 23, 24, 45—49 and 60—64 years).

When compared the stature of the 18—19 years old men in 1955, 1960, 1965 with that of 1975, an acceleration trend can be observed to the higher values. The increment is 3.6 cm, taking its greatest part between the years 1955 and 1960 and only 0.3 cm between the years 1965 and 1975. Growth acceleration demonstrates itself also in the displacement of the age limit, when the definite mean stature is reached. This limit can be situated into the age interval of 18—20 years in 1975, in comparison with the age interval of 25—29 years in 1955.

As a proof of the increasing acceleration the stature in the joint age category of adult men of 25—39 years not yet under the involution changes can be considered. While in the period of 1955 to 1965 the total increment did not reach 1 cm (it was 0.7 cm only), the mean increment went over the expectation in the period of 1965—1975 and was 1.7 cm. Also in the remaining age categories the mean stature in 1975 was higher than 10 years ago (the increment ranged between 1.1 and 2.6 cm).

This event corresponds to the explanation of M. Prokopec, J. Suchý and S. Titlbachová (1973), presented by them in the analysis of the results of the third national research of the youth in 1971. The effect of many factors can be supposed, in connection with the technical progress, development of medical sciences and their preventive components and finally with improved socio-economical conditions not only for children but also for adult population.

TABLE 3

Stature		Men			Czech countries	
Age	n	$\bar{x}$	s	$\pm m$	min.—max.	
ČSS 1975						
18—19	468	176.5	6.27	0.290	160.0—197.0	
20—24	236	176.5	6.42	0.418	160.0—196.0	
25—29	224	176.4	6.11	0.408	155.0—193.0	
30—34	168	175.2	6.13	0.473	159.0—190.0	
35—39	159	174.9	6.31	0.500	159.0—190.0	
40—44	145	173.5	5.44	0.452	160.0—195.0	
45—49	108	173.8	6.19	0.595	159.0—190.0	
50—54	74	172.8	5.74	0.667	154.0—184.0	
55—59	24	171.8	5.89	1.202	157.0—181.0	
60—64	34	172.2	4.58	0.785	164.0—180.0	
III. CS 1965						
18—19	241	176.2	6.42	0.414	157.0—195.0	
20—24	337	174.9	5.94	0.324	159.0—193.0	
25—29	153	174.9	5.42	0.438	163.0—189.0	
30—34	198	173.7	4.73	0.336	161.0—187.0	
35—39	210	173.5	5.06	0.349	160.0—187.0	
40—44	217	172.4	5.92	0.402	158.0—187.0	
45—49	133	172.0	5.69	0.493	159.0—184.0	
50—54	119	171.6	6.56	0.601	157.0—187.0	
55—59	69	169.3	5.56	0.669	158.0—185.0	
60—64	33	169.6	5.61	0.977	159.0—181.0	
II. CS 1960						
18—19	895	175.6	6.34	0.211	159.0—196.5	
20—24	629	175.0	6.14	0.244	158.0—195.0	
25—29	384	173.8	6.60	0.336	155.0—190.5	
30—34	405	173.5	6.72	0.333	151.0—194.0	
35—39	466	173.2	6.34	0.293	156.5—192.0	
40—44	270	172.2	6.00	0.365	156.0—187.0	
45—49	249	170.5	6.41	0.406	149.0—190.0	
50—54	146	170.4	6.54	0.541	157.5—187.0	
55—59	75	168.8	6.80	0.785	155.0—188.0	
60—64	25	168.9	6.61	1.322	157.5—185.0	
I. CS 1955						
18—19	240	172.9	6.50	0.420	157.0—190.0	
20—24	369	173.9	6.60	0.340	156.0—194.0	
25—29	545	174.0	6.30	0.270	155.0—198.0	
30—34	617	173.3	6.30	0.250	153.0—192.0	
35—39	303	171.8	5.90	0.340	156.0—187.0	
40—44	318	170.8	6.00	0.340	156.0—187.0	
45—49	223	170.7	6.20	0.410	154.0—187.0	
50—54	117	168.6	5.20	0.480	156.0—181.0	
I. CS 1955						
25—39	1465	173.2	—	—	153.0—198.0	
II. CS 1960						
25—39	1255	173.5	6.54	0.184	151.0—194.0	
III. CS 1965						
25—39	561	173.9	5.19	0.219	160.0—187.0	
ČSS 1975						
25—39	551	175.6	6.20	0.264	155.0—193.0	

CS = National Spartakiade

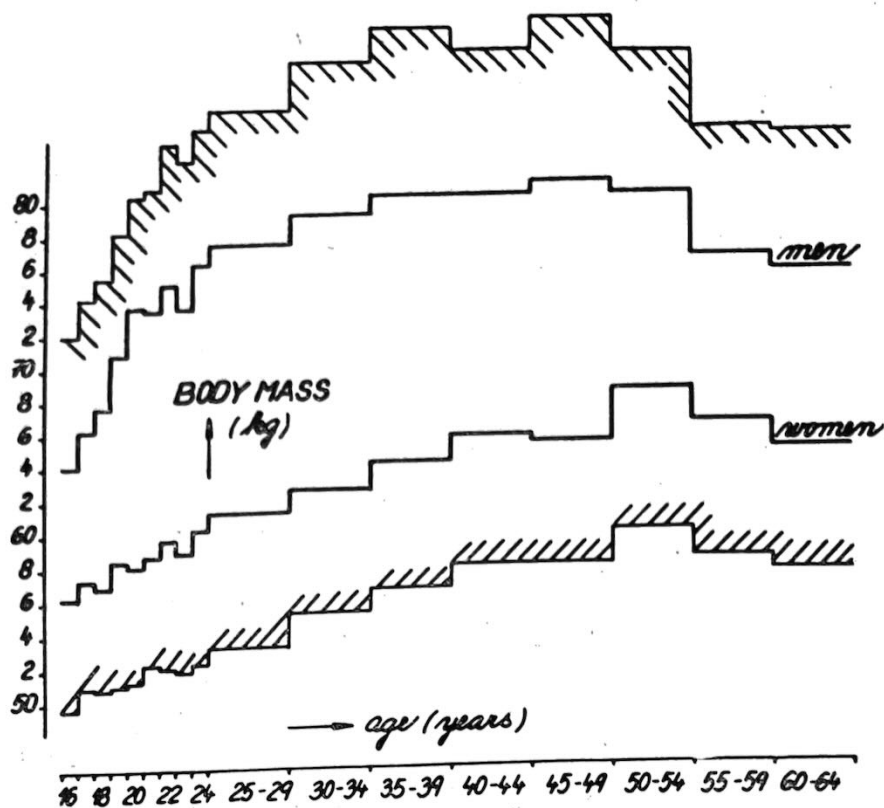
TABLE 4

Stature	Women				Czech countries	
	Age	n	$\bar{x}$	s	$\pm m$	min.—max.
ČSS 1975						
18—19	495	164.2	5.80	0.261	149.0—178.0	
20—24	676	164.6	5.45	0.210	149.0—180.0	
25—29	746	163.9	5.34	0.195	148.0—182.0	
30—34	605	163.2	5.15	0.209	145.0—179.0	
35—39	416	162.8	5.04	0.247	149.0—180.0	
40—44	295	162.9	5.03	0.293	150.0—178.0	
45—49	198	161.6	4.77	0.339	150.0—173.0	
50—54	111	161.7	5.04	0.479	150.0—175.0	
55—59	50	160.2	5.42	0.766	147.0—172.0	
60—64	18	160.2	3.67	0.865	153.0—168.0	
III. CS 1965						
18—19	357	163.5	5.82	0.308	148.0—180.0	
20—24	511	163.3	5.49	0.243	153.0—180.0	
25—29	283	162.3	5.40	0.321	150.0—178.0	
30—34	358	162.6	5.01	0.265	157.0—179.0	
35—39	330	161.4	4.96	0.273	150.0—178.0	
40—44	291	161.3	5.16	0.303	147.0—174.0	
45—49	115	159.6	5.16	0.481	147.0—176.0	
50—54	59	160.7	5.00	0.651	152.0—175.0	
55—59	27	157.7	4.70	0.904	149.0—168.0	
60—64	10	157.0	4.67	1.476	151.0—163.0	
II. CS 1960						
18—19	833	162.4	5.62	0.194	144.4—179.5	
20—24	1259	162.3	5.45	0.153	148.0—178.5	
25—29	867	161.5	5.40	0.183	147.0—184.0	
30—34	964	160.9	5.51	0.177	144.0—176.0	
35—39	823	160.5	5.67	0.197	143.0—179.0	
40—44	297	159.8	4.87	0.282	146.0—172.0	
45—49	192	158.2	4.87	0.351	147.5—173.0	
50—54	91	157.8	5.43	0.569	146.0—169.0	
55—59	21	156.3	3.82	0.833	149.0—165.0	
I. CS 1955						
18—19	425	161.1	5.80	0.300	143.0—178.0	
20—24	718	160.3	5.70	0.210	143.0—178.0	
25—29	446	160.9	5.70	0.270	145.0—175.0	
30—34	420	160.7	5.30	0.260	147.0—178.0	
35—39	176	159.2	5.40	0.410	146.0—177.0	
40—44	148	158.6	5.20	0.430	144.0—171.0	
45—49	84	157.5	5.40	0.600	145.0—169.0	
50—54	33	157.6	5.40	0.940	147.0—168.0	
I. CS 1955						
25—39	1042	160.5	—	—	145.0—178.0	
II. CS 1960						
25—39	2654	161.0	5.54	0.107	143.0—184.0	
III. CS 1965						
25—39	971	162.1	5.05	0.162	150.0—179.0	
ČSS 1975						
25—39	1767	163.4	5.22	0.124	145.0—182.0	

CS = National Spartakiade



FIG. 2.  
Body mass as a function of the  
age. For further details see  
Fig. 1.



Evaluating mean stature of men, the values over 170 cm can be found in any age category in 1975. In comparison to it, mean stature did not reach 170 cm for the men older than 55 years, in 1965.

When evaluating the minimal individual values, no subjects with the stature under 160 cm were found to be present among the 18–24 years old men in 1975, while there were some 10 years ago. On the other side, the frequency of the occurrence of the individual statures equal to or over 190 cm was higher in 1975.

Variability of the stature in single age categories ranges in 1975 approximately in the same extent as was observed in the results of the IIIrd National Spartakiade. Standard deviations of the stature in men are in 1975 in six age categories slightly higher and in the remaining four ones slightly lower than in 1965. In women, the corresponding standard deviations are in 1975 in four age categories higher and in six ones lower than in 1965.

The development of the stature of female adolescent and of adult women shows a systematic acceleration, too. In 1975, mean values are higher in all age categories, when compared with the IIIrd National Spartakiade. In the age categories between 17 and 24 years mean stature is higher than 164 cm. Such a value was not reached in any age category during the preceding studies (1955–1965). Women 18–19 years old in 1975 are higher by 0.7 cm when compared with the women of the same age

in 1965, by 1.8 cm when compared with those in 1960 and by 3.1 cm when compared with those in 1955. In no age category mean stature of women is under 160 cm, in 1975. (During the IIIrd National Spartakiade, this mean stature was not reached by the older women, in the age categories over 55 years.) Paralelly to it, maximal individual statures equal or over 180 cm in women occur more frequently.

In the joint age category of the fully developed women of the age between 25 and 39 years, mean stature in 1975 is by 1.3 cm over that found in 1965, by 2.4 cm over that found in 1960 and by 2.9 cm over that found in 1955. In this age category, stature accelerated somewhat slowly in the last decade (the increment between 1965 to 1975 being 1.3 cm) in comparison with the foregoing decade 1955–1965 (the increment being 1.6 cm).

From an analysis of the national research carried out in 1961 the conclusion was made that after 16 years of age girls did not increase their stature. In addition to it, our material enables to derive that the young women grow after 16 years of age, too, but less markedly.

#### BODY MASS

The results concerning body mass for men and women are summarized in *Tables 5–8* and in *Fig. 2*.

In the same age categories as mentioned above, body mass is higher in 1975 when compared with

TABLE 5

Body mass		Men			Czech countries
ČSS 1975					
Age	n	$\bar{x}$	s	$\pm m$	min.—max.
16	464	64.0	8.10	0.376	41.0—90.0
17	832	66.3	8.12	0.281	42.0—105.0
18	367	67.7	7.83	0.409	48.0—96.0
19	101	70.8	7.38	0.734	55.0—95.0
20	47	73.6	6.82	0.994	60.0—95.0
21	23	73.4	7.41	1.545	63.0—92.0
22	55	74.9	8.64	1.165	56.0—96.0
23	64	73.5	9.06	1.132	55.0—94.0
24	47	76.1	8.19	1.195	56.0—97.0
25—29	224	77.4	8.27	0.553	57.0—102.0
30—34	168	79.2	9.31	0.718	58.0—103.0
35—39	159	80.3	10.21	0.810	55.0—113.0
40—44	145	80.3	8.87	0.737	62.0—113.0
45—49	108	81.2	10.05	0.967	58.0—115.0
50—54	74	80.4	8.68	1.009	58.0—109.0
55—59	24	76.6	7.75	1.582	63.0—102.0
60—64	34	75.8	8.29	1.422	61.0—96.0

the periods of 1955, 1960 and 1965, except for the category of 18—19 years. The tendency of men to have higher body mass is confirmed by the conclusions of the foregoing Spartakiades.

Mean values of body mass grow as a function of age to the category of 45—49 years, having the highest value of 81.2 kg. Body mass becomes lower after the 50 years, though the mean values are higher in 1975 than in 1965, also in these age categories. The highest increment (4.3 kg) was reached by men in the age category of 50—54 years and further by men of 45—49 years (3.4 kg). The greatest increments during the last 10 years have been found just among the men in the age of 45—54 years, which was considered as significant first of all from the point of view of the public health.

In 1965, men reached maximum of their body mass already in the age category of 35—39 years. In 1975, the displacement of this maximum by two age categories can be seen, into the interval of 45 to 49 years.

An increase of the body mass is observable in the minimal and maximal values, too, determining the range of variation of the dimension followed up, in each age category. Besides the age category of men 18—19 years old, whose markedly lower mean body mass situates itself outside the regular course of the body mass (as a function of age), least individual body mass observed in 1975 is 55 kg. The remaining minimal values approach to the minimal values measured in 1965, during the IIIrd National Spartakiade.

On the other side, great changes occurred in the maximal values. Besides the two youngest age categories of men (under 25 years) and the oldest one (60—64 years), maximal values of the body mass in each of the remaining seven age categories get over the limit of 100 kg. In 1965 (IIIrd National

TABLE 6

Body mass		Women			Czech countries
ČSS 1975					
Age	n	$\bar{x}$	s	$\pm m$	min.—max.
16	605	56.2	6.63	0.270	40.0—78.0
17	861	57.2	6.32	0.215	41.0—82.0
18	367	56.8	6.05	0.316	42.0—85.0
19	128	58.4	7.42	0.656	45.0—79.0
20	132	58.1	6.85	0.596	44.0—90.0
21	136	58.6	6.40	0.548	45.0—90.0
22	136	59.5	7.60	0.652	42.0—95.0
23	137	58.9	6.97	0.595	47.0—85.0
24	135	60.2	8.17	0.703	46.0—86.0
25—29	746	61.1	8.03	0.294	45.0—104.0
30—34	605	62.6	7.41	0.301	44.0—91.0
35—39	416	64.2	7.67	0.376	47.0—93.0
40—44	295	65.9	7.83	0.456	48.0—105.0
45—49	198	65.5	7.45	0.529	50.0—98.0
50—54	111	68.6	8.52	0.808	51.0—100.0
55—59	50	66.7	8.19	1.158	51.0—85.0
60—64	18	65.1	7.41	1.746	52.0—84.0

Spartakiade) mean value of body mass over 100 kg occurred in two age categories only. In 1975, total maximal individual body mass is 115 kg, occurring in the age category of 45—49 years. In this age category, men have the highest mean value of body mass, too. The variability of the body mass is characterized by relatively high standard deviations, in all studies to be compared.

In contrast to the situation in men, an interesting event can be observed in women — a decrease in body mass. In 1975, women — participants of ČSS — are slimmer than the participants of the foregoing Spartakiades. Mean body mass of women decreases in all age categories, when compared with the results of the IIIrd and the Ist National Spartakiade. In comparison with the IIrd National Spartakiade only in two age categories (40—44 years and 50—54 years) no decrease occurs in 1975. The decrease is most marked in young (18—19 years) women and in the age categories of 30—39 years. In the age category of 30—34 years the decrease in body mass is of the highest value at all (2.6 kg).

Taking into account that women have in 1975 lower body mass accompanied by the higher stature, it can be concluded that there exists an obvious tendency for the women to become slimmer, in all age categories. The decrease in the body mass in women is observable from 1955, when V. Fetter founded the tradition of the anthropological research of our adult population, in the occasion of the Ist National Spartakiade.

The course of the body mass as a function of age is similar in 1975 to that registered in 1965. The dimension increases in the mean, to the age category of 50—54 years, reaching there its highest value of 68.7 kg. Mean body mass is then decreasing for older women.

In 1975, minimal values of the body mass in

TABLE 7

Body mass		Men			Czech countries
Age	n	$\bar{x}$	s	$\pm m$	min.—max.
ČSS 1975					
18—19	468	68.3	7.83	0.362	48.0—96.0
20—24	236	74.4	8.23	0.535	55.0—97.0
25—29	224	77.4	8.27	0.553	57.0—102.0
30—34	168	79.2	9.31	0.718	58.0—103.0
35—39	159	80.3	10.21	0.810	55.0—113.0
40—44	145	80.3	8.87	0.737	62.0—113.0
45—49	108	81.2	10.05	0.967	58.0—115.0
50—54	74	80.4	8.68	1.009	58.0—109.0
55—59	24	76.6	7.75	1.582	63.0—102.0
60—64	34	75.8	8.29	1.422	61.0—96.0
III. CS 1965					
18—19	241	69.9	7.71	0.496	57.0—85.0
20—24	337	72.1	6.35	0.346	57.0—90.0
25—29	153	75.5	9.27	0.749	60.0—95.0
30—34	198	75.9	8.68	0.617	62.0—95.0
35—39	210	79.4	10.51	0.725	63.0—105.0
40—44	217	77.6	9.86	0.669	61.0—104.0
45—49	133	77.8	9.52	0.825	61.0—99.0
50—54	119	76.1	10.77	0.987	61.0—95.0
55—59	69	75.8	8.54	1.028	61.0—94.0
60—64	33	74.5	8.04	1.399	61.0—92.0
II. CS 1960					
18—19	894	69.0	7.56	0.252	50.0—97.0
20—24	628	71.1	9.10	0.363	53.0—107.0
25—29	384	72.3	9.00	0.536	47.5—107.0
30—34	404	75.5	9.20	0.457	50.0—110.0
35—39	465	77.5	9.44	0.437	52.5—110.0
40—44	270	76.4	9.30	0.566	52.5—109.0
45—49	249	74.8	9.10	0.576	55.0—101.0
50—54	146	75.6	9.00	0.840	54.0—106.0
55—59	75	73.0	7.77	0.897	58.0—95.0
60—64	25	74.4	8.45	1.690	55.0—93.0
I. CS 1955					
18—19	240	67.5	7.30	0.470	51.0—92.0
20—24	369	71.5	8.60	0.450	53.0—101.0
25—29	545	74.1	9.10	0.390	51.0—105.0
30—34	617	75.5	9.80	0.390	49.0—107.0
35—39	303	74.5	9.40	0.530	50.0—104.0
40—44	318	74.0	9.20	0.520	52.0—98.0
45—49	223	75.0	9.20	0.620	49.0—103.0
50—54	117	72.6	8.20	0.760	55.0—97.0
I. CS 1955					
25—39	1465	74.8	—	—	49.0—107.0
II. CS 1960					
25—39	1253	75.3	9.95	0.281	47.5—110.0
III. CS 1965					
25—39	561	77.1	9.74	0.411	60.0—105.0
ČSS 1975					
25—39	551	78.8	9.25	0.394	55.0—113.0

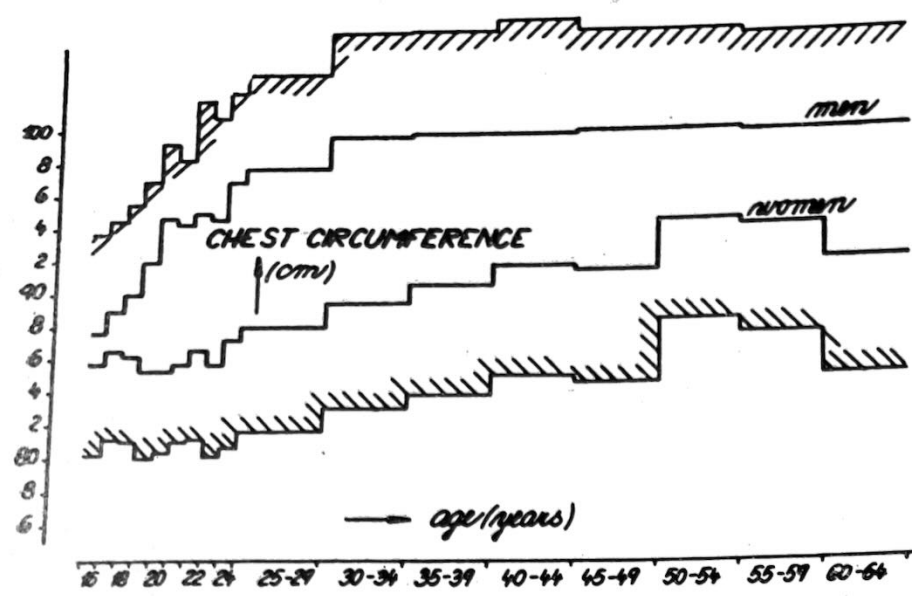
CS = National Spartakiade

TABLE 8

Body mass		Women			Czech countries
Age	n	$\bar{x}$	s	$\pm m$	min.—max.
ČSS 1975					
18—19	495	57.2	6.46	0.290	42.0—85.0
20—24	676	59.1	7.24	0.279	42.0—95.0
25—29	746	61.1	8.03	0.294	45.0—104.0
30—34	605	62.6	7.41	0.301	44.0—91.0
35—39	416	64.2	7.67	0.376	47.0—93.0
40—44	295	65.9	7.83	0.456	48.0—105.0
45—49	198	65.5	7.45	0.529	50.0—98.0
50—54	111	68.6	8.52	0.808	51.0—100.0
55—59	50	66.7	8.19	1.158	51.0—85.0
60—64	18	65.1	7.41	1.746	52.0—84.0
III. CS 1965					
18—19	357	59.6	6.56	0.347	42.0—79.0
20—24	511	60.5	6.40	0.283	41.0—91.0
25—29	283	62.7	8.40	0.499	45.0—87.0
30—34	358	65.2	7.91	0.418	49.0—89.0
35—39	330	66.4	8.03	0.442	50.0—96.0
40—44	291	66.7	8.68	0.509	45.0—99.0
45—49	115	67.0	9.39	0.875	49.0—101.0
50—54	59	68.7	8.86	1.153	51.0—87.0
55—59	27	67.7	9.59	1.846	54.0—97.0
60—64	10	65.7	10.44	3.302	52.0—87.0
II. CS 1960					
18—19	832	58.4	6.80	0.235	42.0—83.0
20—24	1259	59.5	7.30	0.206	40.0—93.0
25—29	867	61.7	6.46	0.219	43.0—94.0
30—34	957	64.2	8.56	0.276	44.0—95.0
35—39	815	64.6	8.20	0.287	44.0—97.0
40—44	297	65.5	8.80	0.510	46.5—94.0
45—49	192	66.2	8.20	0.591	45.0—91.0
50—54	91	66.8	8.77	0.919	50.0—92.0
55—59	21	69.2	6.35	1.385	—
I. CS 1955					
18—19	425	59.5	6.10	0.300	44.0—76.0
20—24	718	59.6	7.20	0.270	43.0—86.0
25—29	446	62.4	8.40	0.400	46.0—92.0
30—34	420	64.7	9.20	0.450	45.0—97.0
35—39	176	65.3	8.60	0.650	42.0—90.0
40—44	148	66.2	8.80	0.730	48.0—96.0
45—49	84	66.8	9.00	0.980	49.0—85.0
50—54	33	67.7	9.90	1.740	44.0—88.0
I. CS 1955					
25—39	1042	63.8	—	—	42.0—97.0
II. CS 1960					
25—39	2639	63.5	7.94	0.154	43.0—97.0
III. CS 1965					
25—39	971	64.9	8.22	0.264	45.0—96.0
ČSS 1975					
25—39	1767	62.4	7.83	0.186	44.0—104.0

CS = National Spartakiade

FIG. 3.  
Chest circumference as a function  
of the age. For further details  
see Fig. 1.



women are similar to that found to be present during the IIIrd National Spartakiade. In three age categories, the values over 100 kg are present, the absolute maximum being 105 kg. No values of body mass over 100 kg were present during the Ist and IIrd National Spartakiade and during the IIIrd National Spartakiade such a high body mass only in one age category was found to be present.

CHEST CIRCUMFERENCE

Chest circumference belongs to the dimensions determining the proportionality of the body. Its values are summarized in Tables 9-12 and in Fig. 3.

In coincidence with the increase of basic body dimensions during the last ten years as observed in the CSS 1975, the same is found in all age categories of men (except the youngest men of 18-19 years) to be valid for chest circumference, too.

Chest circumference grows with increasing age and depends also moderately on the stature. Its values increase up to the age category of 50-54 years. In comparison with the IIIrd National Spartakiade maximal mean values in 1975 are shifted by two age categories, in men. Mean values of chest circumference are somewhat lower in the two oldest age categories. The dependence of chest circum-

TABLE 9

Chest circumference		Men			Czech countries
ČSS 1975					
Age	n	$\bar{x}$	s	$\pm m$	min.—max.
16	464	87.7	6.06	0.282	69.0—107.0
17	832	89.0	5.54	0.192	69.0—115.0
18	367	90.6	5.59	0.292	77.0—113.0
19	101	92.1	5.10	0.507	80.0—108.0
20	47	94.7	4.68	0.682	87.0—109.0
21	23	94.3	4.00	0.833	89.0—105.0
22	55	95.1	7.08	0.954	62.0—115.0
23	64	94.7	6.29	0.786	80.0—110.0
24	47	97.0	5.55	0.810	88.0—113.0
25—29	224	97.8	5.92	0.395	76.0—114.0
30—34	168	99.9	6.51	0.502	80.0—115.0
35—39	159	101.2	6.44	0.511	84.0—120.0
40—44	145	101.2	7.12	0.591	73.0—118.0
45—49	108	102.7	6.18	0.594	88.0—125.0
50—54	74	102.2	6.18	0.718	73.0—115.0
55—59	24	101.5	6.08	1.241	91.0—113.0
60—64	34	101.7	6.17	1.058	89.0—116.0

TABLE 10

Chest circumference		Women			Czech countries
ČSS 1975					
Age	n	$\bar{x}$	s	$\pm m$	min.—max.
16	605	85.8	5.57	0.226	70.0—109.0
17	861	86.5	5.46	0.186	69.0—122.0
18	367	86.3	5.22	0.272	64.0—110.0
19	128	85.4	5.33	0.471	76.0—98.0
20	132	85.4	4.98	0.433	74.0—102.0
21	136	85.7	4.74	0.406	74.0—106.0
22	136	86.6	5.57	0.477	69.0—106.0
23	137	85.7	5.66	0.484	69.0—107.0
24	135	87.3	6.59	0.568	74.0—105.0
25—29	746	88.0	6.41	0.235	61.0—112.0
30—34	605	89.6	6.48	0.264	67.0—117.0
35—39	416	90.7	6.80	0.333	69.0—116.0
40—44	295	91.9	6.85	0.399	64.0—118.0
45—49	198	91.5	7.03	0.499	64.0—115.0
50—54	111	94.5	6.25	0.593	78.0—115.0
55—59	50	94.2	6.70	0.948	76.0—107.0
60—64	18	92.1	7.18	1.693	80.0—103.0



TABLE 11

Chest circumference		Men			Czech countries
Age	n	$\bar{x}$	s	$\pm m$	min.—max.
ČSS 1975					
18—19	468	90.9	5.52	0.255	77.0—113.0
20—24	236	95.2	5.90	0.384	62.0—115.0
25—29	224	97.8	5.92	0.395	76.0—114.0
30—34	168	99.9	6.51	0.502	80.0—115.0
35—39	159	101.2	6.44	0.511	84.0—120.0
40—44	145	101.2	7.12	0.591	73.0—118.0
45—49	108	102.7	6.18	0.594	88.0—125.0
50—54	74	102.2	6.18	0.718	73.0—115.0
55—59	24	101.5	6.08	1.241	91.0—113.0
60—64	34	101.7	6.17	1.058	89.0—116.0
III. CS 1965					
18—19	241	91.9	5.00	0.322	80.0—109.0
20—24	337	94.5	4.17	0.227	80.0—109.0
25—29	153	96.6	6.56	0.530	83.0—113.0
30—34	198	97.4	5.74	0.408	83.0—113.0
35—39	210	100.4	8.92	0.616	82.0—118.0
40—44	217	100.9	8.19	0.556	84.0—115.0
45—49	133	100.3	6.85	0.594	84.0—116.0
50—54	119	100.5	6.89	0.632	84.0—116.0
55—59	69	100.7	7.72	0.930	84.0—115.0
60—64	33	99.7	5.90	1.026	85.0—111.0
II. CS 1960					
18—19	894	90.5	6.34	0.212	80.5—114.0
20—24	629	91.8	5.81	0.231	78.0—111.0
25—29	384	93.2	6.11	0.311	78.0—118.0
30—34	404	95.5	5.85	0.290	83.0—118.0
35—39	465	97.0	7.02	0.325	78.0—118.0
40—44	270	97.2	6.05	0.368	81.0—116.0
45—49	249	96.6	7.75	0.491	83.0—117.5
50—54	145	98.2	6.80	0.562	84.0—115.0
55—59	69	96.4	7.20	1.478	83.0—114.0
60—64	25	96.9	6.09	1.218	89.0—108.0
I. CS 1955					
18—19	240	89.3	4.60	0.290	76.0—107.0
20—24	369	91.7	5.30	0.270	80.0—111.0
25—29	545	93.9	5.50	0.240	77.0—116.0
30—34	617	95.2	6.20	0.250	78.0—115.0
35—39	303	95.6	5.60	0.320	81.0—115.0
40—44	318	96.3	5.90	0.330	82.0—113.0
45—49	223	97.3	6.30	0.420	82.0—115.0
50—54	117	97.2	5.70	0.530	84.0—115.0
I. CS 1955					
25—39	1465	94.8	—	—	77.0—116.0
II. CS 1960					
25—39	1253	95.4	6.46	0.182	78.0—118.0
III. CS 1965					
25—39	561	98.3	7.44	0.314	82.0—118.0
ČSS 1975					
25—39	551	99.4	6.41	0.273	76.0—120.0

CS = National Spartakiade

TABLE 12

Chest circumference		Women			Czech countries
Age	n	$\bar{x}$	s	$\pm m$	min.—max.
ČSS 1975					
18—19	495	86.4	5.57	0.250	64.0—115.0
20—24	676	86.1	5.57	0.214	69.0—107.0
25—29	746	88.0	6.41	0.235	61.0—112.0
30—34	605	89.6	6.48	0.264	67.0—117.0
35—39	416	90.7	6.80	0.333	69.0—116.0
40—44	295	91.9	6.85	0.399	64.0—118.0
45—49	198	91.5	7.03	0.499	64.0—115.0
50—54	111	94.5	6.25	0.593	78.0—115.0
55—59	50	94.2	6.70	0.948	76.0—107.0
60—64	18	92.1	7.18	1.693	80.0—103.0
III. CS 1965					
18—19	357	85.2	4.38	0.232	71.0—98.0
20—24	511	86.3	5.40	0.239	75.0—106.0
25—29	283	87.9	6.33	0.376	77.0—106.0
30—34	358	90.1	5.95	0.314	77.0—107.0
35—39	330	90.9	6.38	0.351	77.0—108.0
40—44	291	91.6	6.79	0.398	78.0—109.0
45—49	115	92.3	6.61	0.617	80.0—109.0
50—54	59	93.1	7.27	0.946	81.0—105.0
55—59	27	95.1	7.40	1.425	82.0—108.0
60—64	10	93.0	9.61	3.040	81.0—105.0
II. CS 1960					
18—19	833	87.7	7.00	0.242	80.0—101.5
20—24	1242	85.6	4.96	0.140	80.0—112.0
25—29	866	85.8	7.78	0.264	80.0—110.0
30—34	964	87.7	6.76	0.217	78.0—109.0
35—39	824	88.5	5.94	0.206	88.0—112.0
40—44	297	89.1	7.19	0.417	78.0—107.0
45—49	192	90.1	8.40	0.606	79.0—107.0
50—54	88	91.5	8.10	0.863	80.5—109.5
55—59	24	94.5	8.06	1.645	89.0—111.0
I. CS 1955					
18—19	425	84.2	4.10	0.200	71.0—97.0
20—24	718	84.6	4.80	0.180	71.0—102.0
25—29	446	86.3	5.40	0.250	73.0—106.0
30—34	420	87.7	6.40	0.310	73.0—108.0
35—39	176	88.9	5.50	0.410	78.0—105.0
40—44	148	89.6	6.40	0.580	74.0—106.0
45—49	84	90.8	6.30	0.680	77.0—106.0
50—54	33	92.0	6.90	1.210	77.0—109.0
I. CS 1955					
25—39	1042	87.3	—	—	73.0—108.0
II. CS 1960					
25—39	2654	87.3	6.94	0.134	78.0—112.0
III. CS 1965					
25—39	971	89.7	6.23	0.200	77.0—109.0
ČSS 1975					
25—39	1767	89.2	6.61	0.157	61.0—117.0

CS = National Spartakiade

ference on the body mass is observable. Equal values of the dimension (101.2 cm) are found in the age categories of 35–39 years and 40–44 years. The greatest increments occur in the age category of 30–34 years (2.5 cm) and of 45–49 years (2.4 cm). In such a way, acceleration trend demonstrates itself in men of our set (1975) most markedly in younger participants (25–49 years), when compared with the foregoing Spartakiades.

In women, mean values of chest circumference are lower in six age categories (20–24, 30–34, 35 to 39, 45–49, 55–59, 60–64) in 1975 than in the IIIrd National Spartakiade. In the remaining four age categories slight increase of the mean values can be observed in 1975. This increment gets over 1 cm in the age categories of 18–19 years (by 1.2 cm) and of 50–54 years (by 1.4 cm) only.

In the joint age category of women 25–39 years old, mean value of the chest circumference is lower by 0.5 cm when compared with the IIIrd National Spartakiade. Provided that chest circumference depends also on the subcutaneous fat tissue, thickness, lower values of the dimension correspond thus with the decrease of the body mass of women, in the last ten years.

#### RELATIONS EXISTING BETWEEN DIMENSIONS STUDIED

The relations between stature and body mass, stature and chest circumference and body mass and chest circumference have been evaluated by means of the product-moment correlation coefficients (Table 13).

Correlation coefficients between stature and body mass vary in the range of 0.39–0.78 for men and of 0.32–0.62 for women. In the joint age category of 25–39 years, this coefficient equals 0.56 for men and 0.44 for women.

From these values, the existence of a medium sized relationship between stature and body mass can be supposed, for both sexes. Nevertheless, this relationship seems to be closer for men than for women.

Correlation coefficients between stature and chest circumference vary in the range of 0.05–0.45 for men and of 0.00–0.39 for women. In the joint age category of the participants 25–39 years old, this coefficient equals 0.28 for men and 0.09 for women.

Calculated values of the correlation coefficients demonstrate low relationship between both dimensions for men and very low one for women. The degree of correlation decreases with increasing age, first of all for women, which underlines almost independent development of both dimensions.

Correlation coefficients between body mass and chest circumference vary in the range from 0.59 to 0.82 for men and of 0.57–0.72 for women (the age category of 16 years old adolescents being omitted). In the joint age category of the participants 25–39 years old, the value of correlation yields 0.74 for men and 0.61 for women.

TABLE 13

Czech countries						
ČSSR 1975						
Correlation coefficients between						
Age	Stature and body mass		Stature and chest circumference		Body mass and chest circumference	
	Men	Women	Men	Women	Men	Women
16	0.65	0.50	0.45	0.05	0.73	0.24
17	0.60	0.55	0.36	0.21	0.72	0.59
18	0.61	0.56	0.28	0.24	0.65	0.57
19	0.56	0.62	0.15	0.38	0.73	0.61
20	0.39	0.50	0.21	0.19	0.75	0.61
21	0.49	0.50	0.28	0.15	0.72	0.60
22	0.78	0.50	0.40	0.20	0.59	0.65
23	0.55	0.46	0.21	0.28	0.79	0.62
24	0.34	0.38	0.05	0.09	0.65	0.72
25–29	0.56	0.48	0.24	0.14	0.67	0.59
30–34	0.53	0.44	0.28	0.09	0.75	0.59
35–39	0.67	0.43	0.44	0.07	0.80	0.63
40–44	0.50	0.49	0.27	0.15	0.77	0.66
45–49	0.53	0.34	0.32	0.00	0.80	0.58
50–54	0.49	0.32	0.18	0.07	0.65	0.63
55–59	0.52	0.40	0.08	0.07	0.67	0.67
60–64	0.44	0.56	0.22	0.39	0.82	0.69
18–19	0.60	0.58	0.26	0.18	0.67	0.36
20–24	0.53	0.46	0.23	0.18	0.70	0.65
25–39	0.56	0.44	0.28	0.09	0.74	0.61

Calculated values show that there is a very close relation between body mass and chest circumference for men and a close one for women.

#### SUMMARY

In this paper, the results of the anthropological research of the participants of the Czechoslovak Spartakiade (ČSS) 1975 are presented, being thus a continuation of the similar studies carried out in the years 1955, 1960 and 1965, on the occasion of the 1st, IIrd and IIIrd National Spartakiades.

8,012 participants from the Czech countries were measured, 2,936 male adolescents and men and 5,076 female adolescents and women.

Transversal research of the adult population in the ČSSR demonstrates an accelerated increase of the stature, body mass and chest circumference, in all age categories of men. The stature increases in women, too, but their body mass as well as chest circumference become lower. In such a way, a marked tendency to be slimmer is demonstrated in all age categories of women.

Acceleration in the stature of the adult population during the last ten years is higher than assumed. From this a further continuation of the secular trend in the future development of our adult population can be concluded.

In the evaluation of the correlations between the basic somatic dimensions relatively highest relation between the body mass and chest circumference was found to be present, lower one between the stature and body mass and the least between the stature and chest circumference. Body dimensions seem to correlate less in women than in men.

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