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GROWTH AND DEVELOPMENT OF APPRENTICES IN EAST SLOVAKIA

Within twelve months — between October 1971 and the end of September 1972 — we realized a research of apprentices and grammar-school boys in two urban centres of East Slovakia, in Prešov and in Košice. The following body characters were studied in boys of 15—18 years of age: body height, body weight, sitting height, arm span, chest circumference, inspirational and expirational chest circumference, sagittal and transversal chest diameters, vital capacity of lungs, dynamometry of the clasp of the right and left hand, bi-cristal, bi-spinal and bi-acromial breadths, head length, breadth and circumference, facial height and breadth and the thickness of 10 skin folds. Besides, we have followed also the number of children (brothers and sisters) in the families of the probands, the influence of sports on the development of the probands, and whether they live in rural or in urban areas, in boarding-schools, or with their parents.

In the present paper we studied 428 grammar-school boys (G), 435 motor-car mechanic's apprentices (M), 429 fitter's (F), and 417 bricklayer's apprentices (B), altogether 1709 individuals. The numbers of probands in the individual profession and age groups are as follows:

age in years	G	M	F	B
15	104	105	116	105
16	104	112	106	108
17	118	115	106	103
18	102	103	101	101

The purpose of the investigation was to study the physical development of the youth of the above four groups during their apprenticeship and grammar-school studies .

We were investigating the differences in the growth of grammar-school boys and apprentices, caused by physical work, both the positive and negative changes, and the impact of the markedly improved social and economic conditions in East Slovakia upon the growth of the investigated adolescents.

Our study is based on the comparison of the physical development of the age groups of 15—18 years. We were following their physical growth and somatotypes and we studied also the growth of apprentices and grammar-school boys from the viewpoint of the growth acceleration.

The body height and body weight, chest circumference and horizontal head circumference were compared with Slovak standards from 1951—1971 (Fetter—Láb 1954, Suchý 1967, Lipková 1975), with the Czech standards of 1961 (Suchý 1967), but also with older data (Dušková 1923). Some of the body characters were compared with the data published by various, mainly Czechoslovak authors (Chot 1958, Krátoška and coll. 1961, Prokopec 1960, 1961, Drdková—Čech 1962, Suchý—Urbánková 1964, Vu-Thi-Hong 1974) and with the data of certain other authors (Ivanovič 1970, Eiben 1971).

When evaluating the investigated body characters of the East Slovakian apprentices and grammarschool boys we have come to the following conclusions:

1. Apprentices at the age of 15 years (at the beginning of their apprenticeship) have lower body character values than the grammar-school boys (with the exception of the bi-spinal breadth), the skin folds are dealt with elsewhere.

TAB. 1. *Body Height (cm)*

Age	G				M			
	x	s	m	Growth 15—18 y.	x	s	m	Growth 15—18 y.
15	170,8	6,69	0,66	4,5 to	167,0	7,02	0,69	
16	172,7	7,34	0,72	4,7	170,8	7,38	0,70	6,3
17	175,5	6,73	0,62	(2,63 to	173,2	6,76	0,63	(3,77 %)
18	175,3	6,19	0,61	2,75 %)	173,3	5,98	0,59	

Age	F				B			
	x	s	m	Growth 15—18 y.	x	s	m	Growth 15—18 y.
15	166,1	8,52	0,79		162,2	8,18	0,80	
16	170,2	6,81	0,66	6,4	165,8	7,64	0,74	8,2
17	170,8	6,03	0,59	(3,85 %)	170,0	6,33	0,62	(5,06 %)
18	172,5	6,05	0,60		170,4	6,26	0,63	

TAB. 2. *Body Weight (kg)*

Age	G				M			
	x	s	m	Growth 15—18 y.	x	s	m	Growth 15—18 y.
15	57,2	6,62	0,65		54,4	8,34	0,81	
16	60,5	7,50	0,74	7,7	59,8	8,28	0,78	10,8
17	62,9	7,59	0,70	(13,46 %)	63,8	7,48	0,70	(19,85 %)
18	64,9	7,57	0,75		65,2	6,47	0,64	

Age	F				B			
	x	s	m	Growth 15—18 y.	x	s	m	Growth 15—18 y.
15	53,5	9,04	0,84		49,4	8,28	0,81	
16	57,9	7,30	0,71	10,6	55,7	9,03	0,87	13,1
17	61,7	8,08	0,79	(19,81 %)	61,2	7,89	0,78	(26,52 %)
18	64,1	7,32	0,73		62,5	6,92	0,69	

TAB. 3. *Sitting Height (cm)*

Age	G				M			
	x	s	m	Growth 15—18 y.	x	s	m	Growth 15—18 y.
15	87,6	4,14	0,41		85,9	4,30	0,42	
16	88,8	4,25	0,42	2,9	87,5	4,71	0,45	3,7
17	90,5	3,68	0,34	(3,31 %)	89,1	3,74	0,35	4,31 %
18	90,5	3,24	0,31		89,6	3,13	0,31	

Age	F				B			
	x	s	m	Growth 15—18 y.	x	s	m	Growth 15—18 y.
15	84,8	5,07	0,47		82,6	4,50	0,44	
16	86,4	5,03	0,49	4,0	85,5	4,48	0,43	5,3
17	87,5	3,82	0,37	4,72 %	87,6	3,79	0,37	6,42 %
18	88,8	4,33	0,43		87,9	3,56	0,36	

TAB. 4. *Arm Span (cm)*

Age	G				M			
	x	s	m	Growth 15—18 y.	x	s	m	Growth 15—18 y.
15	173,1	7,25	0,71		169,5	8,16	0,80	
16	175,1	7,74	0,76	5,5	173,2	8,01	0,76	7,1
17	178,0	7,12	0,66	3,18 %	176,3	7,45	0,69	4,19 %
18	178,6	7,84	0,78		176,6	6,26	0,62	

Age	F				B			
	x	s	m	Growth 15—18 y.	x	s	m	Growth 15—18 y.
15	168,2	9,85	0,91		164,1	9,48	0,93	
16	172,7	7,10	0,69	8,1	169,0	8,62	0,83	9,6
17	174,4	6,02	0,60	4,82 %	172,5	7,40	0,73	5,85 %
18	176,3	6,92	0,69		173,7	7,28	0,73	

2. The basic characteristics of the human body, such as body height, body weight, and some others have proved that there is a real growth acceleration.

3. The relative three year's growth of the apprentices in all body-growth indices (with the exception of bi-spinal breadth and transverse chest diameter in the group of motor-car mechanics) are 1.5—2.5 times higher than in the group of grammar school boys.

4. The growth between 15—18 years of age is slowing down in all studied characters.

5. In most characters the differences are statisticaly significant only at the age of 15 years. In the following years most differences fade away, and at the age of 18 years the differences in most characters are quite negligible.

The lower parameters in the apprentices at the beginning of their apprenticeship can be explained e.g. through the influence of genetic factors, and also through the fact that a comparatively high percentage of the apprentices come from rural areas (49.2 % of the motor-car mechanics, 58.7 % of the fitters, 63.3 % of the bricklayers, compared with 21.5 % of grammar-school boys). The apprentices come from families with a large average number of children (3.6 children per family in the group of motor-car mechanics, 4.2 in the group of fitters, 4.8 in the group of bricklayers, compared with 1.9

TAB. 5. *Chest Circumference Mean Between Normal Inspiration and Expiration (cm)*

Age	G				M			
	x	s	m	Growth 15—18 y.	x	s	m	Growth 15—18 y.
15	83,3	4,59	0,45		81,6	5,71	0,56	
16	85,5	5,26	0,52	5,8	86,4	5,44	0,51	7,7
17	87,0	5,41	0,50	6,96 %	87,8	5,06	0,47	9,44 %
18	89,1	5,20	0,52		89,3	4,46	0,44	

Age	F				B			
	x	s	m	Growth 15—18 y.	x	s	m	Growth 15—18 y.
15	81,2	6,04	0,56		79,1	5,25	0,51	
16	84,7	5,00	0,49	8,4	84,4	6,03	0,58	11,1
17	87,5	5,50	0,53	10,34 %	87,6	5,31	0,52	14,03 %
18	89,6	5,37	0,54		90,2	4,91	0,49	

TAB. 6. *Chest Circumference — Inspiration (cm)*

Age	G				M			
	x	s	m	Growth 15—18 y.	x	s	m	Growth 15—18 y.
15	88,3	4,77	0,47		86,3	5,73	0,56	
16	91,4	5,14	0,50	6,2	91,4	5,56	0,53	8,0
17	93,2	5,49	0,51	7,02 %	92,8	4,85	0,45	9,27 %
18	94,5	5,00	0,50		94,3	4,43	0,44	

Age	F				B			
	x	s	m	Growth 15—18 y.	x	s	m	Growth 15—18 y.
15	86,1	5,95	0,55		83,6	5,67	0,55	
16	89,8	5,09	0,49	8,1	89,2	6,18	0,59	10,8
17	92,5	5,40	0,52	9,41 %	92,3	5,15	0,51	12,92 %
18	94,2	5,25	0,53		94,4	5,00	0,50	

TAB. 7. *Chest Circumference — Expiration (cm)*

Age	G				M			
	x	s	m	Growth 15—18 y.	x	s	m	Growth 15—18 y.
15	80,3	4,40	0,43		79,2	5,70	0,51	
16	82,3	4,95	0,49	4,6	83,3	5,30	0,50	6,9
17	83,7	5,24	0,48	5,73 %	84,8	5,02	0,47	8,71 %
18	84,9	4,75	0,47		86,1	4,09	0,40	

Age	F				B			
	x	s	m	Growth 15—18 y.	x	s	m	Growth 15—18 y.
15	78,4	5,84	0,54		76,6	5,31	0,52	
16	81,8	4,88	0,47	9,1	81,4	5,74	0,55	10,4
17	84,5	5,39	0,52	11,61 %	84,4	5,38	0,53	13,58 %
18	87,5	5,09	0,51		87,8	4,65	0,47	

TAB. 8. *Antero-Posterior (Sagittal) Diameter of the Thorax (cm)*

Age	G				M			
	x	s	m	Growth 15—18 y.	x	s	m	Growth 15—18 y.
15	17,6	1,44	0,14		17,4	1,70	0,17	
16	17,9	1,84	0,18	0,7	17,9	1,73	0,16	1,2
17	18,3	1,41	0,13	3,98 %	18,5	1,64	0,15	6,90 %
18	18,3	1,54	0,15	3,98 %	18,6	1,51	0,15	

Age	F				B			
	x	s	m	Growth 15—18 y.	x	s	m	Growth 15—18 y.
15	17,1	1,58	0,15		17,0	1,58	0,15	
16	17,1	1,58	0,15	1,7	18,0	1,89	0,18	1,8
17	18,1	1,54	0,15	9,94 %	18,5	1,60	0,16	10,59 %
18	18,8	1,58	0,16		18,8	1,54	0,15	

children per family in the group of grammar-school boys).

The growth acceleration can be explained by the steadily improving social and economic conditions of all social groups of the Slovak socialist society. Children have sufficient food of favourable composition. The standard of medical care, of the health service, and the cultural niveau of the population are steadily increasing.

These favourable socio-economic conditions have a positive impact on the growth and development of the studied characters. In the groups of apprentices there is one more positive factor — these boys have regular physical activites (physical work), adequate to their age, and positively influencing their growth during the three years we were investigating. The three years' growth of most of the followed characters in the individual groups is proportionate to the increasing physical load. The grammar-school boys have the lowest physical load, higher is the physical load of the motor-car mechanics and fitters, and the bricklayers are subjected to the highest fatigue. The absolutely highest growth was marked in the group of bricklayers, which is, in our view, also due to the fact that the bricklayer's apprentices included in this investigation have full board and lodging in their apprentice boarding-schools. They have sufficient, biologically

TAB. 10. *Vital Capacity of Lungs (ml)*

Age	G				M			
	x	s	m	Growth 15—18 y.	x	s	m	Growth 15—18 y.
15	3 643	508	50		3 241	596	58	
16	3 942	661	65	689	3 419	712	67	794
17	4 166	676	62	18,91 %	3 921	666	62	24,50 %
18	4 332	615	61		4 035	552	54	

Age	F				B			
	x	s	m	Growth 15—18 y.	x	s	m	Growth 15—18 y.
15	3 170	654	61		3 025	614	60	
16	3 334	585	57	742	3 426	634	61	795
17	3 657	675	66	23,41 %	3 776	643	63	26,28 %
18	3 912	622	62		3 820	518	52	

TAB. 9. *Transverse Diameter of the Thorax (cm)*

Age	G				M			
	x	s	m	Growth 15—18 y.	x	s	m	Growth 15—18 y.
15	25,2	1,54	0,15		24,8	1,97	0,19	
16	26,2	1,89	0,19	2,2	25,8	1,84	0,17	2,1
17	26,7	1,78	0,16	8,73 %	26,4	1,95	0,18	8,47 %
18	27,4	1,89	0,19		26,9	1,51	0,15	

Age	F				B			
	x	s	m	Growth 15—18 y.	x	s	m	Growth 15—18 y.
15	24,9	2,19	0,20		24,2	1,76	0,17	
16	26,0	1,87	0,18	2,2	25,3	2,09	0,20	2,6
17	26,7	2,04	0,20	8,84 %	26,3	2,07	0,20	10,74 %
18	27,1	2,00	0,20		26,8	1,78	0,18	

TAB. 11. *Dynamometry of the Clasp of the Right Hand (kg)*

Age	G				M			
	x	s	m	Growth 15—18 y.	x	s	m	Growth 15—18 y.
15	40,79	7,78	0,76		38,66	8,20	0,80	
16	45,01	9,65	0,95	9,26	42,64	8,14	0,77	13,30
17	47,51	9,21	0,85	22,70 %	47,87	9,10	0,85	34,40 %
18	50,05	8,96	0,89		51,96	8,06	0,79	

Age	F				B			
	x	s	m	Growth 15—18 y.	x	s	m	Growth 15—18 y.
15	36,70	9,06	0,84		33,56	7,43	0,73	
16	42,14	8,76	0,85	14,09	39,56	8,39	0,81	13,72
17	48,31	9,39	0,91	38,39 %	43,75	7,42	0,73	40,88 %
18	50,79	9,13	0,91		47,28	7,65	0,77	

TAB. 12. *Dynamometry of the Clasp of the Left Hand (kg)*

Age	G				M			
	x	s	m	Growth 15—18 y.	x	s	m	Growth 15—18 y.
15	36,85	7,40	0,73		35,32	8,00	0,78	
16	40,29	8,38	0,82	8,15	39,58	7,84	0,74	12,31
17	43,60	7,17	0,66	22,12 %	44,93	7,96	0,74	34,85 %
18	45,00	8,22	0,81	22,12 %	47,63	7,75	0,76	

Age	F				B			
	x	s	m	Growth 15—18 y.	x	s	m	Growth 15—18 y.
15	33,06	7,81	0,73		30,77	7,37	0,72	
16	38,58	7,62	0,74	13,12	36,04	7,42	0,71	12,47
17	43,91	8,34	0,81	39,69 %	40,83	7,15	0,71	40,53 %
18	46,18	8,99	0,90		43,24	7,72	0,77	

and calorically correctly selected food, and they have their meals in regular intervals. On the other hand, only 17.2 % of motor-car mechanics and 11.7 % of the fitters have board and lodging in apprentice training centres. The rest live with their families. All the investigated grammar-school boys live with their families.

The slowing down of the growth is connected with the all-tissue effect of the STH (somatotropic hormone), with the exception of the central nervous system. One of the basic conditions of normal growth is adequate secretion of the growth hormone. There are no proofs of its increased secretion during the growth period, as compared with adult age. It is believed that the STH enables normal growth (Jílek and coll. 1971).

I would like to draw the attention of the readers to an interesting result: the level of the growth hormone increases due to the effects of bathing in hyperthermic water (38°—40 °C) by increasing the body temperature in healthy adult men (Palát and coll. 1974).

The following conclusion can be drawn from the results of the investigation of the physical development of 15—18 year old apprentices and grammar-school boys:

1. The 15 year old motor-car mechanic's, fitter's and bricklayer's aprentices have lower values

TAB. 13. *Bi-Cristal Breadth (cm)*

Age	G				M			
	x	s	m	Growth 15—18 y.	x	s	m	Growth 15—18 y.
15	26,3	1,34	0,13		25,7	2,00	0,20	
16	26,7	1,78	0,17	0,7	26,6	1,61	0,15	1,7
17	26,8	1,81	0,17	2,66 %	27,4	1,67	0,16	6,61 %
18	27,0	1,76	0,17		27,4	1,67	0,16	

Age	F				B			
	x	s	m	Growth 15—18 y.	x	s	m	Growth 15—18 y.
15	25,6	1,92	0,18		24,7	1,80	0,18	
16	26,6	1,73	0,17	1,9	26,1	1,78	0,17	2,6
17	26,8	1,64	0,16	7,42 %	26,9	1,87	0,18	10,53 %
18	27,5	1,87	0,19		27,3	1,64	0,16	

TAB. 14. *Bi-Spinal Breadth (cm)*

Age	G				M			
	x	s	m	Growth 15—18 y.	x	s	m	Growth 15—18 y.
15	21,5	1,61	0,16		22,2	2,00	0,20	
16	22,1	1,84	0,18	1,0	22,6	1,84	0,17	0,7
17	22,4	1,94	0,18	4,65 %	22,8	1,73	0,16	3,15 %
18	22,5	1,97	0,20		22,9	1,76	0,17	

Age	F				B			
	x	s	m	Growth 15—18 y.	x	s	m	Growth 15—18 y.
15	22,0	2,02	0,19		21,3	1,87	0,18	
16	22,4	1,92	0,19	1,4	22,3	1,94	0,19	1,6
17	22,6	1,89	0,18	6,36 %	23,0	1,76	0,17	7,51 %
18	23,4	1,94	0,19		22,9	1,87	0,19	

TAB. 15. *Bi-Acromial Breadth (cm)*

Age	G				M			
	x	s	m	Growth 15—18 y.	x	s	m	Growth 15—18 y.
15	37,0	1,78	0,17		35,8	2,23	0,22	
16	37,5	1,84	0,18	1,5	37,3	2,14	0,20	2,7
17	37,9	1,87	0,17	4,05 %	38,1	1,80	0,17	7,54 %
18	38,5	1,97	0,19		38,5	1,80	0,18	

Age	F				B			
	x	s	m	Growth 15—18 y.	x	s	m	Growth 15—18 y.
15	35,4	2,40	0,22		34,7	2,40	0,23	
16	36,9	2,73	0,27	3,2	36,4	2,30	0,22	3,4
17	37,6	2,16	0,21	9,04 %	37,2	2,48	0,24	9,80 %
18	38,6	1,94	0,19		38,1	1,81	0,18	

TAB. 16. *Greatest Circumference (Horizontal) of the Head (cm)*

Age	G				M			
	x	s	m	Growth 15—18 y.	x	s	m	Growth 15—18 y.
15	55,5	1,37	0,13		54,8	1,58	0,15	
16	56,0	1,26	0,12	0,8	55,5	1,78	0,17	1,3
17	56,2	1,41	0,13	1,44 %	55,8	1,44	0,13	2,37 %
18	56,3	1,34	0,13		56,1	1,41	0,14	

Age	F				B			
	x	s	m	Growth 15—18 y.	x	s	m	Growth 15—18 y.
15	54,7	1,54	0,14		53,9	1,70	0,17	
16	55,4	1,51	0,15	1,6	55,2	1,70	0,16	2,2
17	55,8	1,70	0,17	2,93 %	55,6	1,64	0,16	4,08 %
18	56,3	1,34	0,13		56,1	1,48	0,15	

in 20 investigated characters (the 10 skin folds will be discussed separately) than the 15 year old grammar-school boys, with the exception of a single dimension, of the bi-spinal breadth, which is 0.5 to 0.7 cm wider in the groups of motor-car mechanics and fitters.

The apprentices at the beginning of their apprenticeship appear less developed than at the grammar-school boys of the same age.

2. Among the three groups of apprentices we were investigating the highest values (with the exception of the breadth of the skull, facial breadth and height and transversal thorax diameter) were reached by the group of motor-car mechanics, followed by fitters, and the lowest are the values of the bricklayers.

By the end of the 18th year of age the order between various professions remains the same in about fifty per cent of the characters (body height, body weight, rate of growth, span of arms, vital capacity of lungs, dynamometry of the right and left hand, length of the head). In approximately $^1/_4$ of the characters the fitters occupy the place of motor-car mechanics (in bi-cristal, bi-spinal and bi-acromial breadths, in the breadth of the head and thorax and in the head circumference). In the remaining characters the order of various professions varies.

TAB. 17. *Greatest Head Length (mm)*

Age	G				M			
	x	*s*	*m*	Growth 15—18 *y.*	*x*	*s*	*m*	Growth 15—18 *y.*
15	180,8	5,94	0,58		179,4	6,72	0,66	
16	182,1	6,28	0,62	1,7	179,5	6,51	0,62	3,5
17	182,4	6,38	0,59	0,94 %	181,3	5,65	0,53	1,95 %
18	182,5	6,26	0,62		182,9	5,94	0,59	

Age	F				B			
	x	*s*	*m*	Growth 15—18 *y.*	*x*	*s*	*m*	Growth 15—18 *y.*
15	178,7	6,15	0,57		177,5	6,38	0,62	
16	179,0	6,62	0,64	4,1	179,3	6,32	0,61	4,0
17	180,8	6,58	0,64	2,29 %	180,8	6,48	0,64	2,25 %
18	182,8	6,61	0,66		181,5	5,22	0,52	

TAB. 18. *Greatest Head Breadth (mm)*

Age	G				M			
	x	*s*	*m*	Growth 15—18 *y.*	*x*	*s*	*m*	Growth 15—18 *y.*
15	157,5	4,77	0,47		154,5	6,32	0,62	
16	157,4	5,01	0,49	0,5	154,5	5,81	0,55	2,5
17	156,7	6,88	0,63	0,32 %	157,6	5,45	0,51	1,62 %
18	158,0	5,90	0,56		157,0	6,85	0,68	

Age	F				B			
	x	*s*	*m*	Growth 15—18 *y.*	*x*	*s*	*m*	Growth 15—18 *y.*
15	154,7	7,42	0,69		154,2	6,00	0,59	
16	154,8	6,87	0,66	2,4	155,2	6,49	0,62	2,7
17	156,7	6,65	0,65	1,55 %	155,7	6,09	0,60	1,75 %
18	157,1	5,03	0,50		156,9	6,18	0,62	

TAB. 19. *Morphological Facial Height (mm)*

Age	G				M			
	x	*s*	*m*	Growth 15—18 *y.*	*x*	*s*	*m*	Growth 15—18 *y.*
15	114,7	6,55	0,64		112,7	7,10	0,69	
16	113,9	6,91	0,68	0,7	112,1	7,01	0,66	5,3
17	115,8	6,14	0,57	0,61 %	116,7	6,79	0,63	4,70 %
18	115,4	5,49	0,54		118,0	7,38	0,73	

Age	F				B			
	x	*s*	*m*	Growth 15—18 *y.*	*x*	*s*	*m*	Growth 15—18 *y.*
15	113,0	7,56	0,70		114,0	5,98	0,58	
16	113,3	6,88	0,67	2,9	114,2	7,39	0,71	1,4
17	115,2	7,11	0,69	2,57 %	115,2	6,38	0,63	1,23 %
18	115,9	7,80	0,78		115,4	6,08	0,61	

TAB. 20. *Bizygomatic Breadth (mm)*

Age	G				M			
	x	*s*	*m*	Growth 15—18 *y.*	*x*	*s*	*m*	Growth 15—18 *y.*
15	135,1	5,29	0,52		132,9	6,66	0,65	
16	135,5	5,84	0,57	1,7	131,7	8,40	0,79	3,9
17	135,9	6,41	0,59	1,26 %	137,2	6,67	0,62	2,93 %
18	136,8	5,84	0,58		136,8	7,89	0,78	

Age	F				B			
	x	*s*	*m*	Growth 15—18 *y.*	*x*	*s*	*m*	Growth 15—18 *y.*
15	133,3	5,76	0,63		132,4	4,30	0,42	
16	134,4	6,84	0,66	4,6	134,5	7,23	0,70	5,4
17	135,5	6,97	0,68	3,45 %	135,9	6,16	0,61	4,08 %
18	137,9	5,62	0,56		137,8	5,08	0,51	

3. By the end of the 18th year of their age the apprentices outdimension the grammar-school boys in the following way:

a) motor-car mechanics, fitters and bricklayers: in the antero-posterior diameter of the thorax, expirational and mezosternal thorax circumference, bi-cristal breadth, and also in the bi-spinal breadth,

b) motor-car mechanics and fitters: in the dynamometry of the clasp of the right and left hand, length of the skull and in facial height,

c) motor-car mechanics in body weight, and fitters in the bi-acromial breadth.

4. At the age of 18 years the apprentices reach the same values as the grammar-school boys in the following characters: motor-car mechanics in bi-acromial and facial breadth, fitters in the horizontal head circumference and bricklayers in facial height.

5. By the end of the studied period the apprentices had not caught up with grammar-school boys in the following values:

a) In body height, arm span, sitting height, vital capacity of lungs, transverse diameter of the thorax, inspirational thorax circumference and skull breadth,

b) Fitters and bricklayers in body weight,

c) Bricklayers in the dynamometry of the clasp of the right and left hand, in bi-acromial breadth and in skull length,

d) Motor-car mechanics and bricklayers in the horizontal head circumference.

6. The relative growth of apprentices between 15 and 18 years of age in all investigated characters, and expressed in per cents is 1.5—2.5 times higher than in the group of grammar-school boys, with the exception of the bi-spinal breadth and transverse diameter of the thorax in motor-car mechanics. The growth rate of the apprentices during the three years we were following is higher than that of the grammar-school boys.

The relative percentual growth during the entire investigated period was the highest, practically in all characters, in the group of bricklayers, and was gradually dropping towards the groups of fitters, motor-car mechanics and grammar-school boys. With the increasing physical load the growth rate is also increasing.

7. The average values of the thickness of 10 skin folds during the followed thre years are the highest in the Group of fitters (78.9 mm). In the group of motor-car mechanics they reached 77.2 mm, in grammar-school boys 73.3 mm, and in bricklayers 69.1 mm. To these values corresponds the total amount of body fat of 14.8 %, 14.5 %, 13.9 % and 13.1 %, respectively.

8. Our groups, as a whole, are above the average values of the Slovak population from 1951 and 1961 in body height, body weight, mezosternal thorax circumference, and in the horizontal circumference of the head, which is a further proof of the continuing growth acceleration.

9. It follows from the evaluation of the body height and body weight according to Wetzel's growth method that up to the age of 18 years the percentage of stronger statures is increasing, while that of the thin statures is decreasing. The apprentices are smaller and square-built, the grammar--school boys are taller and slimmer.

Though the highest degree of body growth (D) was reached by the grammar-school boys, followed by motor-car mechanics, fitters and bricklayers, the total body growth has the opposite order of professions between the age of 15 and 18 years.

We compared also the time sequence of growth in our groups with that of the Slovak population of 1951. Our group as a whole is approximately about a half higher, showing again that there is an acceleration of growth.

10. Fifteen year old Slovak boys, starting as miner's apprentices (1960) were 4.7 cm smaller and 2.6 kg lighter than the boys investigated by this author.

Cooperative farmer's and forester's apprentices from West Slovakia (1974), equals in age of the boys in our groups, are somewhat smaller than the boys investigated by us. At the age of 15 and 16 years they are heavier, but towards the end of the investigated period the values measured in the West and East Slovak apprentices are almost identical (there is a difference of 0.1 kg between the two groups). The dynamometry of the clasp of the right hand of the West Slovakian apprentices is 6 kg higher.

11. In the body height and body weight Czech boys (1961), groups from Budapest (Eiben, 1971), Titograd (Ivanovič, 1970) and from Central Germany (1961) are above our group as a whole.

12. In body height, sitting height, arm span and vital capacity of lungs the differences between apprentices on the one side, and grammar-school boys on the other, are statistically very significant — the values measured in the latter ones are well above the values obtained by measuring the apprentices.

At the age of 15 and 16 years there are very significant differences in the horizontal circumference, length and breadth of the head in the favour of grammar-school boys. By the age of 18 years these differences disappeared.

During the three years of investigations the differences in the antero-posterior and transverse diameters of the thorax, in the bi-spinal breadth and in facial height are quite negligible.

At the age of 15 years the difference in the expirational chest circumference is markedly in favour of the grammar-school boys, and at the age of 18 years it is in the favour of the apprentices.

In other characters the difference is very significant (significant) in the favour of grammar-school boys — these differences later fade away.

13. An important interdependence ($r = +0.95$) has been discovered between body weight and between the degree of physical development. There is considerable interdependence also between the vital capacity of lungs, and between body surface ($r = +0.70$), between the vital capacity of lungs and the mezosternal chest circumference ($r = 0.68$) in grammar-school boys, and + 0.58 in fitters).

14. From the evaluation of the indices follows:

a) Sitting height is growing quicker than body weight. There is a higher percentage of brachycormic (40.7 %) and lower percentage of macrocormic (30.2 %) individuals among apprentices than among grammar-school students (37.1 % and 33.1 %).

b) The arm span is growing much quicker than the body height — this is very conspicuous in the groups of apprentices.

c) The apprentices show broader shoulders, compared with body height than the grammar--school boys do. Narrow-shouldered individuals prevailed in all groups (55—58 %), the percentage of semi-broad shoulders varied between 30—40 %, and that of the broad-shouldered boys was between 6—14 %.

d) The bi-cristal breadth is lagging behind the bi-acromial one.

e) In the groups of apprentices the bi-cristal breadth increases quicker than the body height. In the grammar-school boys both dimensions grow equally quickly.

f) The mezosternal chest circumference is growing in all groups quicker than the body height — in the groups of apprentices it is growing much quicker than in the grammar-school boys.

g) The weight and the chest circumference grow more quickly than the body height. The or-

ganism of the apprentices is becoming more vigorous than that of the grammar-school boys.

h) The body weight of the adolescents grows quicker than their body height. The biggest increase of weight compared with body height was marked in the group of bricklayers.

ch) The skull grows more along its longitudinal axis — not in the width. In the four groups we found 0.7 % of dolichocephalic, 5.5 % of mezocephalic and 93.8 % of brachycephalic individuals.

i) The faces of the grammar-school students, fitters and bricklayers grow more to the width, and those of the motor-car mechanics to the height.

15. Adequate and regular physical work, suitable working environment and the steady improvement of the social and economic factors have a very positive influence upon the growth and development of apprentices.

The increasing standard of living influences favourably also the physical development of the grammar-school boys.

The attention paid to the education of apprentices is one of the manifestations of the extraordinary care of the working people in the socialist society.

In our view it is necessary to pay more attention to the investigation of the development of the apprentices, of our future workers, forming the backbone of our working class. Similar investigations should be focused also on other professions, on minner's, farmer's, founder's, waiter's and cook's apprentices and apprentice girls, especially in the Slovak Socialist Republic, where the biology of the working youth is at its very beginnings.

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