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SECULAR TREND IN SOMATOTYPE OF HUNGARIAN SCHOOLBOYS

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Abstract: *The aim of the study was to analyse the differences between the somatotype of the non-athletic Budapest children and adolescents in 1976 and 2001. The subjects of the second investigation were significantly taller and heavier than their age mates 25 years earlier. The unfortunately significantly greater relative body fat content refers to their heavier body mass. The mean somatotype of the children and adolescents in the first data collection was endo-mesomorphic and the meso-endomorphic mean somatotype was characteristic in 2001. Although the observed differences between the means of successive investigations were moderate, they are in harmony with the changes of life style in the Hungarian society of the past 25 years. The increased endomorphy as well as the decreased mesomorphy expresses numerically the consequences of continuously decreasing habitual physical activity of the investigated children and adolescents. The changes are unambiguously and unfavourably negative and point simultaneously toward a decreasing health status of the future generation with an increasing risk of cardiovascular and metabolic diseases as serious consequences of overweight and inactivity.*

Keywords: *Non-athletes; Height; Body mass; Somatotype components.*

Introduction

The results of representative data collections in body dimensions of Hungarian children and adolescents indicate significant size differences between the means of the successive generations (Eiben et al. 1971, Mészáros and Mohácsi 1987, Eiben et al. 1992). For the greater height and body mass means often refer different body proportions indicating by weight-height ratio, sitting height, lower extremity length, and relative bone widths (Bodzsár and Pápai 1994, Uvacsek et al. 2002). Though, the more or less expressed generation differences in body proportions may indicate the differences in the physique of the successive generations, and only a limited Hungarian observation may have of interest in this respect. Analysing the results of the 1968 and 1978 studies of Körmend characterised by the Heath-Carter method (1967), Eiben found (1985) that endomorphy has grown in the somatotype. Mohácsi and associates (1994) comparing the linearity component of growth type (Conrad 1963) in the samples of 1975, 1981 and 1991 of Budapest children aged between 14 and 18 found that the mean growth type had become significantly narrower, that is, the youngsters at the beginning of the 90th were more leptomorphic than 15 years earlier. Interestingly, the more linear body build referred to greater relative body fat content in this comparison. The statistical relationship between more linear body built and slender bone diameters is significant by the observations of Susanne and Bodzsár (1998).

The aim of this study was to analyse the differences between the somatotype characterising the Budapest children and adolescents investigated in 1976 and 2001.

Subjects and Methods

Two anthropometric data collections were carried out in 1976 (n=1,777) and 2001 (n=2,029) in the same districts of the capital. Volunteer, 9 to 14-year-old, non-athletic boys of the middle socio-economic class were recruited. All the investigated subjects were of Europid origin. The number of curricular PE classes was uniformly 3 in a decade. The data of children participating in adapted physical education (by orthopaedic, cardiac, metabolic etc. indications) were excluded from the comparison. Frequency distribution of the subjects by time of investigation and calendar age are summarised in Table 1. Although about 10% decrease has occurred in the number of inhabitants of the capital during the observation period, this reduction did not influence remarkably the socio-economic structure of the respective districts.

Table 1. Frequency distribution of subjects.

Age (yrs)	1976	2001
8.51– 9.50	310	350
9.51–10.50	305	350
10.51–11.50	303	355
11.51–12.50	297	345
12.51–13.50	291	329
13.51–14.50	271	300

The anthropometric somatotype components were calculated by one of the early suggestions of Heath and Carter (1967) in the sample of 1976; the same method was used in 2001 necessarily. Relative body fat content was estimated by the description of Parížková (1961). In taking the required body dimensions the IBP suggestions (Weiner and Lourie 1969) were followed.

While the standard deviations around the means of somatotype components were approximately circular in all the three directions, the differences between the means were tested by t-tests for independent samples at 5% level of random error.

Results

Descriptive and comparative statistics for height and body mass are summarised in Table 2 and 3. As the consequence of secular changes the subjects of the second data collection (2001) were significantly taller and heavier than their age mates 25 years ago. Since the body mass differences were not proportionate to the taller stature, the greater body mass means (in the second investigation) can be related to the secular changes just in part. This conclusion is supported by the consistent and significant differences in relative body fat content (Table 4). The children and adolescents of the second data collection were more fat by 1.03–1.39%. The secular trend had no significant effects on the intra-group variabilities.

Table 2. Means and standard deviations for height (cm).

Age (yrs)	1976 Mean	1976 SD	2001 Mean	2001 SD
9	134.55	5.99	137.23*	5.61
10	138.80	6.38	142.11*	6.02
11	143.57	6.51	147.48*	6.55
12	149.79	7.81	152.56*	7.12
13	156.18	8.25	159.64*	7.82
14	161.59	8.10	163.77*	8.04

* = differences between the means are significant at 5% level of random error.

Table 3. Means and standard deviations for body mass (kg).

Age (yrs)	1976 Mean	1976 SD	2001 Mean	2001 SD
9	30.86	5.29	34.00*	5.49
10	33.01	5.50	37.11*	6.01
11	36.42	6.89	40.44*	7.63
12	40.77	7.27	44.58*	7.59
13	45.51	8.77	49.14*	8.82
14	50.26	8.76	54.06*	8.64

* = differences between the means are significant at 5% level of random error.

Table 4. Means and standard deviations for relative body fat content (%).

Age (yrs)	1976 Mean	1976 SD	2001 Mean	2001 SD
9	17.47	5.09	18.50*	5.23
10	17.72	5.29	18.96*	5.45
11	17.79	5.30	19.14*	5.31
12	17.36	5.23	18.75*	5.14
13	17.46	5.58	18.69*	5.34
14	17.94	5.22	19.11*	5.26

* = differences between the means are significant at 5% level of random error.

The mean relative body fat contents in the second investigation are evaluated as definitely high. Taking into account the marked standard deviations around the means (5.23–5.45%) nearly 30% of the subjects can be qualified as fat or obese. It is evident there is no reason in analysing the somatotype components separately, the mean somatotype components are arranged in various tables only for the reason of easier review

and comparison. Though the mean somatotype of the investigated subject is located in or very close to the central area of the somatochart (Tables 5–7), significant statistical differences can be observed between the means of successive data collections.

Table 5. Means and standard deviations for Endomorphy.

Age (yrs)	1976		2001	
	Mean	SD	Mean	SD
9	3.46	1.01	3.97*	1.09
10	3.44	1.04	3.92*	1.07
11	3.41	1.07	3.88*	1.01
12	3.39	1.09	3.94*	1.02
13	3.36	1.03	3.93*	1.03
14	3.32	1.05	3.83*	1.06

* = differences between the means are significant at 5% level of random error.

Table 6. Means and standard deviations for Mesomorphy.

Age (yrs)	1976		2001	
	Mean	SD	Mean	SD
9	4.48	0.84	3.79*	0.88
10	4.34	0.80	3.96*	1.02
11	4.29	0.91	3.42*	1.06
12	4.17	1.02	3.43*	1.04
13	4.15	0.98	3.55*	1.06
14	4.29	1.01	3.61*	1.03

* = differences between the means are significant at 5% level of random error.

Table 7. Means and standard deviations for Ectomorphy.

Age (yrs)	1976		2001	
	Mean	SD	Mean	SD
9	2.82	1.08	2.43*	0.88
10	3.09	1.01	2.61*	0.99
11	3.13	1.03	2.87*	1.05
12	3.28	1.06	2.91*	1.04
13	3.46	1.00	3.30*	0.98
14	3.47	1.02	3.12*	1.02

* = differences between the means are significant at 5% level of random error.

The initial mean somatotype (in 1976) was endo-mesomorphic in all the six age groups, however, meso-endomorphic mean somatotype was characteristic in 2001. As one of the consequences of the non-proportionally heavier body masses and also of the significantly greater relative body fat contents, the endomorphy was consistently greater and the ectomorphy significantly lower at the time of second data collection. The indicator of mean relative robustness (component II) was slightly but significantly greater in 1976. In contrast to the observations of Carter and Heath (1990) as well as Classens (1981) no clear age dependence of the somatotype was found in this comparison.

The standard deviations around the means were similar (very close to unity) in all the six age groups and both investigations.

Discussion

The moderate differences between the mean somatotypes of the successive investigations could be evaluated as sampling error or negligible inter-sample variability at a first glance. Taking into account that the analysis of secular differences is one of the possibilities to estimate the health conditions and vital status of the population (Wolanski 1978, Susanne 1998), the moderate differences may also have importance.

From a methodological point of view it has to be stressed that somatotyping is a useful technique for describing and comparing populations. It sensitively monitors the changes in life-style, especially in habitual physical activity (Carter and Heath 1990). Although there are probably genetic factors in the development and inter-group differences of endomorphy and mesomorphy (Chovanová et al. 1982), nutrition and regular physical activity have also important roles (Carter and Heath 1990).

Following the technical and theoretical considerations above, the first statement of our discussion has to be modified. Although the observed differences between the means of successive investigations were moderate, they are in harmony with the changes of life style in the Hungarian society of the past 25 years. The increased endomorphy as well as the decreased mesomorphy express numerically the consequences of continuously decreasing habitual physical activity (Laki and Nyerges 2000) of our children and adolescents, resulting in an imbalance between energy intake and utilisation as well as underdevelopment of the locomotor system. These changes are unambiguously and unfavourably negative and point simultaneously toward the decreasing health status of the future generation with an increasing risk of cardiovascular and metabolic diseases as the possible serious consequences of overfat and inactivity. The decreased mesomorphy and the increased endomorphy were characteristic for the subjects of the second data collection (2001), however, these effects cannot be evaluated as the necessary consequences of secular growth changes.

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