SECULAR TREND AND MOTOR PERFORMANCE SCORES IN HUNGARIAN SCHOOLBOYS

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Abstract:

Secular changes in growth and development are ways of observing the socio-economic conditions of populations as well as their state of health.

The series of height and body mass arithmetic means for Budapest children shows a significant trend towards increasing (Bodzsár, 1998). The increase of mean stature and body mass has been larger in boys and young adult males during the past 20-30 years (Eiben, Barabás & Pantó, 1991; Mészáros, Szmodis, Mohácsi & Frenkl, 1981). Unfortunately, no published data are available about the changes in motor performance either in Hungary or in Europe. The aim of the present investigation was to compare the height, body mass, relative body fat content and two motor test scores (30m dash and 1,200m run) in the samples of Budapest children aged between 10 and 13 years, investigated in 1975 (n = 739) and 2000 (n = 660). As one of the consequences of the secular growth trend boys were significantly taller and heavier in the year 2000 than 25 years ago in all the four studied age groups. Unfortunately, their mean relative body fat content was also larger. No significant differences were found between the means of the 30m dash time. Nevertheless, their average running time in the endurance test was statistically longer in the year 2000. The possible explanations of the observed unfavourable tendencies can be: the decrements in prestige of general, non-competitive training, like regular physical activity, the decrease in the number of classes with an extra PE curriculum, as well as in the number of sport schools and youth sections within the sport clubs. All of these opportunities for organized physical activity of the young have diminished during the past decades. Physical activity has become a profitable business. However, the majority of families cannot and do not want to pay for their children's regular physical activity.

Key words: *boys, height, body mass, 1,200m run, 30m dash*

SÄKULARER TREND UND BEWEGUNGSLEISTUNGSERGEBNISSE BEI UNGARISCHEN SCHÜLERN

Zusammensetzung:

Säkulare Veränderungen im Wachstum und in der Entwicklung sind die Wege, wie man sowohl die sozio-ökonomische Bedingungen als auch den Gesundheitszustand von Grundgesamtheiten beobachten kann. Die Serie von arithmetischen Mitteln der Höhe und Körpermasse für die Kinder aus Budapest zeigt einen Steigerungstrend (Bodzsár, 1998). Die Steigerung von durchschnittlicher Statur und Körpermasse ist größer bei Jungen und jungen erwachsenen Männern in den letzten 20 – 30 Jahen (Eiben et al., 1991; Mészáros et al., 1981). Leider stehen uns keine veröffentlichten Daten zur Verfügung über die Veränderungen in der Bewegungsleistung entweder in Ungarn oder in Europa. Das Ziel dieser Forschung war, Höhe, Körpermasse, relatives Körperfett und Resultate von zwei Bewegungsleistungstests (30-Meter-Sprint und 1200-Meter-Lauf) zu vergleichen. Als Stichprobe galten 10 – 13jährige Kinder aus Budapest, die im Jahre 1975 (n = 739) und 2000 (n = 660) getestet wurden. Eine der Folgen von säkularem Wachstumstrend war, dass die Jungen aus allen vier analysierten Altersgruppen im Jahre 2000 höher und schwieriger waren als vor 25 Jahren. Leider, ihr relatives Körperfett war auch größer. Keine bedeutenden Unterschiede zwischen den Mittelwerten der Laufzeit im 30-Meter-Sprint wurden gefunden. Die durchschnittliche Laufzeit im Ausdauertest war jedoch statistisch länger im Jahre 2000. Die möglichen Deutungen von diesen negativen Trends können Folgende sein: das Zurückgehen im Prestige des allgemeinen Trainings, dem es am Wettbewerbsgeist fehlt, die Verringerung von regelmäßiger sportlicher Betätigung, die Reduzierung sowohl von der Anzahl der Sportunterrichtsstunden in der Schule als auch von Sportschulen und Gruppen für die Jugendlichen in Sportklubs. Alle diese Möglichkeiten, Sportaktivitäten für die jungen Menschen zu organisieren, verringerten sich in den letzten Jahrzehnten. Sportliche Betätigung wurde zum profit-

bringenden Geschäft. Die meisten Familien können nicht und wollen nicht für die regelmäßige sportliche Betätigung ihrer Kinder bezahlen.

Schlüsselwörter: *Jungen, Höhe, Körpermasse, 1200-Meter Lauf, 30-Meter Sprint*

Introduction

All living organisms continuously change under the pressure of environmental conditions. These changes affect either the genotype or the phenotype (when the environment modifies the manifestation of genetic endowment).

In auxology (the science of growth), the term *secular trend* is generally applied to such positive changes that have become manifested in faster growth, earlier maturation of children, taller stature of adults etc. (Susanne & Bodzsár, 1998). However, negative tendencies have also been described, when the standard of the living conditions has markedly decreased over a longer period of time.

Consequently, secular changes in growth and development are ways of observing the socio-economic conditions of populations, as well as their state of health.

In European countries secular trend is more marked among the lower social classes than in the upper class (Vercauteren & Slachmuylder, 1993).

The series of height and body mass means for Budapest (the capital of Hungary) children encompass the years 1930 through 1990 and show a significant trend towards increasing (Bodzsár, 1998). The increase of mean stature and body mass has been noticeable in boys and young adult males over the past 20-30 years (Eiben, Barabás & Pantó, 1991, Mészáros, Szmodis, Mohácsi & Frenkl, 1981).

Regarding physique and body composition, two observations may be of interest. Eiben (1995) described a more or less marked increase in the endomorphy of somatotype within the 30-year observation period. Mohácsi, Mészáros & Farkas investigated the growth type of Conrad (1963) in the 1975 and 1991 data regarding the young from Budapest. They have observed that the mean growth type was more linear in the year 1991.

Unfortunately, no observations are available about the changes in motor performance either in Hungary or in Europe. The sole publication refers to Wolansky (1978). The author drew only a theoretical conclusion. In parallel with the increase in height and weight, the linearity of the physique also increases. However, the physical performance decreases both in children and adults as a consequence of secular growth trend. The aim of the present investigation was to compare the height, body mass, relative body fat content and two motor test scores in the samples of Budapest children, aged between 10 and 13, investigated in 1975 and 2000.

The increase in mean height and body mass is irrelevant in this respect, but larger body fat content and lower mean endurance and speed performances were hypothesised in the sample from the year 2000.

Subjects and methods

In both data collections, the subjects were volunteer boys living in the same districts of the capital of Hungary. All of them were non-athletes, they took part only in the curricular PE classes (2-3 classes a week, 45 minutes each). Children taking part in the adapted PE classes were excluded from these samples.

The age groups were created on the suggestions of the International Biological Program (Weiner & Lourie, 1969). The frequency distribution of the subjects by age and the investigation was as follows:

Age	1975	2000
9.51-10.50	188	160
10.51-11.50	191	165
11.51-12.50	180	166
12.51-13.50	180	169

Stature, body mass and the necessary skinfold thickness were also taken according to the IBP protocole (Weiner & Lourie, 1969). Taking into account the significant relationship between height and body mass, relative body mass was also calculated (relative body mass = body mass x 0.01 stature^{-1}).

Body fat content was expressed as a percentage of total body mass using the tables of Parizková (1961).

Cardiorespiratory endurance and basic speed performance were estimated from the running time scores in the 1,200m run and the 30m dash. The tests were executed as determined by the rules of track-and-field athletics. In the speed test 3 trials were completed and the best result was included in the statistical analysis.

The differences between the respective means were tested by the *t*-test at 5% level of random error.

Results

The results of the descriptive and comparative statistics are summarised in the tables. Table 1 contains the means and standard deviations of height. The pre-pubertal boys of all the four studied age groups were significantly taller in the year 2000 than 25 years ago. However, the standard deviations from the means did not change during the period between two observations.

Table 1. Differences between the height means (cm).

	1975		2000		
Age	**Mean**	**SD**	**Mean**	**SD**	**p**
10	138.80	6.38	141.59	6.18	< 0.05
11	143.56	6.51	146.68	6.28	< 0.05
12	149.79	7.80	153.37	6.99	< 0.05
13	156.18	9.26	160.90	9.47	< 0.05

Abbreviations: SD = standard deviation, p < 0.05 = the difference between the means is significant at a 5% level of random error.

The absolute and relative (relative to stature) body mass means and standard deviations can be seen in Table 2. The youngsters in the second investigation were significantly heavier than their peers in the first data collection. The larger body mass is partly a consequence of their significantly increased height. Nevertheless, the differences between the relative body mass means were also significant. The boys in the second investigation had consistent larger relative body weight, too.

Table 2. Differences between the absolute and relative body mass means.

Absolute body mass (kg)

	1975		2000		
Age	**Mean**	**SD**	**Mean**	**SD**	**p**
10	33.01	5.50	35.56	5.59	< 0.05
11	36.42	6.89	38.95	6.87	< 0.05
12	40.77	8.27	43.59	8.31	< 0.05
13	45.50	8.77	49.82	8.32	< 0.05

Relative body mass (kg x m^{-1})

10	23.78	3.96	25.11	3.95	< 0.05
11	25.27	4.74	26.55	4.68	< 0.05
12	27.22	5.52	28.42	5.42	< 0.05
13	29.13	5.61	30.96	5.17	< 0.05

Abbreviations are as in Table 1.

The height and body mass means in the year 1975 were very close to the respective Budapest reference data (Eiben, Hegedűs, Bánhegyi, Kiss, Mouda & Tasuádi, 1971), but our samples investigated in the year 2000 were slightly taller and heavier than the characteristic means at the beginning of the final decade of the past century (Eiben, Farkas, Kormendy, Paksy, Varga Teghze-Gerber & Varga, 1992).

The taller stature and heavier body mass means can be related to the effects of secular growth changes. Yet, the differences in relative body fat content are the consequences of a modified lifestyle. These results are summarised in Table 3. The body-mass-related fatness was significantly and consistently larger in the second investigation. The standard deviations from the fat means were markedly high (ranging between 25-33% of the respective averages) in both investigations. The increase in body fat coincides with the observation of Eiben (1985), who investigated the Körmend (South-West Hungary) population.

Table 3. Differences between the relative body fat content means (%).

	1975		2000		
Age	**Mean**	**SD**	**Mean**	**SD**	**p**
10	17.72	5.92	19.36	5.36	< 0.05
11	18.79	6.30	19.85	6.00	< 0.05
12	19.26	6.23	20.33	6.24	< 0.05
13	19.32	5.79	20.41	5.51	< 0.05

Abbreviations are as in Table 1.

We have to note that the fat content between 18-20% of body mass can be qualified as high, unfavourable and unhealthy in 10-13-year-old boys. This moderate obesity, observed in both investigations, is basically a consequence of boys' sedentary lifestyle. Our former results indicated 14-15% of body fat in regularly trained youngsters (but not competitive athletes) of the same age range (Mészáros, Petrekanits, Mohácsi, Farkas & Frenkl, 1991).

No consistent differences were found between the means of the basic speed test used (30m dash), though the numerical data were slightly greater in the second investigation (Table 4).

In our opinion, the results achieved in a short burst-out activity in non-athletic individuals depends mostly on genetic inheritance. And the marked change in genetic background (in healthy groups of the population) could not have been a realistic expectation for the 25-year long period.

Table 4. Differences between the 30m dash means (s).

	1975		2000		
Age	**Mean**	**SD**	**Mean**	**SD**	**p**
10	5.89	0.44	5.99	0.76	NS
11	5.74	0.41	5.79	0.75	NS
12	5.64	0.40	5.67	0.83	NS
13	5.42	0.37	5.50	0.59	NS

Abbreviations are as in Table 1. NS = the difference between the means is not significant at a 5% - level of random error.

Aerobic fitness was estimated by the time achieved in the 1,200m run. The mean running times and standard deviations can be seen in Table 5. The aerobic performance was significantly poorer at the time of the second investigation in all the investigated groups.

Table 5. Differences between the 1,200m run means (s).

	1975		2000		
Age	**Mean**	**SD**	**Mean**	**SD**	**p**
10	367.20	53.21	398.08	51.52	< 0.05
11	357.01	48.51	371.08	54.37	< 0.05
12	345.20	44.69	372.69	49.29	< 0.05
13	330.29	37.75	354.46	48.41	< 0.05

Abbreviations are as in Table 1.

The unchanged speed and the significantly decreased aerobic performance between 1975 and 2000 are surprising. Namely, because of the significant negative relationship between height, body mass, 30m dash and 1,200m run scores (Mészáros, Mohácsi, Frenkl, Szabó & Szmodis, 1986), better physical performances had been predicted and expected.

Discussion

As regards the stature and the body mass means of the young from Budapest, it can be said that they were significantly taller and heavier than 25 years ago. These differences are in accordance with the described tendencies of secular growth trends (Bodzsár, 1998; Bodzsár & Susanne, 1998). However, the increased relative body fat content cannot be evaluated as a favourable consequence of the trend. The larger body fat content and the poorer performance in the aerobic test do not predict any favourable health status in our next generations.

The following possible reasons and explanations of the observed, unfavourable tendencies can be mentioned:

Although the successes of Hungarian athletes in competitive sports represent an important and high quality in Hungary, the prestige of general, non-competitive-training, like regular physical activities, has decreased considerably during the past decades. The ratio of young athletes has reduced significantly, from 20-25% to 7-8%. The ratio of classes with the extra PE curriculum to the classes with the regular PE curriculum was about 30% 25 years ago, but nowadays they are an exception.

Parallel with the continuously decreased living standard between 1980-1995, the number of sport schools and youth departments within sport clubs has dramatically decreased. Consequently, physical activity has become a profitable business. However, the majority of families cannot and do not want to pay for their children's regular physical activity. The insufficient number of PE classes and their distribution in elementary schools cannot compensate for the lack of biologically indispensable, physical stimuli.

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SEKULARNI TREND I MOTORIČKE SPOSOBNOSTI MAĐARSKIH UČENIKA

Sažetak

Uvod

U auksologiji (znanosti o rastu) termin sekularni trend (skokovite promjene) općenito se upotrebljava za označivanje pozitivnih promjena koje se manifestiraju kao ubrzani rast, ranije dozrijevanje djece, veća tjelesna visina odraslih i slično (Susanne & Bodzsár, 1998). Istina, opisane su i negativne tendencije, osobito za duža razdoblja u kojima su uvjeti života postali znatno lošiji nego prije. Sukladno tome sekularne, skokovite promjene tijekom rasta i razvoja jesu jedan od načina na koji se manifestiraju socio-ekonomski uvjeti života populacije, ali i njen zdravstveni status. U europskim zemljama sekularni trend je uočljiviji u nižim društvenim klasama negoli u višima (Vercauteren & Slachmuylder, 1993).

Podaci o prosječnim vrijednostima tjelesne visine i tjelesne mase budimpeštanske mladeži za razdoblje od 1930. do 1990. godine, pokazuje znatan trend porasta (Bodzsár, 1998). Znatnije povećanje tjelesne visine i tjelesne mase zabilježeno je među dječacima i mladim muškarcima posljednjih 20-30 godina (Eiben i sur., 1991; Mészáros i sur., 1993). U svezi s konstitucijskim tipom i tjelesnom kompozicijom dvije napomene mogle bi biti zanimljive. Eiben (1995) je opisao sve izraženiji porast endomorfnosti u somatotipiji tijekom promatranog razdoblja od trideset godina. Mohácsi i suradnici (1994) istražili su tipove rasta prema Conradu (1963) na podacima o budimpeštanskoj mladeži iz 1975 i 1991. Primijetili su da je prosječan tip rasta bio linearniji 1991. godine.

Nažalost, ni u Europi ni u Mađarskoj nema istraživanja o promjenama motoričkih sposobnosti.

Cilj je ovoga istraživanja bio usporediti podatke o tjelesnoj visini, tjelesnoj masi, relativnoj količini masnoga tkiva i rezultate koje je u dva motorička testa postigao uzorak budimpeštanske djece u dobi od 10-13 godina 1975. i 2000. godine. Bez sumnje se očekivala potvrda o povećanju visine i težine, a pretpostavljene su veća količina masnoga tkiva te slabija prosječna izdržljivost i lošiji rezultati u brzinskom testu za uzorak iz 2000. godine.

Materijal i metode

Dječaci - ispitanici (165 – 191 dječak u svakoj dobnoj skupini) bili su dobrovoljci iz istih dijelova glavnoga grada u oba istraživanja. Nitko se nije bavio sportom, a pohađali su redovitu nastavu tjelesne i zdravstvene kulture (2-3 sata nastave tjedno; sat po 45 minuta). Iz uzorka su isključeni dječaci koji su sudjelovali u programu tjelesne i zdravstvene kulture za djecu s posebnim potrebama. Dobne skupine oblikovane su prema uputama Međunarodnog biološkog programa (International Biological Program - IBP, Weiner & Lourie, 1969). Prema propisima IBP-a izmjereni su tjelesna visina, tjelesna masa i debljina kožnih nabora. S obzirom na iznimno važan odnos između tjelesne visine i težine, izračunata je i relativna tjelesna masa (relativna tjelesna masa = tjelesna masa x 0.01 visina^{-1}). Količina masnoga tkiva izražena je kao postotak ukupne tjelesne mase, a prema tablicama koje je dala Parizková (1961). Kardiopulmonalna izdržljivost i brzina procijenjene su testovima trčanja 1200m (izdržljivost) i sprintom na 30m (brzina). Testovi su se provodili prema atletskim pravilima. Test brzine izvodio se tri puta, a u obzir je za statističku analizu uzet najbolji rezultat.

Razlike među pojedinim aritmetičkim sredinama provjerene su *t*-testom na razini slučajne pogreške od 5%.

Rezultati i rasprava

Dječaci predpubertetske dobi iz 2000. godine znatno su viši od svojih vršnjaka od prije 25 godina u sve četiri dobne skupine, ali se standardne devijacije nisu znatnije promijenile tijekom promatranog razdoblja. Ispitanici iz 2000. godine su i znatno teži od svojih vršnjaka iz 1975. godine. Djelomično se povećanje tjelesne mase može pripisati povećanju visine, ali statistički značajne razlike između aritmetičkih sredina relativnih tjelesnih težina upućuju na to da su dječaci iz 2000. godine teži od svojih vršnjaka i relativno i apsolutno.

Prosječne tjelesna visina i masa bile su 1975. godine vrlo blizu referentnim podacima za Budimpeštu (Eiben i sur., 1992), dok je uzorak iz 2000. godine bio nešto viši i teži od prosjeka karakterističnih za početak posljednjeg desetljeća 20. stoljeća (Eiben i sur., 1992).

Prosječna visina i veća tjelesna težina mogu se povezati s učincima sekularnih, skokovitih promjena rasta, no povećanje relativne količine masnoga tkiva posljedica je promijenjenoga načina življenja. Količina masnoga tkiva, povezana s tjelesnom masom, bila je statistički značajno i konzistentno veća u drugom istraživanju. Standardne devijacije prosjeka masnoga tkiva bile su u oba istraživanja izrazito velike (kretale su se u rasponu od 25-33%). Zabilježena povećana masnoća (debljina) poklapa se s promatranjima Eibena (1985) koji je istraživao populaciju iz Körmenda (jugozapadna Mađarska).

Valja ovdje naglasiti da se u oba istraživanja zabilježen sadržaj masnoga tkiva koji prelazi 18 – 20 % tjelesne mase dječaka u dobi od 10-13 godina može označiti kao visok, nepoželjan i rizičan za zdravljev. Ova umjerena pretilost uglavnom je posljedica sedentarnog načina življenja. Neka ranija istraživanja zabilježila su 14-15% masnoga tkiva u normalno treniranoj mladeži (ali ne onih koji se bave natjecateljskim sportom) iste dobi (Mészáros i sur., 1991).

Nisu zabilježene konzistentne razlike u aritmetičkim sredinama rezultata brzinskih testova postignutih u oba istraživanja (sprint 30m), premda su numeričke vrijednosti bile nešto veće u drugom istraživanju. Prema našemu mišljenju, rezultati ne-sportaša u eksplozivnim aktivnostima određeni su najviše faktorom nasljeđa. A nije realno očekivati da se tijekom 25 godina dogode znatnije promjene genetičke podloge (u zdravim skupinama populacije).

Aerobna funkcionalna sposobnost (fitnes) procijenjena je trčanjem na 1 200m. U svim dobnim skupinama drugog istraživanja dobiveni su značajno slabiji rezultati u aerobnoj aktivnosti.

Nepromijenjena brzina i znatno snižena aerobna funkcionalna sposobnost uzorka iz 2000. godine, a u odnosu na uzorak iz 1975. godine, u najmanju ruku izaziva čuđenje. Prema statistički značajnim negativnim relacijama između tjelesne visine, tjelesne mase, rezultata sprinta na 30m i trčanja na 1 200m (Mészáros i sur., 1985) očekivali bi se puno bolji rezultati u motoričkim testovima.

Zaključak

Prosječni stas i tjelesna masa budimpeštanske mladeži upućuju na to da su dječaci viši i teži od svojih vršnjaka od prije 25 godina. Te razlike u skladu su s opisanim tendencijama sekularnog rasta (Bodzsár, 1998; Susanne & Bodzsár, 1998). Međutim, zabilježeno povećanje relativne količine masnoga tkiva ne može se ocijeniti poželjnom karakteristikom toga trenda. Na temelju povećane količine masnoga tkiva i slabijih rezultata u aerobnom testu izdržljivosti teško je prognozirati zadovoljavajući zdravstveni status iduće generacije.

Navest ćemo neke moguće razloge i objašnjenja za primijećene nepoželjne tendencije. Dok mađarski vrhunski sportaši postižu zavidne uspjehe na nacionalnom i internacionalnom planu, što se i u Mađarskoj smatra visokom vrijednošću, ugled općeg, ne-natjecateljskog vježbanja, poput redovite, svakodnevne fizičke aktivnost, jako je opao tijekom proteklih desetljeća. Omjer mladih sportaša u populaciji opao je s 20-25% na 7-8%. Razredni odjeli s pojačanim sportskim programom danas su rijetkost, a prije 25 godina bilo ih je čak 30% u sustavu mađarskog školstva.

Usporedo s kontinuiranim opadanjem životnog standarda u razdoblju 1980.-1995., broj sportskih škola i mlađih selekcija u sportskim klubovima dramatično se smanjio. Nasuprot tome, pružanje usluga fizičke aktivnosti postao je unosan posao. No, većina obitelji ne može i ne želi plaćati za redovitu tjelesnu aktivnost svoje djece. Neujednačena zastupljenost sati tjelesne i zdravstvene kulture u programu osnovne škole ne može kompenzirati nedostatak biološki nužnog fizičkog podražaja.