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PHYSICAL ACTIVITY AND SOMATOTYPE

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Abstract: *The aims of the study were (1) to compare the somatotype of athlete and non-athlete boys; (2) to observe the physique of children pursuing different sport disciplines; (3) to reveal the differences between the somatotype of elite young and adult athletes.*

The subjects were athlete and non-athlete boys studied longitudinally (athlete boys N=30; non athlete boys N=30, talented athlete boys N=120). Physique was estimated by the Heath–Carter (Carter and Heath 1990) method.

The results show that athlete children are more mesomorphic than their non-athlete counterparts. Along the age athlete children increase their mesomorphy but the pattern of the changes is different for the different sport disciplines. Performing on different competition level the alterations in mesomorphy are well detected. The higher the level of performance the more the mesomorph dominance manifests.

Keywords: *Longitudinal study, Somatotype; Maturation; Sport disciplines.*

Introduction

Body build, composition and size have been accepted as important factors in physical performance. Highly selected elite athletes of the same event are known to be similar in their body build and dissimilar body structures belong to the different events.

However, it is far from simple if we want to answer the question: "What about the growing child athlete?". Body size, proportions, composition, consequently also shape are changing during growth and development. One of the most conspicuous shapes forming period is puberty, in which significant changes take place in body build resulting in the adult shape. These changes appear in the physique both of the non-athlete and athlete children (Szmodis 1977, Bodzsár 2001).

The aims of the study were:

- To compare the somatotype of athlete and non-athlete children.
- To observe the physique of children pursuing different sport disciplines.
- To reveal the differences between the somatotype of elite young and adult athletes.

Subjects and Methods

The subjects of the study were athlete and non-athlete children. The total sample consisted of three subgroups (Table 1). Two groups from the three were the parts of the Athlete Longitudinal Study (ALS) carried out in our research group. This study started in 1987 and finished in 2005. The children were measured in intervals of half a year, in spring and autumn.

Athlete boys pursuing different sports events were engaged in regular intense training and competition. Non-athlete boys were the pupils of an elementary school in the Buda

part of Budapest. They could not be regarded as a selected group in respect of physical training. Very few of them participated in programmed physical training so their means reflect activity at the P.E. classes mainly.

Table 1. Parameters of the children studied.

Age interval	N	Study	Type
8.5–17.0	30	ALS athlete	longitudinal
8.5–14.5	30	ALS non-athlete	longitudinal
16.0–17.0	46	Heracles Project	cross-sectional

The subjects of the cross-sectional sample were the best and most successful young people participating in the national project for talented athletes (Heracles project). These children have already proved their gift for a given sport and performed at a high level both on national and world championships.

Physique was estimated by the Heath–Carter (Carter and Heath 1990) method using the regression equations of Szmodis (1977). Descriptive statistics were applied to calculate the means of somatotype components. Somatoplots of the different groups were depicted in the somatochart.

Results

Athletes and non-athletes

The first point was to observe the differences in the somatotype of athlete and non-athlete children. To discuss the results two points were regarded. The first was the settle of the somatoplots in the fields of the somatochart.

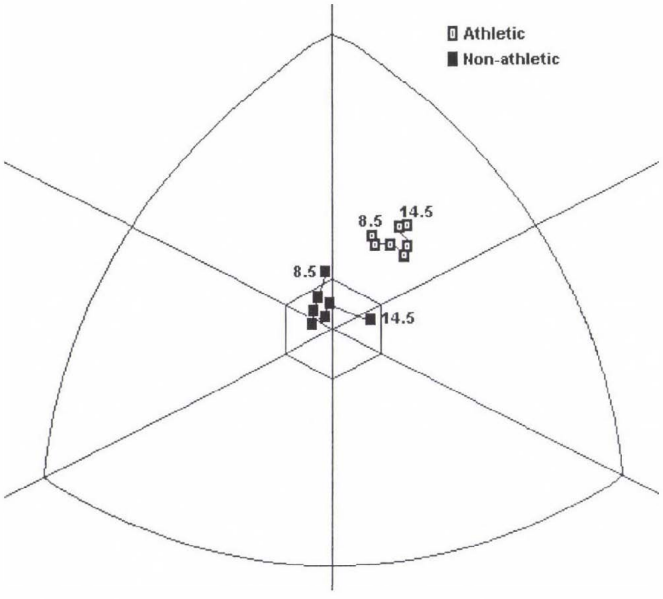

Figure 1: The somatotype of athlete and non-athlete boys.

Depending on the composition of the samples, athlete children may have bigger or smaller body measurements than their non-athlete counterparts of the same age. Consistent differences appear mainly in body composition and physique. Athlete children have higher rate of musculo-skeletal system and are more robust than their non-athlete counterparts (Malina and Rarick 1973, Carter and Heath 1990, Malina and Bouchard 1991, Pápai 2000, Pápai et al. 1992.

During sexual maturation athlete boys tend to be ecto-mesomorphic, while non-athletes have endo-mesomorphic physique. However, it is characteristic for both groups, that at the time of the growth spurt they become more slender in shape than were before (Pápai 2000, 2003, Négele 2006).

In Fig. 1 the somatoplots of athlete and non-athlete boys are depicted. The numbers indicate the starting and closing ages of the examined groups. Not depending on the age the average somatoplots of athlete and non-athlete boys can be clearly differentiated in the somatochart. The non-athletes stay in the central hexagon; the athletes have ecto-mesomorphic physique.

The second approach was to examine the changes in the somatotype along the age (Fig. 1). Taking into consideration the direction of the wandering, the physique of both groups becomes more linear in pre-puberty. Non-athletes start from the balanced mesomorph field and after age 9.5 they stay in the central hexagon. During the ages they change only their component of mesomorphy, but from age 13.5 they become more ectomorphic in figure.

Athlete boys also start from the field of balanced mesomorphy. From age 10.5 they become ecto-mesomorphs and after age 12.5 increase the component of mesomorphy and become more robust.

The figure also shows that in non-athlete boys the most intense longitudinal growth appears between 13.5 and 14.5 years and there is no such a sudden change in athlete ones. Our earlier results proved that there is a phase shift between the growth of athlete and non-athlete children (Pápai et al. 1991, 1992, Pápai 2000), athlete ones grow more rapidly in prepuberty and they have no such a swift growth rate in puberty. This is also demonstrated on the somatochart.

Athletes by sports events

The further analysis refers to the athlete boys. We were interested in the question whether there is any difference in the somatotype of the boys pursuing different sport disciplines. We separated the groups on the basis of the sport events. The somatotype of boys belonging four sport disciplines were analysed by the age.

The data of runners and jumpers are exhibited in Figure 2. The somatoplots are depicted between ages 10 and 17. Their somatoplots start from the field of balanced mesomorphy. The mean values show that mesomorphy remains stable and dominant until the end of the investigated period. Between ages 10 and 11 the relative fatness decreases and the dominance of linearity grows. Their body form changes only before the intense pubertal growth. By this time their somatotype becomes ecto-mesomorphic. From age 12 on their somatotype is practically unchanged.

Another pattern of wandering can be drawn for pentathletes (Fig. 3). At age 10 they have ecto-mesomorphic physique. Passing with time the mean somatoplots tend toward higher mesomorphy. The component of the linearity decreases and there is a little increase in the component of endomorphy.

The boys belonging to these disciplines have dissimilar body form in prepuberty and a very similar physique in the pubertal period. The trend for the changes in body structure is perceptively different in these disciplines. It is a question whether the similarity experienced in puberty is a transient phenomenon or it persists in adulthood.

For gymnasts the pattern of the changes differs from the previous sports events (Fig. 4). At age 10 their somatotype is dominantly mesomorph. Increasing this component steadily with age the dominance becomes more and more manifested. The endomorphy remains low and stable, while ectomorphy increases until age 14 and decreases afterwards. At the end of the studied period they become balanced mesomorphs.

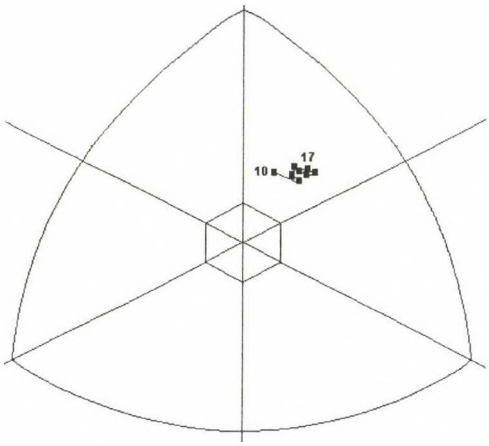

Figure 2: The somatotype of track and field athletes.

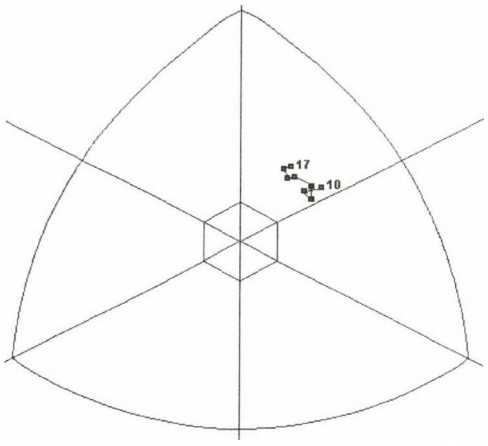

Figure 3: The somatotype of modern pentathlonists.

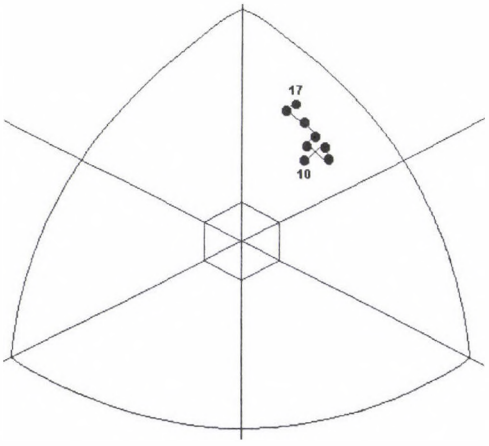

Figure 4: The somatotype of gymnasts.

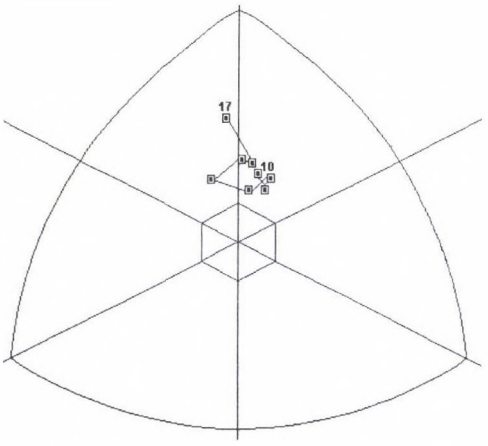

Figure 5: The somatotype of judoists.

Judoists stay in the balanced mesomorph field during the whole time period (Fig. 5). It is very interesting to observe the alterations appear in their somatotype. The age changes are in connection mainly with the component of endomorphy. Before puberty it increases, at the timing of the growth spurt it diminishes showing clearly the "proto-

adolescent fat wave" (Pápai et al. 1996/97) characteristic of adolescent boys (Falkner 1975, Malina and Bouchard 1991). The component of ectomorphy does not change; the mean somatoplots of the 16 year olds is very similar to the one of 10 years. Between ages 16 and 17 mesomorphy increase dramatically and associate with a slight shift toward endomorphy.

Anthropometric somatotype is sensitive to the events of puberty. Changes in body measurements, proportions and composition appear similarly in the body form of normal and athlete boys, i.e. they tend toward higher ectomorphy.

The similarity is only a tendency. It is also evident that the somatotype of non-athlete and athlete boys differ, their somatoplots are in separated fields of somatochart. Athlete boys have more mesomorphic physique than their non-athlete counterparts.

It was also proved that the somatoplots of young athletes belonging to different sports can be found in the different fields of somatochart. The age trends in the change of body form are also different for the representatives of the sport events.

The settle of the somatoplots on somatochart is a proof for the existence of the selection process. The differences may reflect not only for the selection but also for the event specific training, mainly in late puberty.

Without exception the athlete groups increase their mesomorph component, though the rate of the increase differs from events to events. The most significant increase emerges in the somatotype of gymnasts and judoists; the changes are moderate for track and field athletes and pentathletes. Endomorphy changes little. Judoists give the only exception. The linearity of the body usually decreases, except the track and field athletes.

Elite athletes and average athletes

The following figure (Fig. 6) shows the physique of young talented Hungarian athletes of Heracles project. For the sake of the comparison those sports events were chosen that were analysed above longitudinally.

The Heracles Project includes the would-be athletes, the most efficient young sportsmen of a specific event all over the country. Their age is between 16 and 17 years. They have more intense work loading than do the "average" athlete boys.

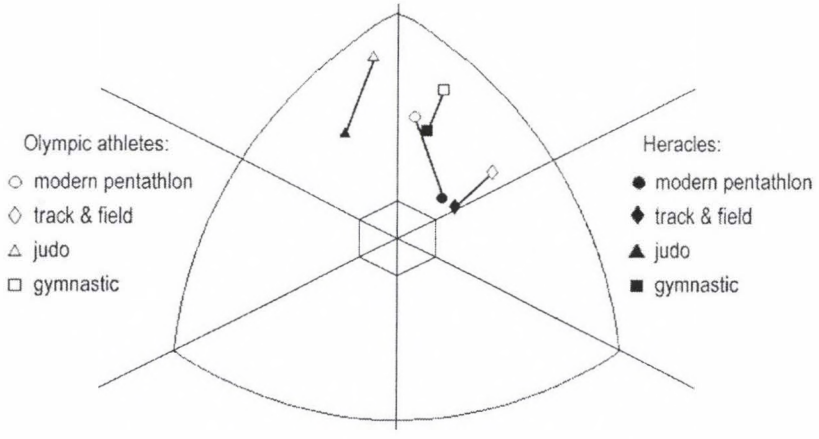

Figure 6: The somatotype of young and adult athletes.

The longitudinal arrangement demonstrates the possible trends in the change of somatotype along the age; the cross-sectional one gives a "snapshot" on the bests. We do not know how these boys attained this body form but we have suggestions for it from our longitudinal data.

We compared the somatotype of the 17-year-old boys of the longitudinal sample (Figs 2–5) to the physique of talented children (Fig. 6). The elite pentathletes and track and field athletes are slender, while gymnasts have more mesomorphic body shape than their non-elite counterparts. The results found here are in line with the data of ours (Tróznai and Pápai 2007) where the elite athletes performing better and worse were compared.

The somatoplot of talented judoists is the farthest from the judoists studied longitudinally. The difference is due to the fact, that the heavier classes are over-represented in the talented group.

The elite sportsmen (Carter and Heath 1990) of the same events are also displayed in Fig. 6. The settle of the somatoplots indicates the significant differences between the body form of young athletes and their adult peers and help to define the direction of the changes.

Elite adult track and field athletes have a bit mesomorphic figure. The dominance of the mesomorph component is more pronounced in the adult penthatletes than in the young ones. Figure 6 answers our earlier question: reaching the adult physique elite track and field athletes and pentathletes differ form each other.

Olympic judoists have an extreme mesomorphic physique. Young peers fall behind them in muscular dominance and overtake them in the rate of endomorphy. Adult gymnasts are more mesomorphic and a bit slimmer than their young counterparts.

Comparing the somatotypes of young and adult elite sportsmen, young athletes are more slender. Their musculo-skeletal robustness has not been manifested yet and they accumulate more body fat than adults.

The differences between the somatotype of junior and senior athletes are due both to the dissimilar developmental status and to the training history.

Young athletes continue to increase their height and body mass, but they have less body mass in relation to their height. Similarly to normal boys and following from the normal biological development talented young boys increase the rate of their muscle mass in their total body mass till the end of juvenile and discrepancy in the training history.

Talented boys have not yet such an extreme work loading that is characteristic for Olympic athletes.

Summary

1. The difference between the physique of athlete and non-athlete children is in connection with the selection for sport.
2. Athlete children with different events also differ in their somatotype.
3. Along the age athlete children increase their mesomorphy. The pattern of the changes is different for the different disciplines.
4. Performing on different competition level the alterations in mesomorphy are well-detected. The higher the level of performance the more the mesomorph dominance manifests.

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We dedicate our work and this delightful idea to Éva "There is only one real luxury: the relationship of humans".

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