Anthrop. Közl. 30;227–231.(1986)

BODY STRUCTURE, SOMATOTYPE, AND MOTOR FITNESS OF YOUNG BELGIAN BASKETBALL PLAYERS OF DIFFERENT COMPETITIVE LEVELS

A. Claessens, J. Boutmans and *G. Beunen*
Institue of Physical Education, Katholieke Universiteit Leuven, Leuven, Belgium

Abstract: The purpose of this study is to compare bodily characteristics, somatotype and motor fitness of young Belgian basketball players competing at national (N=16) and regional (N=14) level. The mean chronological age of the national and regional groups varied between 15.3 ± 0.6 years and 15.1 ± 0.4 years, respectively. The following anthropometric dimensions were taken: weight, height, reaching height, humerus and femur widths, biceps and calf girths and the triceps, scapula, supra-illiac and calf skinfolds. Somatotype was estimated according to the anthropometric Heath–Carter technique and motor fitness was evaluated by means of the Leuven Motor Ability Test Battery (Renson et al. 1980). Mean values and standard deviations were calculated for all variables. Because a difference for skeletal age was observed between both groups, differences between the variable means were tested by an analysis of co-variance with skeletal age as covariate. When skeletal age was held constant, the results indicate that in the national group significant ($p < 0.05$) higher values were found for weight, height and biceps and calf girths. Although the somatotype analysis revealed that the national group could be described as more endomorphic, more mesomorphic and less ectomorphic in comparison with the regional group, no significant differences between the component means could be observed (mean somatotypes of 2.8–4.1–3.9 and 2.3–3.7–4.5, respectively, were noted). For the motor characteristics the national group performed significantly better for speed of limb movement (test: plate tapping), static strength (test: arm pull), functional strength (test: bent arm hang) and running speed (test: shuttle run 50 m).

Key words: Basketball-players, Somatic development, Motor fitness.

Introduction

The relation between body structure and function has already been stressed in a number of studies. Apart from technical and other factors (e.g. tactical, psychological, physiological), the bodily constitution also plays a determining role in the achievement of top sporting performance. It is also indicated that for different types of physical activities different types of physique are required, and even so, that such bodily characteristics play a major role in the success of the athlete at all levels of competition. Already various researchers have carried out studies on basketball players to investigate the somatic structure, body type and body composition of these sportsmen, most of these studies are dealing with the observation of senior basketball players, competing at Olympic or high national level (e.g. Bláha 1981, Brown el al. 1974, Laska-Mierzejewska 1980, Lewis 1966, Mathur 1982, Muthiah and Sodhi 1980, Novotný 1963, Soares et al. 1986, Sodhi 1980, Vaccaro et al. 1980, Verma et al. 1978, Whiters et al. 1977). Studies on young basketball players are rather scarcely (Chovanová and Zapletalova 1980, Hopkins 1979, Mészáros et al. 1980).

The aim of this study is to test the hypothesis that already at adolescence young basketball players are characterised by typical somatic and motor characteristics which are more pronounced in boys competing at a higher level.

Material and Methods

Subjects

The test groups investigated consisted of 16 and 14 young boys competing at high (= national) and lower (= regional) levels, respectively. The boys of the national group

were selected by the national coach from different regional clubs of Belgium. The boys of the regional group were all players of the basketball club Standard A.Z.H. from the Leuven regio.

For the national and regional groups mean chronological age of 15.3 ± 0.6 and 15.1 ± 0.4 years, respectively, are observed.

Measurements and Tests

To determine the somatic structure the following anthropometric dimensions were taken: weight, height, reaching height, humerus and femur widths, biceps and calf girths, and triceps, scapula, suprailliac and calf skinfolds. All the measurementes were taken according to the recommendations made by Cameron (1978).

Skeletal age was determined according to the Tanner–Whitehouse II method (Tanner et al. 1975).

The three components of the somatotype were anthropometrically determined according to the Heath–Carter technique (Carter 1975).

To evaluate the motor fitness of our testees the Leuven Motor Ability Test Battery (Renson et al. 1980) was administered.

Statistical Analysis

Mean values and standard deviations were calculated for all variables. Because a significant difference for skeletal age was observed between both groups, differences between the variable means were tested by an analysis of co-variance with skeletal age as the covariate (Nie et al. 1975).

Results and Discussion

The means and standard deviations of the somatic characteristics for both groups are given in Table 1. Significant differences (ANCOVA) between the means are also indicated. For all dimensions boys competing at the national level have bigger body dimensions than boys competing at the regional level. Although both groups are of the same chronological age, the national group is however significantly ($p < 0.01$) skeletally more mature than the regional group.

Table 1. Means (M) and standard deviations (SD) of somatic characteristics of young Belgian Basketball Players

Somatic characteristic	National Group (N=16)		Regional group (N=14)		F-ratio (A)
	M	SD	M	SD	
Weight (kg)	69.8	10.1	58.0	8.8	4.757(*)
Height (cm)	181.9	7.2	173.8	8.0	4.244(*)
Reach. height (cm)	234.4	10.0	225.5	10.9	2.505
Humerus width (cm)	7.2	0.3	6.9	0.4	3.342
Femur width (cm)	10.0	0.5	9.7	0.4	1.617
Biceps girth (cm)	29.3	2.5	25.9	2.2	6.863(*)
Calf girth (cm)	36.4	2.0	34.0	2.2	5.775(*)
Triceps skinfold (mm)	9.1	2.8	8.1	1.6	0.068
Suprailiac skinfold (mm)	9.4	4.3	7.9	2.5	0.072
Subscap, skinfold (mm)	9.7	2.9	7.2	1.5	3.544
Calf skinfold (mm)	8.6	2.6	8.5	2.3	0.344
Sum skinfolds (mm) (B)	28.3	8.2	23.2	4.7	0.784

(A) Ancova/skeletal age
(B) Triceps + subscapular + suprailiac skinfolds
(*) $p \leq 0.05$

The mean skeletal ages of both groups are 16.5 ± 1.0 and 15.4 ± 0.8 years,respectively. When this maturity characteristic is held constant the results of the ANCOVA-analysis indicate (cfr. Table 1) that in the national group significant ($p < 0.05$) higher mean values are found for weight, height, and biceps and calf girths. It is thus indicated that not only a higher stature, but also a more muscular body build are clearly an advantage to play basketball at a higher competing level. These results are in full agreement with the findings of Mészáros et al. (1980) who compared 21 talented young basketball players (mean age: 11 years) with children with normal development and average physical activity. Means and standard deviations of the three somatotype components are given in Table 2.

Table 2. Means (M) and standard deviations (SD) of somatotype components and ponderal index of young Belgian Basketball Players

Component	National group (N=16)		Regional group (N=14)		F-ratio (A)
	M	SD	M	SD	
Endomorphy	2.8	0.8	2.3	0.6	0.688
Mesomorphy	4.1	0.8	3.7	0.9	0.320
Ectomorphy	3.9	1.0	4.4	1.0	0.063
Som. pond. index	44.3	1.4	45.0	1.4	0.065

(A) Ancova/skeletal age

The somatotype distribution of both groups are shown in Figure 1. For the national (A) and regional (B) groups somatotype means of 2.8–4.1–3.9 and 2.3–3.7–4.4, respectively, are observed. The somatotypes of 15–16 year old basketball players of the best Czechoslovak teams, investigated by Chovanová and Zapletalova (1980), are situated in the same sector as that of our groups, indicating that young basketball players have, in general, mesomorphic–ectomorphic body types (classification according to Carter, 1975).

Although no significant differences between the component group means are observed, we can state, in general, that the higher competing group (=national) is more endo-mesomorph than the lower competing regional group, as shown in the somatotype distribution (Fig. 1). Analyzing the physique of New Zealand basketball players (estimated according to the method of Parnell, 1958), Lewis (1966) demonstrated also that mesomorphy is a factor in better playing ability as seen in the steady upward shift on the somatochart of players from A grade club teams (= lower level) to national representatives (= higher level).

The means and standard deviations of the motor characteristics for both the national and regional groups are given in Table 3. When skeletal age is held constant the analysis of covariance reveals significant better results for the national group on the following motor test items: plate tapping, arm pull, bent arm hang and shuttle run, indicating that basketball requires athletes with good performance for speed of limb movement, static and functional strength, and running speed.

Using skill tests to identify successful and unsuccessful basketball performers, ranging in age from 12 to 17 years, Hopkins (1979) found that, beside some specific basketball skill (e.g. speed pass, front shot and zig-zag dribble), also other motor performance tests discriminate effectively between both performing groups, namely: zig-zag run, side step, and free jump. Although the 'free jump' is a slightly modified jump and reach test (in the free jump the participants were allowed to move one foot prior to take off), neither

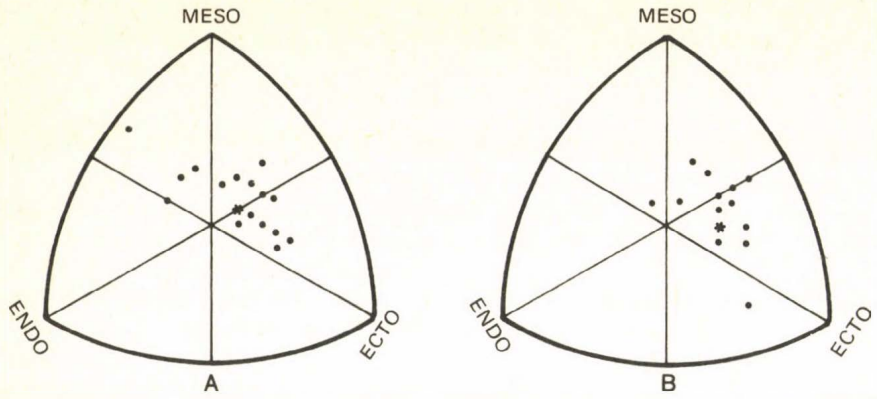

Fig. 1: Somatotype distribution of young Belgian basketball players competing at national (A) and regional (B) levels (N=16 and 14, respectively)

Table 3. Means (M) and standard deviations (SD) of motor characteristics of young Belgian Basketball Players

Motor test item	National Group (N=16)		Regional group (N=14)		F-ratio (A)
	M	SD	M	SD	
Flamingo balan. (N/60 S)	15.4	4.9	14.9	5.1	0.475
Plate tapping (N/20 S)	83.5	10.5	77.8	10.0	6.386(*)
Sit and reach (cm)	24.6	5.5	22.5	4.3	1.349
Vertical fump (cm)	55.2	4.6	47.9	6.9	3.000
Arm Pull (kg)	68.0	9.8	44.2	10.1	27.426(**)
Leg lifts (N/20 S)	16.6	2.7	14.1	1.8	2.898
Bent arm hang (sec)	43.5	16.8	25.5	12.0	7.534(*)
Shuttle run (sec)	18.9	1.0	20.1	0.7	4.719(*)

(A) Ancova/skeletal age
(*) $p \leq 0.05$
(**) $p \leq 0.01$

in Hopkins' study, nor in our investigation the 'classic' vertical jumb could be identified as a test discriminating boys playing basketball at higher and lower levels, respectively.

Compared to our data, Soares et al. (1986) found also a rather moderate 'regional' result on the vertical jump test (mean: 47.95 ± 8.45 cm) measured on 21 Brazilian basketball players (mean age 24.43 ± 3.59 years) selected for the 1983 Pan-American Games.

In conclusion: Although basketball demands especially athletes with higher stature, results of this study reveal that young players whose tall stature is associated with a more robust body build and some specific basic motor characteristics (e.g. speed of limb movement, static and functional strength, running speed) are at advantage in this specific ball game.

References

BLÁHA, P. (1981): Anthropologische Charakteristik tschechoslowakischer und ausländischer Basketballspieler unter Berücksichtigung ihrer Spielpositionen. – Med. u. Sport *21*: 55–57.

BROWN, B. S. – MOORE, G. C. – KIM, C. K. – PHELPS, R. E. (1974): Physiological and hematological changes among basketball players during preseason. – The Research Quarterly *45;* 257–262.
CAMERON, N. (1978): Methods of Auxological Anthropometry. – *in* Faulkner, F. and Tanner, J. M. (eds), *Human Growth, II, Postnatal Growth.* pp. 35–90. Ballière Tindall, London.
CARTER, J. E. L. (1975): *The Heath–Carter Somatotype Method.* – San Diego State University, San Diego, Cal.
CHOVANOVÁ, E. – ZAPLETALOVA, L. (1980): Size, shape and body proportion of young basketball players. – Anthrop. Közl. *24;* 39–44.
HOPKINS, D. R. (1979): Using Skill Tests to Identify Successful and Unsuccessful Basketball Performers. – Research Quarterly *50;* 381–387.
LASKA-MIERZEJEWSKA, T. (1980): Body build as one of the elements of selection and adaptation of competitors in team games. – *in* Ostyn, M. – Beunen, G. – Simons, J. (eds) *Kinanthropometry II.* pp. 214–221. University Park Press, Baltimore.
LEWIS, A. S. (1966): The Physique of New Zealand Basketball Players. – New Zealand Journal of Physical Education *29;* 25–36.
MATHUR, D. N. (1982): Body Composition of Top Ranking Nigerian Basketball Players. – S. A. Journal for Research in Sport, Physical Education and Recreation *5;* 15–19.
MÉSZÁROS, J. – MOHÁCSI, J. – SZMODIS, I. (1980): A four-year study of physique in young basketball players. – Anthrop. Közl. *24;* 153–157.
MUTHIAH, C. M. – SODHI, H. S. (1980): The effect of training on some morphological parameters of top-ranking Indian Basketball players. – Journal of Sports Medicine and Physical Fitness *20;* 405–412.
NIE, N. H. – HULL, C. H. – JENKINS, J. G. – STEINBRENNER, K. – BENT, D. H. (1975): *Statistical Package for the Social Sciences.* – McGraw-Hill, New York.
NOVOTNÝ, V. (1963): Somatometrische Studie bezüglich der tschechoslowakischen Basketball-Spitzenspieler und Spitzenspielerinnen. – *in* Jelinek, J. (ed.) *Akten des Anthropologischen Kongress, Mikulov, 1961.* pp. 191–199. Anthropological Publications Oosterhout N.B., Brno.
PARNELL, R. W. (1958): *Behaviour and Physique. An introduction to practical and Applied Somatometry.* – Greenwood, Westport, Conn.
RENSON, R. – BEUNEN, G. – VAN GERVEN, D. – SIMONS, J. – OSTYN, M. (1980): Description of motor ability tests and anthropometric measurements. – *in:* Ostyn, M. – Simons, J. – Beunen, G. – Renson, R. – Van Gerven, D. (eds), *Somatic and Motor Development of Belgian Secondary Schoolboys. Norms and Standards.* pp. 24–44. Leuven University Press, Leuven.
SOARES, J. – DE CASTRO MENDES, O. – NETO, C. – MATSUDO, V. (1986): Physical Fitness Characteristics of Brazilian National Basketball Team as Related to Game Functions. – *in*: Day, J. A. P. (ed.) *Perspectives in Kinanthropometry* (The 1984 Olympic Scientific Congress Proceedings, Volume 1), pp. 127–133. Human Kinetics Publishers, Champaign, Illinois.
SODHI, H. S. (1980): A Study of morphology and body composition of Indian basketball players. – Journal of Sports Medicine and Physical Fitness *20;* 413–422.
TANNER, J. M. – WHITEHOUSE, R. H. – MARSHALL, W. A. – HEALY, M. J. R. – GOLDSTEIN, H. (1975): *Assessment of Skeletal Maturity and Prediction of Adult Height (TW2 Method).* – Academic Press, London–New York–San Francisco.
VACCARO, P. – WRENN, J. P. – CLARKE, D. H. (1980): Selected aspects of pulmonary function and maximal oxygen uptake of elite college basketball players. – Journal of Sports Medicine and Physical Fitness *20;* 103–108.
VERMA, S. K. – MAHINDROO, S. R. – KANSAL, D. K. (1978): Effect of four weeks of hard physical training on certain physiological and morphological parameters of basket-ball players. – Journal of Sports Medicine and Physical Fitness *18;* 379–384.
WHITERS, R. T. – ROBERTS, R. G. D. – DAVIES, G. J. (1977): The maximum aerobic power, anerobic power and body composition of South Australian male representatives in athletics, basketball, field hockey and soccer. Journal of Sports Medicine and Physical Fitness *17;* 391–400.

Mailing address: Dr. A. L. Claessens
Katholieke Universiteit Leuven
Instituut voor Lichamelijke Opleiding
Tervuursevest 101
B–3030 Leuven (Heverlee)
Belgium