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ANTHROPOMETRIC, PHYSICAL AND MOTOR PERFORMANCE DETERMINANTS OF SPRINTING AND LONG JUMP IN 10-15 YEAR OLD BOYS FROM DISADVANTAGED COMMUNITIES IN SOUTH AFRICA

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ABSTRACT

The most talented subjects (N = 39) were selected from 66 boys by means of a Talent Search testing protocol and then subjected to a sport specific test battery consisting of five anthropometric and 16 physical and motor variables. The results indicated that mean anaerobic power output, acceleration, body mass, reaction time, iliopsoas flexibility, speed endurance, sitting height, age and push-ups contributed to 86.5% of the total variance to performance in the 100 meter sprint. Horizontal jump, age, acceleration and ankle flexibility contributed to 81.5% of the total variance in the performance of the long jump. These anthropometric, physical and motor abilities can enable the coach and Sport Scientist to classify the talent of 10-15 year-old boys for sprinting and long-jumping athletes, and then to develop the potential of the athlete accordingly.

Key words: Talent identification; Sprinting; Long-jump; Prediction of performance; Physical and motor fitness; Kinanthropometry.

INTRODUCTION

The outcome of competitions is often seen to be the best form of talent identification, seeing that the most talented will normally excel in competitions (Peltola, 1992). The possibility of the child from a disadvantaged background participating in competitions is often limited due to a factor such as lack of transport (Burnett & Hollander, 1999). It can therefore cause potential athletes from these communities to not receive the necessary exposure to sports gatherings; and therefore they can become lost for sport. In addition, the poverty-stricken circumstances in disadvantaged communities also further contribute to a lack of sport development. Chappel (2004) points out that communities, especially those in rural areas, are often limited to self-made facilities in that financial resources are needed to address the immediate social crises.

Since development of sport talent takes several years and specialization in sprinting and long-jump can start at ages 14-16 and 17-19 respectively (Bompa, 1999), it is important to already establish at these ages which physical, motor or anthropometric determinants contribute to performance ability in sprinting and long-jump. In so doing, the talented can be identified and exposed to appropriate development programmes. Several studies regarding prediction functions on different sports codes for boys have already been documented. This includes football (Sawyer *et al.,* 2002) soccer (Badenhorst & Pienaar, 2000) and rugby (Carlson *et al.*, 1994; Pienaar *et al.,* 1998; Gabbett, 2002). When it comes to athletics, only one study could be found which was done on 12-18 year-old boys (Headley, 2000) and a few on adult and/or elite athletes (Bowerman & Freeman, 1991; Chelly & Denis, 2001; Bret *et al*., 2002; Kiefer, 2004; Moura & Fernandes De Paula Moura, 2001).

According to the literature (Bowerman & Freeman, 1991; Kiefer, 2004; Moura & Fernandes De Paula Moura, 2001) aerobic, strength and speed endurance, muscle strength, explosive power, maximal speed, flexibility and good running technique are some of the most important motor and physical components which play a role during sprinting and long-jump. From the above-mentioned research it appears that some of the underlying performance related factors for sprinting and long-jump coincide to a large degree, and coaches and athletes normally also assume that a good sprinter will also be a good long-jumper, or in other words that the fastest athlete will also be a good long-jump athlete (Perkins, 2003). This assumption is based on the fact that a long-jump athlete should be capable of reaching optimal speed during the approach phase (Kiefer, 2004) which in turn can indicate good acceleration ability, and simultaneously is also an important component during sprinting. Several anthropometrical components such as body size, structure and composition are also indicated as important determinants of performance in sport. In this regard, it is indicated that athletes with longer leverage, a higher centre of gravity and a relatively low fat percentage will have an advantage in jumping and sprinting items (Boileau & Lohman, 1977; Pate *et al.,* 1989; Harman & Frykman, 1992; Houtkooper & Going, 1994). Biological differences in maturation among boys can also have an influence on performance during the development years (Malina *et al.,* 2004). Clear differences in body composition and muscle mass are indicated in different phases of biological maturation, with implications for better anaerobic strength output in early developers.

The question which needs to be answered through this research is which anthropometric, physical and motor components can predict performance in sprinting and long-jump in boys at ages 10 to 15. Answering this question will not only make available more information concerning important talent identification determinants in sprinting and long-jump at an early age, but it can also enable coaches to design more specific training programmes for developing sprinters and long-jump athletes.

METHOD

Subjects

This study initially included sixty-six boys between ages 10 and 15 from two different farm schools in the Potchefstroom district. All the boys voluntarily participated in the study. The socio-economic status of all the children involved in the study can be regarded as low and equal, since they are mainly children of farm workers in the vicinity or of those living on farms close to the school. Both the parents and their children were informed as to the nature of the project, and the parents of 66 children signed an informed consent form. After all the boys in both schools (N=66) were subjected to a Talent Search testing protocol, the results of the top 60% (n=39) who represented the most talented of the group were selected for further analysis. This study received ethical approval from the North-West University (Number 04M12).

Test procedure

The 39 experimental subjects who were identified by means of the talent identification protocol were subjected to further sport specific tests for sprinting and long-jump. This test battery for sprinting and long-jump was composed after having analysed the demands of the two sports codes from the literature in order to establish which factors play a role in sprinting and long-jump performance (Kruger, 2005). This analysis served as a criterion for the selection of the five anthropometric measurements and 29 physical and motor tests as well as a biological maturation questionnaire. Subsequently a more complete description of these 34 tests and the biological maturity questionnaire will be rendered.

Anthropometric measurements

The measurement protocol, as recommended by the International Work Group on Anthropometric Analyses (IWGK) was used in this study (De Ridder, 1993). Since the group was compiled of 10 to 15 year-old boys, age was used as a variable and the following anthropometric measurements were taken in accordance with the recommended measurement protocol: body mass, stature, sitting height and arm span. Body mass index (BMI) was also calculated for descriptive purposes in accordance with the formula of Heyward and Stolarczyk (1996).

Physical and motor tests

Flexibility**:** The sit and reach test was used to determine the flexibility of the hamstrings as described by Kirby (1991). Iliopsoas, quadriceps and ankle flexibility were determined by means of a goniometer in accordance with the method of Harvey and Mansfield (2000). A smaller value in the iliopsoas and hamstring muscle flexibility indicates better performance whereas a larger value in the quadriceps and ankle values indicate better performance.

Strength**:** Abdominal muscle strength was determined by means of the 7-level abdominal muscle power test (Ellis *et al.,* 2000).

Motor components**: Explosive power** was determined by means of the vertical and horizontal jumps as described by Kirby (1991). The better of two attempts was recorded.

Reaction time was determined by means of a 0-5 m speed test where the participants stand in a crouched position and had to react to the sound of a whistle. Electronic speed lights (Brower timing systems) were used in this test and the better of two attempts was recorded.

A **maximum speed** test was done across 0-40, 0-60, 0-80 and 0-100 meters respectively. Electronic speed lights (Brower timing systems) were used in this test and the better of two attempts was recorded.

Muscle endurance**: Abdominal and upper body muscle endurance** was determined by means of sit-ups, push-ups and pull-ups until exhaustion, as described by Kirby (1991).

Speed endurance was tested with the 120 meter speed endurance test, as prescribed by Dintiman and Ward (2003). A formula was used to determine speed endurance where the flying 40 m time was compared against the 80 m and 120 m times. If the flying 40 m time differs by more than 0.2 seconds from the 80 m-120 m time, endurance is considered poor.

***Anaerobic power*:** Anaerobic power was determined by using the RAST (running-based anaerobic sprint test (Mackenzie, 2004). Power output (force x velocity) for the six sprints (with 10 seconds rest between each sprint) over 35 m was determined by using the following equations.

Velocity = distance/time
Acceleration = velocity/time
Force = weight x acceleration
Power = force x velocity

Calculate the power output for each of the six runs and then also determine:
Maximum power – the highest value
Minimum power – the lowest value
Average power – sum of all six power output values/6
Fatigue index – (maximum power-minimum power)/total time for the six sprints.

***Stride length*:** The stride length of the participants was determined by means of the stride length test, as prescribed by Dintiman and Ward (2003). The better of two attempts was recorded.

***Acceleration*:** Acceleration was determined by using a formula described for this purpose by Dintiman and Ward (2003). To determine acceleration, the flying 40 m time was subtracted from the stationary 40 m time and the difference between the stationary 40 m time and the flying 40 m time was taken as the time delay required to accelerate. A difference of more than 0.7 seconds in these scores is considered to be poor.

***Long-jump*:** The long-jump ability of the participants was determined by means of a long-jump attempted with a 7-stride approach without any prior technical coaching. The better of two attempts was recorded.

Maturity

Biological maturity of the boys was determined by means of a maturity questionnaire based on the Tanner stages for pubic hair and genital development. Based on the studies of Duke *et al.* (1980) and Rickey *et al.* (1988) as well as the recommendations of Docherty (1996) a biological maturity questionnaire, described by Adendorff *et al.* (2004) was used to ascertain biological maturity (BMQ). The maturity status was determined by means of two questions which each of the subjects had to answer. They were requested to choose that line diagram (from the five Tanner stages) which represented their own genital (G1-G5) and pubic hair (PH1-PH5) development best. Thirty (30) of the 39 boys consented to complete the maturity questionnaire.

The five general stages for pubic hair and genital maturation, as described by Tanner (Malina *et al.,* 2004) are described as follows: Stage 1, indicates the pre-pubertal state or the absence of development of each characteristic; stage 2, indicates the early puberty state or the initial, overt development of each characteristic; stages 3 and 4, indicate the mid-puberty state which indicates continued maturation of each characteristic; while stage 5 indicates the adult or mature state for each characteristic.

Statistical analysis

The "Statistica for Windows" computer programme (StatSoft, 2004) as well as SAS (2002-2005) was used to analyse the results. Firstly, descriptive statistics were calculated for the relevant variables of the study for the entire group.

Subsequently the Pearson correlation coefficient method (Thomas & Nelson, 1990) was applied to determine whether some of the variables also evaluate underlying aspects of other components. In this manner the number of variables which should be used in the regression analysis, could be reduced, seeing that the initial number of variables were too many compared to the number of subjects in the study. Too many variables can also influence the validity of the multiple regression which was administered to the data. In this manner the initial 34 variables were reduced to 21.

All possible subset regressions were subsequently administered to the data of the 39 subjects and the 21 remaining variables in order to determine the best possible subset of predictors. The variables which were selected in this manner include five anthropometric variables (age, body mass, stature, body mass index, sitting height) and 16 physical and motor variables, namely hamstring flexibility, iliopsoas flexibility (right), quadriceps flexibility (right), ankle flexibility (right), mean anaerobic power output, exhaustion ratio of anaerobic power, horizontal jump, 7-level abdominal strength, sit-ups and push-ups up until exhaustion, reaction time (0-5 meter speed), 0-100 meter speed, speed endurance, acceleration, stride length (right and left) and long-jump with a 7-stride approach.

A stepwise multiple regression was then administered to the best selected subset of 21 variables for sprinting and long-jump separately. The effect size was subsequently determined according to the method of Cohen (1988) in order to determine the practical significance of the selected variables. An effect size of 0.02 refers to a small practical significance, 0.15 to a moderate practical significance and 0.35 to a large practical significance.

RESULTS AND DISCUSSION

From table 1, which presents the chronological age and the biological maturation status of the group, it appears that the majority of the subjects were in phase 2 of development with regard to genital development as well as pubic hair development. Distinct development tendencies regarding both aspects of maturation was observed in the group of 10 to 15 years of age. The development of the majority of the 10 year-olds was in phase 1, whilst that of one was in phase 2 and that of two in phase 3. With regard to the 11 and 12 year-olds, the majority was in phase 2 of development. Most of the 13 year-olds were in phase 3 of development, whilst the one 14 year-old indicated development phases 2 and 3. The fact that the information of nine boys could not be gathered could have influenced the effect of this factor on the regression analysis. The ages of these nine boys were 10 (3), 12 (2), 13 (2), 14 (1) and 15 (1) years respectively. However, the literature indicates that the largest differences occur between boys in G3 and G4 concerning body mass, whilst most of the subjects in the group were in phases G2 and G3. However, stepwise regression and SAS (2002-2005) were used before the regression analysis to determine whether maturity differences, as indicated in table 1, should be included in the stepwise regression analysis for further analysis for sprinting and long-jump. This analysis indicated that it is not necessary to include maturity in either the stepwise regression or all possible regression which was determined with SAS (2002-2005).

TABLE 1. **STAGES IN GENITAL AND PUBIC HAIR DEVELOPMENT OF 10-15 YEAR-OLD BOYS**

Age	**N**	**Genital development**					**Development of pubic hair**				
		G1	**G2**	**G3**	**G4**	**G5**	**PH1**	**PH2**	**PH3**	**PH4**	**PH5**
10	7	4	1	2			4	1	2		
11	8	1	5	2			2	4	2		
12	3	2	1				1	2			
13	11		4	4	3		1	4	6		
14	1			1				1			
Total	**30**	**7**	**11**	**9**	**3**	**0**	**8**	**12**	**10**	**0**	**0**

Subsequently the descriptive statistics of the variables, which were selected in accordance with the Pearson correlation coefficient method, are reported in table 2.

TABLE 2. **DESCRIPTIVE STATISTICS OF THE ANTHROPOMETRIC, PHYSICAL AND MOTOR COMPONENTS IN 10-15 YEAR-OLD BOYS**

Variable	**N**	$\overline{X}$	**SD**	**Min**	**Max**
Age (years)	39	12.1	1.5	10.0	15.0
BMI	39	16.9	2.0	11.8	21.7
Body mass (kg)	39	34.3	8.3	20.4	56.1
Body stature (cm)	39	141.3	11.0	115.5	161.0
Sitting height (cm)	39	70.9	5.2	60.5	83.5
Hamstring flexibility (^{o})	39	43.1	6.0	22.5	51.5
Iliopsoas flexibility (R) (^{o})	39	0.1	8.0	-12.0	30.0
Quadriceps flexibility (R) (^{o})	39	71.8	10.0	50.0	100.0
Ankle flexibility (R) (^{o})	39	48.2	10.2	21.0	67.0
Average anaerobic power output (Watt)	39	132.0	51.8	59.5	277.8
Exhaustion ratio (Watt/sec)	39	1.5	0.5	3.6	0.76
Horizontal jump (cm)	39	154.2	20.8	127.0	218.0
7-level abdominal power (level)	39	1.4	0.0	1.35	5.0

Sit-ups (number)	39	47.5	19.0	16.0	112.0
Push-ups (number)	39	14.6	7.9	0.0	36.0
0-5 meter speed (sec)	39	1.8	0.2	1.5	2.1
0-100 meter speed (sec)	39	17.3	1.3	14.2	20.1
Speed endurance	39	0.6	0.3	0.2	1.3
Acceleration	39	0.9	0.4	-0.4	1.4
Pace length (R-L) (cm)	39	136.1	21.6	98.0	192.0
Long-jump with 7-pace approach (cm)	39	319.3	35.7	255.0	420.0

N = number of subjects; $\overline{X}$ = mean; SD = standard deviation; max=maximum; min=minimum

A stepwise multiple regression analysis was applied to the variables in table 2 as a next step so that, in so doing, those variables could be determined which probably contributed most to performance ability in the 100 meters and long-jump respectively. The results found in this respect with regard to sprinting are reported in table 3.

TABLE 3. **VARIABLES WHICH CONTRIBUTE TO PERFORMANCE IN 100 METER SPRINTS OF 10-15 YEAR-OLD BOYS**

Step	**Variable**	**R^2**	**Contribution to R^2**	**F – to enter**	**F^2 (effect size)**
1	Average anaerobic power output	0.571	0.571	49.19	1.33*
2	Acceleration	0.693	0.123	14.39	0.40*
3	Body mass	0.767	0.074	11.10	0.32*
4	Reaction time	0.792	0.025	4.00	0.12
5	Iliopsoas flexibility (right)	0.806	0.014	2.45	0.07
6	Speed endurance	0.815	0.009	1.62	0.05
7	Sitting height	0.835	0.019	3.59	0.12
8	Age	0.846	0.011	2.14	0.07
9	Push-ups (maximum)	0.865	0.019	4.08	0.14

Nine variables (as determined with all possible subset regressions) contributed to 86.5% of the total variance of the 100 meters in the stepwise multiple regression analysis. The table shows that mean anaerobic power output, acceleration and body mass displayed statistically significant influences on the 100 meters, as the first 3 steps. As indicated in table 3, mean anaerobic power output alone contributed to 57.1% of the total variance, and this contribution showed large practical significance. As confirmation, literature indicates that anaerobic power and capacity has a high relationship with sprinting and consequently plays an important role in predicting performance in the 100 meters sprint (Neville *et al.,* 1989; Green & Dawson, 1993; Medbo & Tabata, 1993).

Good acceleration also seems to be of importance for a sprinter at 10-15 years of age, seeing that acceleration (which is determined by the flying 40 meters time minus stationary 40 meters time) in the 2nd step of the variance analysis contributed 12.3% to the variance (table 3). The contribution also showed large practical significance. As indicated by the 1st step of the regression analysis in this study, explosive power is an important motor component to perform in the 100m sprint. This is confirmed by Butterfield and Loovis (1994) who indicated that explosive power during the first phase of the sprint contributes to fast acceleration and reaching maximum speed. They established a correlation of r=0.66 between explosive power production in the acceleration phase and running speed**.** In this study of Torin (as quoted by Bowerman & Freeman, 1991) acceleration, along with maximal speed, was considered to be the most important contributor to performance ability in sprints. This contribution was made with average anaerobic power output already in the regression model.

With average anaerobic power output and acceleration already in the regression model, body mass (large practical significance), as a 3rd step, significantly contributed to sprinting performance with 7.4% of the variance. A number of researchers (Boileau & Lohman, 1977; Pate *et al.*, 1989) pointed out that an inverted relation exists between fat mass and performance during physical activity where horizontal transfer of body mass occurs, such as during sprinting items. According to these researchers, excessive fat mass is detrimental to these types of activities, seeing that it makes the body heavier, without additional capacity to generate strength. Due to the fact that acceleration is proportional to strength, but reversed proportional to mass, excessive fat mass at a given level of strength exertion, will lead to slower changes in acceleration. The increase in body mass of boys during puberty can largely be ascribed to an increase in muscle mass during adolescence (Malina *et al.*, 2004). An analysis of the body mass results of this study (not indicated in article) indicate that the heavier the body mass of the boys (10-13 and 14-15 years of age), the faster their time in the 0-100 meters. According tot the BMI (body mass index) of these boys, the increase in body mass can possibly be ascribed to an increase in muscle mass and not to fat mass, seeing that the mean BMI of the children is normal.

As displayed in table 3, reaction time (F^2=0.12), iliopsoas flexibility (right) (F^2=0.07), speed endurance (F^2=0.05), sitting height (F^2=0.12), age (F^2=0.07) and muscle endurance (F^2=0.14) (as determined by push-ups) jointly contributed to a further 9.7% of the total variance. This contribution was made with mean anaerobic power output and acceleration already in the regression model.

Subsequently a multiple regression analysis was performed for long-jump and the results are presented in table 4. Four of the initially selected variables contributed to 81.5% of the total variance of long-jump performance in this analysis (table 4). Three of these four variables, namely horizontal jump, age and acceleration seem to contribute statistically significantly to long-jump performance.

TABLE 4. **VARIABLES WHICH CONTRIBUTE TO THE PERFORMANCE ABILITY OF 10-15 YEAR-OLD BOYS IN LONG-JUMP**

Step	Variable	R^2	Contribution to R^2	F – to enter	F^2 (effect size)
1	Horizontal jump	0.711	0.711	90.87	2.46*
2	Age	0.763	0.053	8.01	0.22*
3	Acceleration	0.806	0.423	7.62	2.18*
4	Ankle flexibility (R)	0.815	0.010	1.82	0.05

The horizontal jump (standing long-jump), as a first step, contributed 71.1% of the variance to long-jump performance with a large practical significance. As confirmation of the result, Kiefer (2004) points out that speed, explosive power and flexibility are the most important motor components which play a role during long-jump. The researcher claims that a good distance in the standing long-jump indicates good explosive leg power which is important for successful participation in long-jump. Manning *et al.* (1988) and Newton and Kraemer (1994) link up with this in that they state that explosive power output is the most important determinant of successful participation in activities which generate a high speed at impact.

Age, with a moderate practical significance, contributed to 5.3% of the total variance of long-jump performance. Age should be an important determinant of success in long-jump at ages 10 to 15, considering that it is the period of pubertal changes accompanied by an increase in muscle strength which is important for long-jump. In this regard, Kiefer (2004) points out that the long-jump athlete must have the ability to reach his/her maximum speed during the approach, and Bompa (2000) adds that a significant improvement in speed takes place during puberty. Furthermore, strength, which goes along with puberty, influences the development of speed positively. The direct result of this strength increase is an improvement in speed, which includes both running speed and movement time (Bompa, 2000). From the results displayed in table 1, which indicate the maturation levels of the subjects, it appears that, on average, the group is in developmental phases 1-3. Research indicates that an increase in mean anaerobic power occurs from the pre-pubertal (10.00-12.08 years) up until post-pubertal (13.75-14.92 years) developmental phases (Malina *et al.,* 2004). It is therefore indicative of the importance of determining the maturation levels of boys if this model is to be applied to 10-15 year-olds. The contribution was made with horizontal jump already in the regression model.

The results in table 4 further point to the fact that acceleration contributed to 4.2% of the total variance with a large practical significance (F^2=2.18). A critical element of the approach is good running technique, which begins with gradual acceleration (Bowerman & Freeman, 1991), where the ideal is that acceleration should take place from the beginning to the end of the approach. Acceleration is, among others, determined by two different factors, namely an increase in stride length and stride frequency. Any factors which would lead to decreasing stride length, resulting in a decrease in speed; can contribute to a poor jump. An approach at optimal stride length is therefore an important factor during long-jump, according to Jacoby and Fraley (1995). Fast acceleration also contributes to reaching maximal speed faster, which is an important factor during the approach. The contribution was made with the horizontal jump and age already in the regression model.

The results in table 4 point to the fact that ankle flexibility, with a small practical significance (F^2=0.05), as a fourth and final step, after horizontal jump, age and acceleration already in the regression model, contributed 1.0% to long-jump performance between ages 10 and 15 years.

CONCLUSION

This study on a group of 10-15 year-old black boys has shown that variables with regard to certain anthropometric, physical and motor components do indeed exist which can be used in determining successful participation in sprinting and long-jump.

From this study, it appears that means anaerobic power output, acceleration, body mass, reaction time to a large degree, and iliopsoas flexibility, speed endurance, sitting height, age and muscle endurance to a lesser degree, are those components which are the best predictors of performance in sprints. Regarding long-jump, standing long-jump, age and acceleration, and to a lesser degree ankle flexibility was indicated as the best predictors of performance. Body mass and sitting height are the only anthropometric variables which were indicated as performance predictors and which had an influence on sprinting performance.

Among the few prediction functions for athletes which could be found in the literature (Bowerman & Freeman, 1991; Chelly & Denis, 2001; Bret *et al.,* 2002) anthropometric measurements and age were not used as variables. The ages of the athletes which were used in the above-mentioned literature also fluctuated between 15 years to athletes who compete at international level, and this studies only focused on motor and physical components. Anthropometric measurements were only included in the study of Headley (2000) on 12-18 year-old track and field athletes. The results of this study differ from the results of Headley (2000) in that bi-acromial width, frontal thigh circumference and leg length was identified as anthropometric variables in the study of Headley (2000), compared to body mass and sitting height which was indicated as performance predictors in this study. With regard to the motor and physical components, the results of this study largely coincide with the prediction function of Dick (as quoted by Bowerman & Freeman, 1991) who found that maximal speed, acceleration, reaction time, speed endurance and general endurance are the most important determinants of successful participation in sprints.

Concerning long-jump, Kiefer (2004) points out that maximal speed, power and flexibility are important contributors to success in long-jump. The results of this study found that explosive power, age, acceleration and flexibility (in order of importance) are the most important determinants of performance for long-jump in 10-15 year-old boys. The fact that age was included in both the prediction functions probably links up with strength differences which accompany pubertal changes, which can influence sprinting and long-jump performance between ages 10 and 15.

When evaluating the generalisation possibilities of the results of the study, one must not lose sight of the fact that it was developed from the data of a group of athletes from disadvantaged communities who do not have the infrastructure and equipment necessary for developing their potential. However, the advantage is that the abilities of this group have not yet been developed and that their natural talent was investigated during the analyses. It can bring about that other variables can make a bigger contribution to performance if similar studies are done on other children who live in better conditions and who have already been exposed to athletic development.

Therefore it is recommended that similar follow-up studies be done in order to determine the practical value of the factors essential for performance in sprinting and long-jump. More subjects can be involved in similar studies to be able to make more general conclusions and these talent identifying determinants can be tested on new groups of potential athletes. A further recommendation which arises from this is that variation in age needs to be limited to a minimum and only one age group should be involved in such an analysis, seeing that maturation can indeed influence performance determinants. Although this study indicated that maturation did not have a substantial influence on the group, nine of the boys refrained from filling out the maturity questionnaire, and the inclusion of age in both models indicates that puberty will most probably indirectly have an influence.

The results of this study indicate that boys between ages 10 and 15 can be tested on TID models similar to those of adult athletes regarding the motor and physical characteristics important for performance in sprinting and long-jump, since the basic variables largely coincide. Because of the dynamic nature of motor abilities which can be influenced by age and experience, it is necessary to test the specific prediction functions as determined in this study on other populations as well as other age groups, in order to determine if this prediction function can be used on boys from urban areas as well as on other age groups. These models compiled in this study can enable the coach and Sport Scientist to identify children who display talent for sprinting and long-jump based on selected anthropometric, physical and motor components and then develops the ability of the athlete accordingly.

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