SPORT SPECIFIC TALENT IDENTIFICATION DETERMINANTS AND DEVELOPMENT OF SPRINTING AND LONG JUMPING ABILITY AMONG 10-15 YEAR OLD CHILDREN FROM UNDERPRIVILEGED COMMUNITIES

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Thesis submitted for the degree Doctor in Philosophy in Human Movement Science at the North-West University

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July 2006
Potchefstroom Campus

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NORTH-WEST UNIVERSITY
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DECLARATION

The co-authors of the articles which form part of this thesis, hereby give permission that the candidate, may include these articles as part of a thesis. The contribution (advisory and supportive) of these co-authors was kept within reasonable limits, thereby enabling the candidate to submit this thesis for examination purposes. This thesis, therefore, serves as partial fulfillment of the requirements for the Ph.D. degree in Sport Science within the School of Biokinetics, Recreation and Sport Science in the Faculty of Health Sciences at the North-West University.

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Qualification:

M.Sc-degree

Title of thesis:

Sport specific talent identification determinants and development of sprinting and long jumping ability among 10-15 year old children from underprivileged communities

Signature of promoter: ____________

Date: 11/12/06

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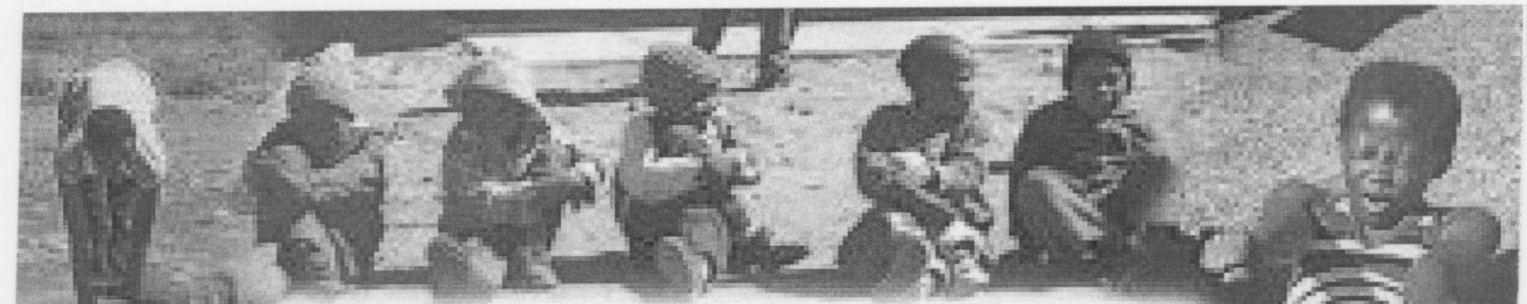
Date: ____________



Foreword

I would like to thank the following persons:

- My promoter, Prof. Anita Pienaar for all her guidance, support, motivation and time spent on this study, without "Dok" it wouldn't have been possible to complete this thesis successfully.
- My assistant promoter, Prof. Dawie Malan for his scientific input during this study.
- Prof. Faans Steyn for assistance with the statistical analysis of the data.
- Mrs. C. van der Walt for the language editing of the thesis.
- The National Research Foundation for financial support.
- My family and friends for their support during the study period.

OPSOMMING

Met die oog op transformasie het die African National Congress (ANC) reeds in 1994 die ontwikkeling van die voorheen benadeelde gemeenskappe in Suid-Afrika as 'n nasionale prioriteit geïdentifiseer. Sodoende is sport onder andere in die strategie gebruik as 'n medium om die omstandighede van mense in agtergeblewe gemeenskappe te probeer verbeter en te verander. Sportontwikkeling in agtergeblewe gemeenskappe is noodsaaklik as in ag geneem word dat, sonder sodanige verdere ondersteuning van hierdie kinders se sporttalent, daar nie in die behoeftes van talentvolle kinders voorsien kan word nie en sal hul potensiaal onontwikkel bly. Talentidentifisering (TID) wat op wetenskaplike beginsels geskoei is, en die eerste stap in sportontwikkeling vorm, is nog relatief nuut in Suid-Afrika. In die verlede het afrigters van eie kennis en ervaring van die eienskappe wat tot sukses in sport behoort te lei en deelname aan kompetisie gebruik gemaak om TID te doen. Tot op hede bestaan daar nog min navorsing oor talentidentifisering (TID) en –ontwikkeling in naellope en verspring, veral sover dit jong seuns en dogters atlete aangaan en veral wat betref atlete uit agtergeblewe gemeenskappe.

Die eerste en tweede doelstellings van hierdie studie was om sportspesifieke atletiekontwikkelingsprogramme te implementeer wat op die verbetering van naelloop- en verspringvermoë gerig is en die effek daarvan op die vermoëns en vaardighede van talentvolle 10- tot 15-jarige dogters en seuns met talent vir naellope en verspring te bepaal. Die derde en vierde doel van hierdie studie was om te bepaal watter kinantropometriese, fisieke en motoriese komponente op 10- tot 15-jarige ouderdom sodanige rol sal speel dat dit prestasievermoë in naellope en verspring by dogters en seuns op hierdie ouderdom kan voorspel.

Die "Australian Talent Search" protokol is gebruik om algemene sporttalent by die geïdentifiseerde kinders (66 dogters en 62 seuns) vir die studie te identifiseer. Die talentvolle kinders uit hierdie aanvanklike groep (19 dogters en 21 seuns) is verder aan 'n sportspesifieke toetsbattery onderwerp vir naellope en verspring. Die seuns se rypingsvlak is bepaal met behulp van 'n rypingsvraelys gebasseer op die 5 Tanner stadia.

Daar is met behulp van die Statistica en SAS rekenaaarprogramme onderskeidelik van onafhanklike t-toetsings, kovariansie analises, korrelasiekoëffisiënte, effekgroottes, beskrywende statistiek sowel as 'n stapsgewyse meervoudige regressie analise gebruik gemaak om die data met betrekking tot die bogenoemde doelwitte te ontleed. 'n P-waarde kleiner as of gelyk aan 0.05 is as betekenisvol aanvaar.

Uit die resultate van die studie het dit geblyk dat die ontwikkelingsprogramme bygedra het tot die verbetering van fisieke en motoriese vermoëns en vaardighede wat belangrik is vir prestasie in beide naellope en verspring. Soepelheid, eksplosiewe krag, spieruithouvermoë, reaksietyd, spoed, spoeduithouvermoë, versnelling en verspring het 'n statisties betekenisvolle verbetering by die dogters getoon, terwyl abdominale spierkrag en paslengte geen verbetering by hulle getoon het nie. Wat die seuns betref, is gevind dat die ontwikkelingsprogram statisties betekenisvol bygedra het tot 'n verbetering in soepelheid, spieruithouvermoë, 0-40 meter spoed en verspringvermoë. Daar was egter ook komponente wat nie 'n verbetering getoon het nie naamlik eksplosiewe krag, reaksietyd, spoeduithouvermoë, versnelling en paslengte.

'n Stapsgewyse meervoudige regressie analise is gebruik om die derde en vierde doelstellings te ontleed. Dit het met betrekking tot die 100 meter naelloop getoon dat 7 veranderlikes (verspring met 'n 7-pas aanloop, opstote tot en met uitputting, 7-vlak maagkrag, 0-5 meter spoed, enkeldorsifleksie, liggaamslengte, ouderdom) 'n 84.0% bydra tot die totale variansie by dogters lewer. Met betrekking tot verspring is ook 7 veranderlikes naamlik 0-100 meter spoed, liggaamlengte, 7-vlak maagkrag, opstote, enkeldorsifleksie, staande verspring en liggaamsmassa as die belangrikste bydraers tot prestasie in dié item uitgewys met 'n totale bydra van 79% tot die totale variansie. Ontleding van die vierde doelstelling het by seuns aangetoon dat gemiddelde anaërobiese kraguitset, versnelling en liggaamsmassa 'n statisties betekenisvolle bydra tot prestasie in die 100 meter naelloop lewer met 'n bydra van 86.5% tot die totale variasie. Horisontale sprong, ouderdom en versnelling het 'n statisties betekenisvolle bydrae tot verspringprestasie gelewer met 'n bydra van 81.5% tot die totale variasie.

Uit die studie is dit duidelik dat sportspesifieke ontwikkelingsprogramme suksesvol op die ouderdom van 10-15 jaar by seuns en dogters geïmplimenteer kan word ter verbetering van naelloop en verspringvermoë, ten spyte van armoedige omstandighede en infrastruktuur. Die studie het ook aan die lig gebring dat daar spesifieke kinantropometriese, fisieke en motoriese vermoëns is wat gebruik kan word om prestasie in naellope en verspring by dogters en seuns afsonderlik op die ouderdom van 10 tot 15 jaar te voorspel.

Sleutelwoorde: athletic, performance, speed, sprint, long jump, motor development, talent identification, prediction of performance, physical and motor fitness, kinanthropometry

Summary

As early as 1994, and with transformation in mind, the African National Congress (ANC) identified the development of the previously disadvantaged communities in South Africa as a national priority. In so doing, sport, among others, was used in this strategy as a medium to improve and change the circumstances of people in disadvantaged communities. Sports development in disadvantaged communities is essential, if taken into consideration that without such further support of the sport talent of some of these children, the needs of these talented children cannot be met and their potential will remain undeveloped. Talent identification (TID), which is based on scientific principles and forms the first step in sports development, still is relatively new in South Africa. Historically, coaches used their own knowledge and experience of the characteristics, which should lead to success in sport as well as participation in competitions in order to do TID. To date, very little research has been done on talent identification and development in sprints and long-jump, especially pertaining to young boy and girl athletes, and in particular concerning athletes from disadvantaged communities.

The first and second objectives of this study were to implement sport specific athletics development programmes aimed at improving sprinting and long-jump ability and to determine its effect on the abilities and skills of talented 10 to 15 year-old girls and boys with talent for sprints and long-jump. The third and fourth objectives of this study were to establish which kinanthropometric, physical and motor components will play such a role in 10 to 15 year-olds that it can predict performance ability in sprints and long-jump in girls and boys at this age.

The "Australian Talent Search" protocol was used to identify general sport talent in the children (66 girls and 62 boys) who were identified for the study. The talented children (19 girls and 21 boys) from the initial group of were then subjected to a sport specific test battery for sprints and long-jump. The maturation level of the boys was determined by means of a maturity questionnaire, based on the 5 Tanner stages.

By using the Statistica and SAS computer programmes, independent t-testing, covariance analyses, correlation coefficients, effect sizes, descriptive statistics as well as a stepwise multiple regression analysis were used to analyze the data with regard to the above-mentioned objectives. A p-value smaller than or equal to 0.05 was accepted as significant.

From the results of the study it is evident that the development programmes contributed to the improvement of physical and motor abilities and skills important for performance in both sprints and long-jump in girls (n=19) and boys (n=21) respectively. Among the girls, flexibility, explosive power, muscle endurance, reaction time, speed, speed endurance, acceleration and long-jump showed statistically significant improvement, while abdominal muscle strength and stride length showed no improvement. Secondly, it was established that the development programme contributed statistically significantly to an improvement in flexibility, muscle endurance, 0-40 metres speed and long-jump ability in boys. However, some components did not show improvement, among them explosive power, reaction time, speed endurance, acceleration and stride length.

A stepwise multiple regression analysis was used to analyze the third and fourth objectives. It indicated that, in respect to the 100 metres sprint, 7 variables, namely long-jump, push-ups to the point of exhaustion, 7-level abdominal strength, 0-5 metres speed, ankle dorsiflexion, body length and age contributed 84.0% to the total variance in girls. As for long-jump, 7 variables, namely 0-100 metres speed, body length, 7-level abdominal strength, push-ups, ankle dorsiflexion, standing long-jump and body mass proved to be the most important contributors to performance in these items with a total contribution of 79% to the total variance. The fourth objective indicated that average anaerobic power output, acceleration and body mass contributed statistically significantly to performance in the 100 metres sprint in boys with a contribution of 86.5% to the total variance. Horizontal jump, age and acceleration contributed statistically significantly to long-jump performance with a contribution of 81.5% to the total variance.

It is evident from this study that sport specific development programmes can successfully be implemented on girls and boys at ages 10-15 in order to improve sprinting and long-jump ability, regardless of poverty-stricken circumstances and poor infrastructure. Furthermore, the study brought to light that specific kinanthropometric, physical and motor abilities exist which can be used to predict performance in sprints and long-jump in girls and boys separately at ages 10 to 15.

Key words: athletic, performance, speed, sprint, long-jump, motor development, talent identification, prediction of performance, physical and motor fitness, kinanthropometry

Index

Index (cont.)

Index (cont.)

Index (Cont.)

List of Tables

Chapter 3

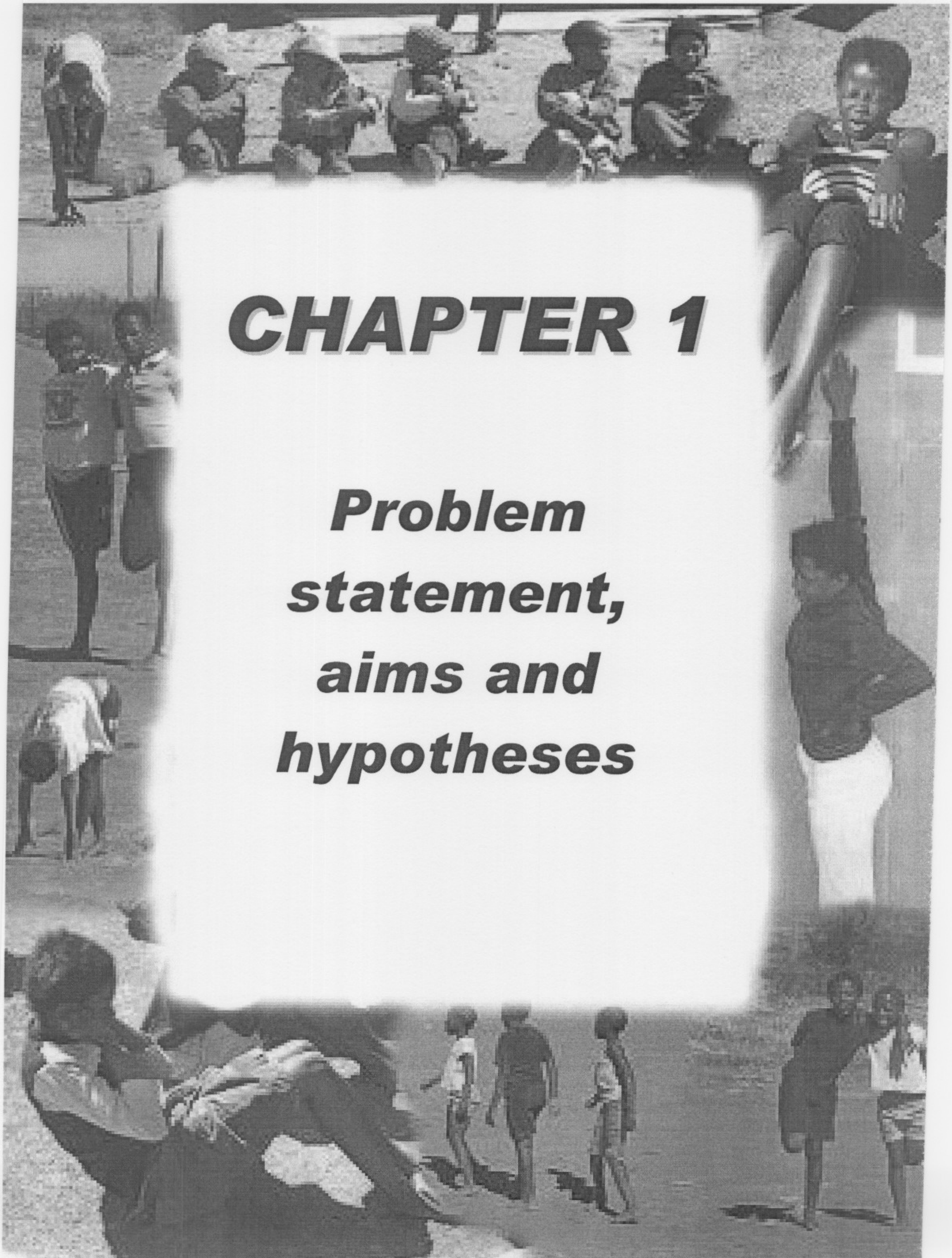
Chapter 4

Chapter 5

Chapter 6

List of Figures

Chapter 3



CHAPTER 1

Problem statement, aims and hypotheses

1.1 Introduction

Sport plays an integral role in the modern society and is a cultural phenomenon for all people, irrespective of race, religion, geographic location or politics (Headley, 1993:1). The combination of the South African (SA) climate, geography and multi-cultural population composition places the people of the country in a favourable position to participate in sports (Van der Merwe, 1997:8). The most important role it plays in South Africa is clearly seen when its prominence in newspapers and on television programmes is taken into consideration. The importance of performance for the South African population on the sports field is also obvious, taking into account that South Africa won the Rugby World Cup in 1995 and the Africa Soccer Trophy in 1996.

Following transformation by the African National Congress (ANC), which has taken place in a variety of areas since 1994, human and resource development of the previously disadvantaged communities has been identified as a national priority. The Reconstruction and Development programme (RDP) identified the provision of sport and recreation for those who were previously disadvantaged as an important component in the development strategy of the country as a whole (Burnett & Hollander, 1999:237). Sport was prioritised, and placed on the political agenda to improve the national esteem of the country. However, sport consists of more than just elite sportsmen and -women who perform at national and international level. The poverty-stricken circumstances in most rural areas are not taken into consideration during elite competitions and the challenge consequently lies in improving and changing the conditions of the people in disadvantaged rural areas through participation in sport (Boshoff, 1997:70) by, among others, creating coaching opportunities and also developing role models (sport performers).

Physical activity, exercise and sport have a positive influence on several aspects of the child's development. When children participate in sport at an organized level, it contributes to the development of life skills within the sport environment, namely problem-solving, decision-making and analytic behaviour (Danish & Nellen, 1997:108). Sport gives local leaders the opportunity to associate with their co-leaders in interaction.

It also gives the opportunity to bring the rural community together and gives community development programmes a basis on which to educate the community with regard to other matters with personal and professional growth in mind (Massey, 2003:14).

During the years of childhood and adolescence, a positive experience of sport is extremely important; not only to become involved in sport and possibly develop into an elite athlete, but also to participate in physical activities as an adult, which will contribute to health. Boreham and Riddoch (2001:916) point out that there are three important advantages to participation in physical activity during the years of childhood, namely a direct improvement in the health status, an improved health status during adulthood as a result of a biological transfer effect and a tendency of active children to become active adults. Apart from the health advantages exercise holds, participation in school sports is further associated with a feeling of physical well-being and involvement in the school, which both in turn trigger an improved self-esteem among children (Tracy & Erkut, 2002:446). Furthermore, participation in sport also gives youth the opportunity to improve their attitude with regard to team sport, fair play and their feeling of "belonging" (Massey, 2003:14).

1.2 Problem Statement

St-Aubin and Sidney (1996:9) indicated that 22% to 37% of children between ages 13 and 15, who participate in sport, are lost for sport. It can possibly be ascribed to the fact that they loose interest because they do not participate in the "right" sport. This dropout figure during early adolescence causes many potential athletes to be lost for sport, and this consequently leads to the quality of the national sports teams being affected.

The identification of most talented athletes to become involved in an organized exercise programme is one of the most important aspects of sport participation (Bompa 1999:273). If children could be channelled to activities which they enjoy and in which they have the abilities and skills, it would increase the possibility of them being successful (St-Aubin & Sidney, 1996:9). Scientific methods aimed at identifying sport talent can therefore contribute to developing this talent. Several studies regarding talent identification in different sports were found in the literature (Hoare, 1995; Pienaar &

Spamer, 1995; Pienaar *et al.,* 1998; Williams & Franks, 1998; Headley, 2000; Morris, 2000; Reilly *et al.,* 2000; Williams & Reilly, 2000; Williams, 2000; Grice 2003). However, Abbot and Collins (2002:157) state in this regard that the moment talented individuals are identified; limited support resources have to be optimally utilized to further refine and develop this talent. Although a development programme is determined by the sports code, it is, according to the "Australian Talent Search Model", the most important element of the talent exploitation process (Australian Sports Commission, 1995). Without such further support for their sport talent, the needs of talented children cannot be fulfilled and their potential will remain undeveloped.

As is evident from the above-mentioned statement, the development of the sport talent of talented children is an extremely important step in the sport development process. However, only a small number of studies could be traced regarding sport development in South Africa (Boshoff, 1997; Hargreaves, 1997; Van der Merwe, 1997; Burnett & Hollander, 1999; Burnett & Uys, 2000). From this, the importance of research regarding the development of identified children who display sport talent becomes very clear.

The recommendations of Du Randt and Headly (1993) in their study on talent identification and development in SA indicates, among others, that:

- models for talent identification and development for selected sports should be developed and implemented on a small scale;
- sport management bodies should be encouraged to give special attention to sport programmes for the youth with the direct aim to expose as many children as possible to sport and to create the necessary opportunities and support for those which will develop their talent in sport; and
- according to researchers, further research is also necessary to solve critical problems concerning sport talent identification and development, as well as research on the scientific support necessary to develop identified talented athletes to their full potential.

Athletics items link up with the movement possibilities of the child, seeing that it is natural in young children to move in a hopping and jumping manner (Botha & De Villiers, 1979:13). Athletics therefore is a sport with a strong natural element, because it entails the basic movements of running, skipping and throwing — actions a child performs spontaneously while moving (Botha & De Villiers, 1979:1). Botha and De Villiers (1979:75) contend that the emphasis constantly is on speed during sprinting and the body needs to be "taught" to take off, build up speed and to maintain the pace to the end. During long-jump the accent is on the horizontal distance an athlete can reach. Optimal speed during the approach and an explosive take-off therefore are two important aspects necessary for the long-jump, according to these researchers. Seeing that this study will focus on the improvement of sprinting and long-jump ability among 10 to 15 year-old boys and girls, it is important to determine what influence the structured exercise programme will have on the improvement of these abilities.

The research questions that therefore need to be answered through this study is whether identified sport talent in athletics among 10 to 15 year-old girls and boys in disadvantaged communities can be developed by means of sport specific development programmes and which kinanthropometric, physical and motor components will play such a role at the age of 10 to 15 years that it can predict performance ability in sprinting and long-jump among girls and boys.

Answers to the questions mentioned above can contribute to the possibilities of using a sport specific development programme for developing young sport talent in disadvantaged communities and can make available more knowledge regarding important talent identification determinants in sprinting and long-jump at an early age among girls and boys. The information regarding sport specific development programmes can further enable coaches, sport scientists and others involved in the development of young talent to be able to develop the talented child in accordance with his/her potential and according to the skill requirements that are set for young athletes. If such sport development programmes can be developed, volunteers can present it to potentially talented children in disadvantaged communities, and in this way, children who would otherwise not have been exposed to sport, can be developed. It can therefore contribute to potential talent not being lost.

1.3 Aims

The aims of this study are:

1.3.1 To implement a sport specific athletics development programme which is directed at improving sprinting and long-jump abilities and determining its effect on the abilities and skills of talented 10 to 15 year-old girls with a talent for sprinting and long-jump;

1.3.2 To implement a sport specific athletics development programme which is directed at improving sprinting and long-jump abilities and determining its effect on the abilities and skills of talented 10 to 15 year-old boys with a talent for sprinting and long-jump;

1.3.3 To establish which kinanthropometric, physical and motor components play such a role in 10 to 15 year-olds that it can predict performance ability in sprinting and long-jump among girls at this age;

1.3.4 To establish which kinanthropometric, physical and motor components play such a role in 10 to 15 year-olds that it can predict performance ability in sprinting and long-jump among boys at this age.

1.4 Hypotheses

This study is founded on the following hypotheses:

1.4.1 A sport specific athletics development programme, based on improving sprinting and long-jump ability, will lead to the improvement of these abilities and skills among 10 to 15 year-old talented girl sprinters and long-jumpers.

1.4.2 A sport specific athletics development programme, based on improving sprinting and long-jump ability, will lead to the improvement of these abilities and skills among 10 to 15 year-old talented boy sprinters and long-jumpers.

1.4.3 Performance in sprinting and long-jump among girls can be predicted at ages 10 to 15 by means of specific kinanthropometric, physical and motor components.

1.4.4 Performance in sprinting and long-jump among boys can be predicted at ages 10 to 15 by means of specific kinanthropometric, physical and motor components.

1.5 Structure of the thesis

This thesis is presented in article format. The structure of the thesis is as follows:

1.5.1 Chapter 1 contains the problem statement, aims, hypotheses and structure of the study. The bibliography is submitted according to the guidelines of the North-West University (Harvard style).

1.5.2 Chapter 2 offers a literature review on the identification and development of motor abilities for the improvement of sport talent. The bibliography is submitted according to the guidelines of the North-West University (Harvard style).

1.5.3 The method of research is set out as part of Chapters 3, 4, 5 and 6, which contain the 4 articles regarding the aims of the study. For technical reasons, the articles are presented in the same format as the rest of the thesis. Thus, all the chapters of the thesis will also have the same margins, line spacing, character size and spacing. The tables will be included in the articles and will not be at the end of each article as required in the guidelines.

Chapter 3: Talent identification and development of sprinting and long-jump ability among 10-15 year-old girls from disadvantaged communities
This article was prepared according to the guidelines of the International SportMed Journal (see Appendix A).

Chapter 4: The effect of a sport development programme on sprinting and long-jump ability among 10 to 15 year-old boys from disadvantaged communities.
This article was prepared according to the guidelines of the Journal of Sports Medicine and Physical Fitness (see Appendix B).

Chapter 5: Talent identification determinants for sprinting and long-jump for 10 to 15 year-old girls from disadvantaged communities.
This article was prepared according to the guidelines of the International SportMed Journal (see Appendix A).

Chapter 6: Talent identification determinants for sprinting and long-jump for 10 to 15 year-old boys from disadvantaged communities.
This article was prepared according to the guidelines of the Journal of Sports Medicine and Physical Fitness (see Appendix B).

1.5.4 Chapter 7 contains the summary, conclusions and recommendations of the study.

1.5.5 Appendixes follow at the end of the thesis, which include the following.

Appendix A: Guidelines for authors for the International SportMed Journal.

Appendix B: Guidelines for authors for the Journal of Sports Medicine and Physical Fitness.

Appendix C: Informed consent form that had to be signed by the parents.

Appendix D: Sport development programme that the children were subjected to.

Appendix E: Letter stating that article 1 is provisionally accepted for publication and 3 is in the review process of the International SportMed journal (Chapter 3 and 5).

Appendix F: Letter stating that article 2 and 4 (Chapter 4 & 6) is in the review process of the Journal of Sports Medicine and Physical Fitness.

The literature review of the study will subsequently follow in Chapter 2.

1.6 References

ABBOTT, A. & COLLINS, D. 2002. A theoretical and empirical analysis of a 'state of the art' talent identification model. High ability studies, 13(2):157-178.

AUSTRALIAN SPORTS COMMISSION. 1995. School teacher manual. Australia : Paragon Printers. 34p.

BOMPA, T.O. 1999. Periodization, theory and methodology of training. 4th ed. Champaign IL. : Human Kinetics Publishers. 413 p.

BOREHAM, C. & RIDDOCH, C. 2001. The physical activity, fitness and health of children. *Journal of sports sciences*, 19:915-929, Jul.

BOSHOFF, G.B.E. 1997. "Barefoot" sports administrators: laying the foundation for sports development in South Africa. *Journal of sport management,* 11(1):69-79, Jan.

BOTHA, H. & DE VILLIERS, C. 1979. Atletiekpret vir die jongspan. Ficksburg : Ficksburgpers. 180 p.

BURNETT, C. & HOLLANDER, W. 1999. Sport development and the United Kingdom-South Africa Sports Initiative: A preevaluation report. *Journal of sport management,* 13:237-251.

BURNETT, C. & UYS, T. 2000. Sport development impact assessment: towards a rationale and tool. *S.A. journal for research in sport, physical education and recreation,* 22(1):27-40.

DANISH, S.J. & NELLEN, V.C. 1997. New roles for sport psychologists: teaching life skills through sport to at-risk youth. *QUEST*, 49:100-113.

DU RANDT, R. & HEADLY, N. 1993. Selected capitalist countries. (*In* Du Randt, R., *ed.* Sports talent identification and development – a situational analysis. Port Elizabeth : University of Port Elizabeth. p. 167-297.)

GRICE, T. 2003. The development of KidTest 2002 update: a talent identification inventory for predicting success in sports for children. *Applied research in coaching and athletics annual*, p. 229-247.

HARGREAVES, A. 1990. Skills and strategies for coaching soccer. USA : Leisure Press. 365 p.

HEADLY, N. 1993. Sports talent identification and development – a situational analysis. Port Elizabeth : University of Port Elizabeth. (Thesis – M.A.) 321p.

HEADLEY, N. 2000. Indicators of potential performance in track and field athletics. Port Elizabeth : University of Port Elizabeth (Thesis – Ph.D.) 735p.

HOARE, D. 1995. Talent search: the national talent identification and development program. *Sports coach*, 24-25, Spring.

MASSEY, J. 2003. Youth football brings rural communities together. *Parks and recreation*, 14, Jul.

MORRIS, T. 2000. Psychological characteristics and talent identification in soccer. *Journal of sports sciences*, 18:715-726, Apr.

PIENAAR, A.E., SPAMER, M.J. & STEYN, H.J. 1998. Identifying and developing rugby talent among 10-year-old boys: A practical model. *Journal of sport sciences*, 16:691-699. Aug.

PIENAAR, A.E. & SPAMER, E.J. 1995. A scientific approach toward identifying and developing of rugby talent among ten year old boys. (Proceedings of the 1995 AIESED word Congress, 26-30 June, Wingate: Israel. p. 283-291.)

REILLY, T., BANGSBO, J. & FRANKS, A. 2000. Anthropometric and physiological predispositions for elite soccer. *Journal of sport sciences*, 18(9):669-683, Sep.

ST-AUBIN, M.A. & SIDNEY, K. 1996. A rationale for talent detection in youth sports. *Cahperd : Journal de l'acsepld*. Spring. 12p.

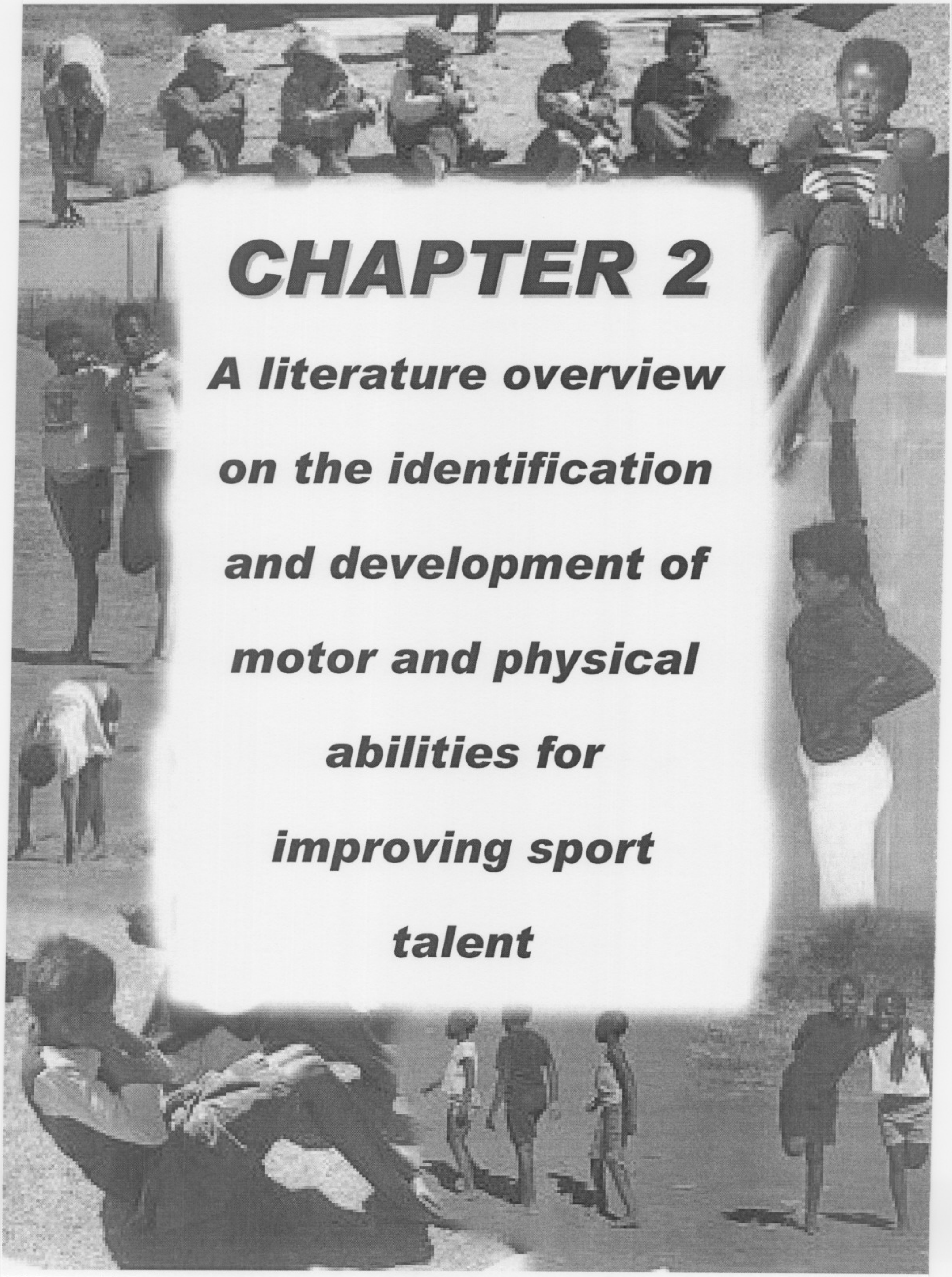
TRACY, A.J. & ERKUT, S. 2002. Gender and race patterns in the pathways from sports participation to self-esteem. *Sociological perspectives*, 45(4):445-466.

VAN DER MERWE, C.A. 1997. Talentidentifisering en –ontwikkeling in rugby by 11-jarige swart seuns/ Talentidentification and development in rugby among 11-year-old black boys. Potchefstroom : PU for CHE (Thesis – Ph.D.) 207p.

WILLIAMS, A.M. 2000. Perceptual skill in soccer: Implications for talent identification and development. *Journal of sports sciences*, 18:737-750, Apr.

WILLIAMS, A.M. & FRANKS, A. 1998. Talent identification in soccer. *Sports exercise and injury*, 4(4):159-165, Nov.

WILLIAMS, A.M. & REILLY, T. 2000. Editorial: searching for the stars. *Journal of sports sciences*, 18(9):655-656, Sept.



CHAPTER 2

A literature overview on the identification and development of motor and physical abilities for improving sport talent

A literature overview on the identification and development of motor and physical abilities for improving sport talent

Contents

2.1 Introduction

Worldwide, sport plays an integral role in modern society and forms part of each person's existence, regardless of race, gender or culture (Headly, 1993:1). The most important role sport plays in South Africa is illustrated by the exceptional coverage it receives in the media (Van der Merwe, 1997:1).

This important role sport plays in modern society and also the fact that children become involved in sports programmes at an ever-younger age contributes to different selection procedures and tests being developed to identify potential talent (Mero *et al.*, 1990:57). This process is generally known as talent identification (TID). Bompa (1999:273) points out that identifying the most talented athletes to become involved in an organized training programme is one of the most important aspects of participation in sports. Since it requires many years of general training to achieve success in most sporting codes, it is important for athletes to start participating in sport long before the age at which generally is accepted that top performance should be reached (Woodman, 1986:49). Identifying talent early can consequently lead to improving performance in sport. In this respect, Woodman (1986:49) indicated that if technique could be trained at an early stage, young athletes would be capable of maintaining a high standard the moment they start participating in competitions. If children can also be channelled to activities they enjoy and in which they have the abilities and skills at an early stage, it increases the possibility of them achieving success (St-Aubin & Sidney, 1996:9).

Although a sports development programme is determined by the sporting code, it is the most important element of the talent development process, according to the "Australian Talent Search" model (Australian Sports Commission, 1995). The moment talented individuals are identified, limited support resources should be utilized optimally in order to further refine and develop this talent (Abbott & Collins, 2002:157). Without such further support and development of their sport talent, the needs of talented children cannot be fulfilled; hence their potential will remain undeveloped. With such systems in place, not so many potential athletes will be lost to sport, which in turn will therefore influence the quality of the national sports teams of the country. From the above-mentioned it becomes clear that talent identification in sport without the necessary development would be a waste of time and resources. South Africa is confronted by the problem of a diverse population in which many children grow up in disadvantaged communities with little opportunity for participation in sport and exposure to coaching. This study therefore aims at identifying children from such communities for possible talent in sprints and long-jump and to expose them to development programmes in order to develop their talent, as well as to determine possible performance predictors which can be used to identify talent.

Subsequently it was firstly deemed necessary in this literature overview to define and describe the terms *talent identification* and *talent development*. Since a variety of factors exist which influence sport talent identification and development, these factors will be extensively discussed in this literature overview. Literature on existing prediction functions will also be briefly discussed in order to get an indication of the extent of research done in this respect. A task analysis of sprints and long-jump, which is the focus of this study, was further seen to be necessary with the view to determine which kinanthropometric characteristics and motor abilities and skills are important for performance in the distinctive items. Finally, literature on a variety of training methods was analysed which can be used to improve the related physical and motor abilities and skills, and are also documented in this literature overview.

2.2 Description of terminology

2.2.1 Talent Identification (TID)

Peltola (1992:7) defines talent identification as "that process through which children are encouraged to participate in the sporting codes in which they are most inclined to achieve success, and which is based on the results of testing of selected components". These components are designed to predict performance, taken into account the child's current fitness level and maturity. In this respect, Peltola (1992:7) indicated that it usually requires different characteristics to be talented in sport. Hence several characteristics are associated with a sporting code which needs to be taken into account to optimise and predict performance in this sporting code. Often, these characteristics cannot be seen with the naked eye and must therefore be measured objectively and/or scientifically.

Peltola (1992:7) and Bompa (1985:1) see talent identification as an aid, which helps, identified individuals to progress to an elite level, which further assists individuals to choose a sport they are good at so as to eliminate frustration caused by participation in a sporting code they are not good at. In this respect, St Aubin and Sidney (1996:9) point out that 22% to 37% of children between ages 13 and 15 who participate in sport are lost to it. According to these researchers, it happens because they lose interest due to the fact that they are not participating in the "right" sporting code. This dropout figure during early adolescence causes many potential athletes to be lost and consequently leads to the quality of national sports teams being affected by it. These researchers contend that talent identification can also be beneficial to coaches in that they can focus on those athletes with talent and better abilities for their specific sporting codes. The above-mentioned researchers added that talent identification also leads to the countries being able to get the best out of their limited sports resources. It is often argued that competition can be the best form of talent identification, seeing that the best of most talented athletes will identify themselves through their performance (Woodman, 1986:49). However, competition, which takes place in which athletes from a large age group participate, does not take into account the effect of biological age on performance, and it also does not present the opportunity of identifying an athlete who could possibly achieve success in another sporting code (Woodman, 1986:49).

In sum, it appears from the above-mentioned that the development of scientific talent identification models, which can give an indication of a person's possible chances of success, can be valuable; for not only the coach, but also the athlete and individuals to whom physical activity and sport are important. St Aubin and Sidney (1996:6) confirm this with their opinion that, by guiding children to activities they enjoy and where their abilities coincide with the requirements of the sport, the possibility for the child of achieving success is increased.

2.2.2 Talent development

Talent development can be described as the development of identified potential individuals by means of a sport specific sports development programme. Appropriate support and training are essential for talented individuals so as to optimally develop their potential. Therefore the moment talented individuals are identified by means of talent identification, the necessary support resources need to be optimally utilised to further refine and develop this talent. Without such further support given to their sport talent, the needs of talented children cannot be fulfilled and their potential will remain undeveloped. Consequently an effective talent identification model is an important precursor to talent development, since it will give support to those individuals who display the most potential to achieve international success in sport (Abbott & Collins, 2002:157).

In an attempt to improve skills and performance during competition, athletes need to prepare themselves by means of a training process. Smith (2003:1105) is of opinion that training is responsible for approximately half the performance differences between individuals, whereas genetic characteristics are responsible for the other half. The physiological aim of such training is to improve the body functions, and in so doing, optimise performance. The training process entails repetition of exercises, which lead to automation in the performance of motor skills as well as the development of structural and metabolic functions, which lead to improved physical performance. Thus the aim of training is to improve the ability to maintain the largest power output or speed of movement for a given distance or time (Smith, 2003:1104).

During a training phase of several weeks or months, the training input (defined by the intensity, duration and frequency of training) changes, and it must constantly be increase due to the modified physical adaptations as a result of training (Smith, 2003:1104).

Against this background of the clarified meaning of the talent identification and development process, factors, which can influence the talent identification process, will subsequently be discussed.

2.3 Factors which need to be taken into account during talent identification (TID)

Woodman (1986:50) contends that different fundamental factors exist which influence sport performance and which need to be considered during any talent identification programme. Hence a broad discussion will follow of the possible factors, which can influence talent identification, and more specifically in sprints and long-jump, which is the focus of this study.

2.3.1 Anthropometric characteristics

Most of the components of body build, namely body size, body structure, and body composition are, according to Houtkooper and Going (1994:1), important fundamental determinants of successful participation in sport — more in some sporting codes than in others. So, for instance, lighter individuals have an advantage in items in which the aim is to move the body foreword, especially over medium to long distances (Houtkooper & Going, 1994:1). Bompa (1999:278) substantiates that anthropometric characteristics are important assets to an individual in different sporting codes, and need to be taken into account during talent identification. The researcher is of opinion that stature, mass and the length of the limbs play a dominant role in certain sporting codes. The researcher points out that a long stature with long lower limbs are important for long-jump.

2.3.2 Physiological characteristics

Woodman (1986:51) indicated that endurance, strength, speed, explosive power and flexibility are the most important physiological characteristics needed for performance in sports. To Dick (as quoted by Bowerman & Freeman, 1991:48), aerobic endurance, strength endurance and speed endurance, flexibility, maximal power and speed are the physiological characteristics a sprinter must have to be able to perform in this item.

As for long-jump, research has indicated that speed, strength, explosive power and flexibility are the most important components which play a role during performance in this item (Moura & Fernandes de Paula Moura, 2001:1; Kiefer, 2004). These characteristics will be discussed in more detail under 2.6.

2.3.3 Psychological characteristics

Factors such as motivation, concentration, aggression, stimulation, taking risks and making decisions are, according to Woodman (1986:51), important psychological characteristics to take into account when identifying talent. The researcher is of opinion that optimal arousal levels also differ between different sporting codes. A high level of arousal will be required to perform well in activities such as sprints and long-jump in which the large muscle groups are involved, opposed to sporting codes in which small muscle group activities are used (Woodman, 1986:51). Bompa (1999:281) contends that a sprinting and long-jump athlete must also be capable of coping with stress.

2.3.4 Genetic factors

Heredity, which forms an important substructure of talent for sport, is a complex biological phenomenon and plays an important role on the influence of training on improvement in sport performance (Bompa, 1999:278). An athlete's genetic potential will therefore determine the extent of improvement in physiological abilities (Bompa, 1999:278). Some kinanthropometric characteristics, such as stature, speed and limb length are, to a lesser extent, influenced by training, since it has a high genetic coefficient, whereas factors such as body mass, strength and the size of muscle tissue have a smaller genetic coefficient; therefore can be influenced by training to a larger extent (Woodman, 1986:51). Hence factors with a high genetic coefficient will be better talent predictors.

2.3.5 Sociological factors

Children are exposed to a large number of social systems (for instance the school, the church, sports organisations, the media and the family). The values and norms within each of these social systems will consequently determine a child's behavioural patterns. Socialising, where individuals learn skills, values and norms, have a huge influence on potential sport performance (Woodman, 1986:52). A social environment, which values participation in sport, presents opportunities as well as encouragement to participate in sport, and good role players (parents, teachers, coaches) will influence individuals to become involved in sport. Without the necessary social systems, or with social systems, which attach no value to participation in sport, potential athletic individuals might be lost, since they cannot be identified through participation in sport (Woodman, 1986:52).

2.3.6 Environmental factors

Several factors, among others climate, geographic location, terrain (mountainous or level ground) and the environment in which an individual grows up (urban or rural) can affect the rate at which children develop (Bompa, 2000:10). The differences in growth and maturation, which occur among children who live in rural and/or urban areas, can possibly be ascribed to the location and the availability of resources. Among others, these resources include economic, educational, nutritional and health related resources which often are centred in urban areas and limited in rural areas (Malina *et al.,* 2004:550).

2.3.7 Biological maturation

Every individual has a biological clock, which influences development up until adulthood. Biological maturation relates biological time to calendar time (Malina *et al.*, 2004:277). Individuals differ with regard to maturation level at a given time, such as the time when maturation related changes occur, as well as the rate at which maturation takes place (Malina *et al.,* 2004:277). Within a specific age level, a wide variety of maturation levels can therefore be expected in school-going children (Volver *et al.,* 2000:17).

Determining sexual maturation is based on secondary sexual characteristics, namely the development of breasts and menarche in girls, genital development in boys and pubic hair development in both sexes (Malina *et al.,* 2004:283). Usually it is described in five developmental phases where sexual maturation phase one points to pre-puberty or the absence of the development of each characteristic. Phase two indicates initial development of each characteristic (early puberty) – enlargement of girls' breasts, enlargement of boys' testicles and the appearance of pubic hair in both sexes. Phases three and four (puberty) suggest the sustained development of each characteristic and phase five indicates the mature phase of each characteristic (Malina *et al.,* 2004:283).

These differences in maturation levels can be beneficial or detrimental to a participant in specific sporting codes (Reilly & Stratton, 1995:208). In general, early-developed boys have an advantage in many sporting codes due to a drastic increase in muscle mass during the growth acceleration phase (Reilly & Stratton, 1995:208). However, the performance of early-developed girls is negatively influenced during participation in several sporting codes as a result of a relative increase in adiposity. Late developed girls are inclined to perform better in motor tasks, whereas early-developed girls are more advantaged in activities in which absolute strength is of importance (Reilly & Stratton, 1995:208).

Therefore it is clear from the above-mentioned literature that the maturation level can be responsible for variation in performance among a group of children with identical chronological age and that it will influence performance. Consequently the effect of different maturation levels on some of the most important motor and physical abilities which contribute to better performance during sprints and long-jump will be discussed in more detail.

Running speed, reaction time and agility constantly improves from the age of five up until adulthood. In boys, a dramatic increase in testosterone levels occurs as from the onset of puberty (11.75–14.83 years) as well as the ability to improve strength (Malina *et al.*, 2004:226). Improvement in strength therefore leads to improved speed. Opposed to this, it seems that the speed of girls also improves during puberty, but reaches a plateau or that performance can even decrease after puberty (Reilly & Stratton, 1995:211). Improvement in speed also depends on the ability of muscles to contract powerfully in order to make the body or limbs move faster. A powerful contraction during any type of agility or speed activity therefore is directly linked to strength. Children display the largest improvement in speed during and after puberty (boys), because it is the period during which strength starts increasing. Improvement in speed is also observed during puberty due to neural adaptation (Bompa, 2000:64). Improvement in speed is not only the result of learning better running skills, but also due to the development of better muscle coordination. Some children can have poor coordination of arm and leg movement. This poor coordination can limit the ability to run fast, seeing that the driving force of the arms directly influences leg frequency. If the arms can drive more powerfully, the legs can push away from the ground with more force (Bompa, 2000:67).

Volver *et al.* (2000:18) contend that the sexual maturation phases two to four are characterised by improved explosive power, whereas phases three to five are typified by improved running speed and muscle strength as well as improved endurance, in male adolescents. In girls, phases three and four are characterised by improved running speed and phases four and five by increased muscle strength. These researchers further point out that the decrease in running speed in girls in the final phases of sexual maturation can be ascribed to the increase in fat tissue and the shift in the centre of gravity due to the development of a heavier pelvis. Hence it can influence performance in sprints and long-jump in girls and must be kept in mind during talent identification.

A study of Volver *et al.* (2000), which was performed on 77 healthy girls (11-14 years), displayed an improvement in agility at commencement of sexual maturation phase two, and a significant improvement in explosive power and flexibility at the commencement of phase three. Consequently it seems that an improvement in speed, agility, explosive power and flexibility in 11-14 year-old girls shows a relation with the development of secondary sexual characteristics as well as with age. These results coincide with those of Kemper and Verschuur (as quoted by Volver *et al.*, 2000), which indicated that the results of the stationary long-jump and flexibility in girls had improved between ages 10 and 12, and 12 and 13 respectively.

It therefore is clear from the above-mentioned literature that differences occur between children of similar chronological age regarding sexual maturation. This emphasises the importance of determining the effect of different maturation levels on performance ability, as will be performed in this study on boys and girls whose development can be influenced by maturation. During talent identification, late developers can, compared to early developers, possibly be seen as not talented, since early developers already have a larger degree of strength and speed.

2.4 Existing talent identification models

Lastly it is important to report on existing TID models, especially in sprints and long-jump. Several studies have already reported prediction functions for different sporting codes such as tennis (female athletes), swimming (female athletes), ice skating (female athletes), volleyball (elite female adolescents) (Leone *et al.*, 2002), basketball (elite female players) (Riezebos *et al.*, 1983; Bale, 1991; Smith & Thomas, 1991), football (male football players) (Sawyer *et al.*, 2002), soccer (16 year-old boys)

(Badenhorst & Pienaar, 2000) and rugby (national rugby players, junior and senior rugby players, 10 year-old boys) (Carlson *et al.,* 1994; Pienaar *et al.*, 1998; Gabbett, 2002).

As for athletics, also only a few studies (Bret *et al.,* 2002; Kukolj *et al.,* 1999) regarding adult and/or elite athletes could be traced. The study of Bret *et al.* (2002) was performed on nineteen regional to national level male sprinters. The results showed that concentric half-squats (leg strength) were related to 100 metres and to the mean speed of each phase of the 100 metre sprint. The counter movement jump (leg strength) was related to 100 metres and was the predictor of the first phase (0-30 metres). The hopping test (leg stiffness) was the predictor of the two last phases. The concentric half-squat test was the best predictor in the 100 metres sprint, while leg stiffness plays a major role in the second phase (0-60 metres). Opposed to the last-mentioned study, Kukolj *et al.* (1999) found in their study on 24 male students of physical education that most of the standard anthropometric, strength and power tests are poor predictors of sprinting performance, and that an assessment of sprinting performance should be based on more specific tests. Only one study on talent prediction related to 10-15 year-old children could be traced (Headley, 2000).

The study of Headley (2000) was performed on 12-18 year-old children (N=397) with the aim to establish talent identification determinants, which can be used for identifying talent in track and field athletes. One hundred and twenty-two (122) categorised as elite (athletes with a count of higher than 850 on the ABSA points table) and 275 as non-elite athletes (do not participate in competitive athletics and/or do not participate at provincial level in any other sporting code), and were compared to one another after having been subjected to an extensive test protocol which consisted of 11 anthropometric measurements, strength (one test), aerobic endurance (four tests), speed (one test), coordination (two tests), explosive power (10 tests) and biological maturation (four tests).

The results of the study indicated that certain tests could be used with a high accuracy percentage in order to discriminate between elite and non-elite athletes. In boys, the following variables could discriminate with 97,7% accuracy, namely: three hops on one leg, vertical jump, biacromial width, five bounds from a standing start, Wingate anaerobic test, medicine ball pendulum throw (three kg), long-jump with 10 stride run-up, 80 cm take-off zone, standing long-jump, 20 m shuttle run test, grip strength and thigh circumference.

In girls, three hops on one leg, biacromial width, five bounds from a standing start, Wingate anaerobic test, long-jump with 10 stride run-up, 80 cm take-off zone, 20 m shuttle run and leg length could discriminate with 99.3% accuracy. From this, a refined test battery was compiled to identify track and field items. This test battery consists of, stature for girls (is needed for leg length), sitting height for girls (is needed to determine leg length), leg length for girls, body mass for boys (is needed for the Wingate anaerobic tests), biacromial breadth, bi-iliocrystal breadth, frontal thigh circumference (only for boys), five bounds tests, three hops tests, Wingate anaerobic tests, vertical jump (only for boys), standing long-jump (only for boys), three kilogrammes medicine ball throw (only for boys), long-jump, 20 metres shuttle run test and grip strength (only for boys).

Although an extensive study, a shortcoming regarding this study of Headley (2000) is that the talent identification determinants are not specific in respect of the different items athletics consists of.

In summary, the importance of this study is therefore accentuated if taken into account that only one study in respect of talent identification on children could be traced for athletics and that it also has specific shortcomings. Also, no studies could be found which have been performed on children from disadvantaged communities.

2.5 Factors which influence sport development

Subsequently, the factors, which influence sport development, will briefly be discussed.

2.5.1 Maturation factors: the relative age effect

A factor, which can have an important influence on sport development, is the relative age effect (differences in age between children who were born in the same calendar year) (Baker *et al.*, 2003:1; Barnsley & Thompson, 1985:11). In schools, children who participate in sport are grouped in accordance with age; therefore inequality can occur during participation in sport with fewer opportunities for children with a younger biological age. Older children are often bigger, stronger, faster and better coordinated than younger players; consequently they are more successful in sport and display a stronger tendency to remain involved in sport (Baker *et al.,* 2003:4). According to these researchers, more mature children are often chosen for representative teams rather than less mature children of the same age, which thus results in these identified athletes often having access to better resources, including better coaching. Hence it brings about that talented athletes are not exposed to sports development due to a lower biological age and therefore are lost to sport.

2.5.2 Sensitive periods for the effect of development

The effect of training is influenced by growth and maturation and through the development of skills and behavioural patterns. During specific periods, children or adolescents are more sensitive to both positive and negative environmental influences. This points to the fact that children or adolescents will acquire skills quicker during a specific period. The concept *sensitive periods* especially is related to aspects of specialisation, selection procedures and trainability in a sports context (Loko *et al.*, 2002:72). In this respect, it seems that absolute strength can be trained in pre-adolescents to a lesser degree, but the improvement can occasionally be similar to or even better, if expressed in a percentage, than in adolescents and adults (Loko *et al.*, 2002:72).

2.5.3 The role of coaching

The availability of important resources such as coaching and the support of the parents can influence sport development significantly, says Baker *et al.* (2003:1). One of the most important aspects in sport development is the ability of the coach to create an environment, which encourages optimal learning. Precise planning of a practice session is for instance highlighted as a characteristic of a good coach (Baker *et al.*, 2003:1).

2.5.4 Influence of parents

Côté (1999:395) designed a sport specific model for talent development in which the role of the support of the parents is clearly evident. In the above-mentioned model, talent development, according to that researcher, is contained in an experimental phase (6-12 years), specialisation phase (13-15 years) and an investment phase (16+ years), and he points out that the roles of parents will change congruent to the demands of each of the mentioned phases. During the experimental years, the parents afford the children the opportunity to participate in a variety of sporting codes and take a leadership position in that they introduce participation in sports to children. During the specialisation years, parents are seen in a facilitating role in which they provide their children with financial and time support (Côté, 1999:395). Through this they create opportunities for them to receive better coaching, equipment and training facilities. During the investment years, parents act in an advisory and supporting capacity as the athlete starts training and participating at a higher level. Parents maintain a strong interest in their children's participation in sport and it is important for them to give emotional support in order to assist them in coping with injuries, pressure and exhaustion, as well as financial support for training. Athletes, who do not have access to such emotional and financial resources, as often is the case with children from disadvantaged communities, can therefore find it difficult to be exposed to the necessary amount of training essential for sports development. Factors such as failure, disappointment, competition, boredom and injuries consequently prevent participation in sport (Taras *et al.*, 2000:1460).

2.5.5 Cultural factors

The role of cultural factors in sports development is an important but often overlooked component of sports development. The emphasis a country or community lays on a certain sport can have a dramatic influence on any success, which can be achieved in sport (Baker *et al.*, 2003:1). The sporting codes, which dominate among Black Americans, for instance, mainly consist of basketball, soccer and athletics which, according to Wiggins (as quoted by Baker *et al.*, 2003:7), indicate that these sporting codes receive a considerable amount of support in government schools. These athletes thus also mostly only have access to coaching, facilities and competitions in sporting codes presented in government schools. According to Wiggins (as quoted by Baker *et al.*, 2003:7), sporting codes presented in club context such as tennis and golf were not accessible to these black people due to the fact that private clubs previously denied certain minority groups access for economic and social reasons.

2.5.6 Influence of the environment

Poverty-stricken circumstances in disadvantaged communities are, among others, one of the problems regarding sports development, because funds in these communities are needed to address the immediate social problems of such children (Chappel, 2004:5). Youth who find themselves in these circumstances in South Africa are confronted with social crises regarding family, crime, violence, an own identity and limitations to recreation and participation in sport. Goslin (1996:208) reported that black communities were limited to self-made facilities and apparatus and had practically no training opportunities. The possibility of people in disadvantaged communities to attend sports events also is relatively limited if taken into account that transport is not so readily available (Burnett & Hollander, 1999:244).

In the past, political differences brought about liaison with the government, but in practice it was not supported and implemented by the sports bodies, which consequently led to an imbalance in the provision of and access to sports facilities and events (Chappel, 2004:5).

With this information on talent identification and sports development as background, a sport specific task analysis of the demands set by sprints and long-jump in order to be able to perform in them will subsequently be done.

2.6 Sport specific task analysis

Several motor and physical abilities and anthropometric characteristics are important for performance in different sporting codes. Subsequently, a task analysis, which was performed on sprinters, will be discussed as seen from the literature. The motor and physical abilities, skills and anthropometric characteristics, which form the substructure of performance in this item, are highlighted in this task analysis.

2.6.1 Sprinting

Sprinting consist of several components, among others; start, acceleration, maximal speed and speed endurance phases, which in turn can each, influence performance in this item (Delecluse, 1994; Young *et al.*, 1995; Carr, 1999; USA Track and Field Coaching Manual, 2000). During sprinting, an athlete can for instance have a good take-off, but maximum speed can be a weakness, whereas the opposite can also be true. The physical abilities necessary for one phase can therefore also differ from those essential during another phase of sprints (Young *et al.*, 1995:13). Each of the different components sprints consist of will subsequently be elucidated at length. The importance of body composition, which compacts on all these phases, will also be discussed.

2.6.1.1 Start

The start action in sprinting is a complex motor skill, which needs to be practised in order to minimise the period between the gunshot and the take-off. Reaction time during the start can be defined as the time that elapses between the sound of the starter's gun and the moment when the athlete can exert a certain amount of pressure (power) to the starting blocks (Mero *et al.*, 1992:377). Collet (1999:65) points out that reaction time is an important determinant of performance in track items (60–400 metres) including hurdles and indoor competitions. Since the starting signal can be easily identified, the start reaction can be anticipated to reduce reaction time. Anticipation of the signal (gunshot) will reduce reaction time, although the International Amateur Athletics Federation (IAAF) has decided that a sub-100 millisecond (msec) reaction time will be considered to be a false start (Collet, 1999:66). The aim of any sprinter will therefore be to start as near as possible to this 100 msec limit in order to optimise his/her reaction time.

From the discussion above, it is evident that reaction time is an important factor in sprint performance (especially at the start), as well as for acceleration and speed. Collet (1999:65) confirms this in that researchers found that reduced reaction time leads to an improvement in 60 metres and 100-metre time. According to Mero *et al.* (1992:377) who, however, found low correlations in this respect, it seems that other parameters such as acceleration and maximum speed can be more important than reaction time.

During a standard 100 metre, maximal speed is not reached immediately, and the speed also is not the same throughout the 100 metre run. Running speed is further characterised by starting speed and speed during the 100 metre. From the start it takes a sprinter four to five seconds to reach maximal speed, which mainly depends on leg strength (Bompa, 2000:74). A Study by Osinski (1988:282) indicated a significant correlation between the take-off and body weight in women, take-off and vertical jump in men and take-off and triple jump from a stationary position in men.

2.6.1.2 Acceleration

Acceleration refers to the process through which an increase in speed takes place until maximal speed is reached (Cissik & Barnes, 2004:42). In athletics, an athlete's acceleration is an important determinant of performance during track items (Murphy *et al.*, 2003:147). After the start from the starting blocks, the athlete accelerates by means of an increase in stride length and frequency. The results of a study which was undertaken by Murphy *et al.* (2003:149) indicated that individuals with better acceleration ability have a 9% higher stride frequency compared to the relatively slow group. The results also indicated that athletes generate a faster running speed over short distance as a result of an improved stride frequency which possibly is brought about by a decreased contact time.

During the first phase (acceleration time) of the 100 metres, faster acceleration depends on explosive power and speed. Coaches and sports scientists often refer to acceleration ability, as running performance over shorter distances such as five metres or 10 metres, and it is usually determined by means of running time or speed. For elite sprinters, the acceleration phase continues for ± 30 metres to 50 metres after commencement of the sprints, but for non-elite athletes it can be less (Young *et al.*, 1995:13).

2.6.1.3 Maximal speed

An analysis of the 100 metres by Bompa (2000:76) indicated that sprinters reach maximal speed at the 50 metres to 60 metres mark and maintain it up until 80 metres, after which a decrease in speed occurs. A study by Young *et al.* (1995) on 11 men and 9 women sprinters, hurdle athletes, jumping athletes and multi-item athletes indicated that strength qualities are significantly linked to sprinting performance, for both the start and the maximum speed phase. The results of the study indicated that absolute maximum strength is important for sprinting, at least for maximum speed. The results are further supported by a study of Morin and Belli

(2003) on 10 male sprinters in which they also found that maximal strength, speed and explosive power of the lower limbs are significantly related to performance in sprinting during the acceleration phase of the 100 metres.

In their study on 30 female experimental subjects (20 track athletes and 10 trained women), Meckle *et al.* (1995) found that the largest difference between the "fast", average and slow female 100 metres sprinters was their ability to generate muscle strength and explosive power. The different groups also displayed a significant difference in their running skills. A negative significant correlation was also found between the values obtained in the Wingate maximal strength test and 100 metres time when all the subjects were analysed together as one group, which confirms the importance of muscle strength during the 100 metres sprint. From this analysis it becomes obvious that the 100 metres sprint is an explosive power item, which depends on muscle strength and explosive power.

2.6.1.4 Speed endurance

Speed endurance refers to the ability to maintain maximal speed over a longer period (60 metres to 120 metres) (Bompa, 2000:76). During the 100 metres, speed endurance from 70 to 80 metres is required to maintain the speed reached during the first phases up until the end of the race (Bompa, 2000:76).

2.6.1.5 Anthropometry

Among others, Headley (2000) used 11 kinanthropometric variables in a study with the aim to establish determinants, which can be used during talent identification of 12 to 18 year-old track and field athletes. The results indicated that three kinanthropometric variables, namely biacromial breadth, frontal hamstring circumference and leg length can be used as determinants while identifying talent in track and field items.

During sprinting, excessive fat mass can be detrimental, since several researchers indicated that an inverted relationship exists between fat mass and performance during physical activity where vertical replacement of the body mass takes place (Boileau & Lohman, 1977; Pate *et al.,* 1989).

2.6.1.6 Summary: Sprinting

In sum, it seems that aerobic endurance, strength and speed endurance, flexibility; maximal strength (especially leg strength), speed, reaction time and good running technique are the motor characteristics a sprinter must have for successful participation in this item.

2.6.2 Long-jump

The task analysis of the long-jump brought to light that the primary components it consists of are the approach, the take-off, flight and landing phase. Seeing that long-jump is a very complex item and performance depends on a multitude of technical aspects, only the approach, take-off and flight phases will be concentrated on in this discussion regarding the importance of motor, physical and kinanthropometric abilities.

2.6.2.1 Approach, take-off and flight phases

Both the horizontal jumps in athletics, namely long-jump and triple jump, require good running technique and reaching of maximal speed in the approach during the take-off (Perkins, 2003:149). The researcher highlights that the aim is to bring about an approach that is consistent so that maximal speed during the take-off can be reached. Further to this, Luna (2005) indicated that the most important factor during the long-jump is the execution of a fast, accurate and controlled approach. Perkins (2003) and Luna (2005) further indicated that speed during the approach is of utmost importance, since the two factors, which determine the distance, or flight of any object is speed and the angle of the take-off.

An additional important element of the approach is good running technique, which begins with a gradual acceleration (Bowerman & Freeman, 1991:139). Horizontal speed in long-jump contributes to more than double the potential distance of the total jump than is the case with regard to vertical speed. The faster the speed, the higher and further the stretch of the centre of gravity will be. Hence the ideal is that the long-jump athlete must accelerate from the start to the finish of the approach. Acceleration is determined by two factors, namely an increase in stride length and stride frequency. Factors, which will contribute to the athlete's stride length shortening and therefore cause a decrease in speed, will consequently lead to the execution of a poor jump. It seems that the athlete's approach to the take-off board at his/her optimal stride length will be an important factor in long-jump performance (Jacoby & Fraley, 1995:44).

Strength is an additional determining factor during long-jump and can manifest with regard to speed and endurance in different ways. Strength is defined as the capacity of the skeletal muscles to produce maximal strength or tension at a given speed (Moura & Fernandes de Paula Moura, 2001:3). The most important strength aspect for long-jump athletes is explosive power, but a good maximal strength foundation is also essential in order to ensure that the athlete has a good basis for training explosive power and to prevent injuries (Moura & Fernandes de Paula Moura, 2001:4). According to Kiefer (2004), strength and flexibility are seen as the protectors of the long-jump athlete (Kiefer, 2004). Strength allows the athlete to control change in the centre of gravity, whereas flexibility, on the other hand, is responsible for protecting the muscles, connective tissue and joints, which play a primary role during the ballistic load which long-jump places on the athlete.

2.6.2.2 Anthropometry

With respect to body size, structure and composition, it seems that taller individuals with longer levers (limbs) and a higher centre of gravity will have an advantage in jumping and throwing items (Houtkooper & Going, 1994).

2.6.2.3 Summary: Long-jump

In sum, it therefore seems that speed, acceleration, strength, explosive power and flexibility are the most important motor and physical components which play a role during long-jump (Moura & Fernandes de Paula Moura, 2001; Kiefer, 2004), while a tall athlete with long levers might also have an advantage.

2.7 Research findings on appropriate training methods for motor and physical components for improving sprints and long-jump

Subsequently a brief discussion will be dedicated to literature findings on the most effective methods to train the identified abilities in sprints, namely reaction time, acceleration, anaerobic capacity (speed and explosive power) and speed endurance, and in long-jump, namely speed, acceleration, strength, explosive power and flexibility.

2.7.1 Sprinting

2.7.1.1 Reaction time

According to Bompa (2000:73), reaction is not only a muscular reflex to a stimulus, but also the ability of the muscles to contract quickly and powerfully. Training to improve speed and explosive power will therefore lead to an improvement in the ability of limbs to move faster (Bompa, 2000:73). Reaction time usually improves with training (Faccioni, 2004:6). By warning an athlete, followed by a brief time delay, and then letting the stimulus follow will lead to an improvement in the way an athlete reacts to a stimulus (Faccioni, 2004:6). It is also important to improve an athlete's concentration before the stimulus. Thus, the better the athlete's ability to "switch on" just before the stimulus is expected, the better the reaction time to the stimulus will be (Faccioni, 2004:6). The time between the preparation signal (ready) and the stimulus (whistle, gunshot) must therefore be varied in order to improve an athlete's reaction time.

2.7.1.2 Acceleration

The duration of the acceleration phase in elite sprinters is approximately six to seven seconds before their maximal speed is reached, and it depends on explosive power and speed (Bompa, 2000:68). Delecluse *et al.* (1994) found that a combination of a resistance programme and a running programme brought about a larger improvement in acceleration, but that neither the resistance programme nor the running programme was sufficiently effective to bring about a significant improvement on their own. These researchers indicated that improved movement speed during the first phase of acceleration was rather linked to the speed of the training during the resistance programme; therefore this training method can be regarded as effective to improve initial acceleration. According to Delecluse *et al.* (994:1208), a plyometric programme of 9 weeks is effective for improving the initial acceleration and final time in sprints (Delecluse *et al.*, 1994:1208). This relation between plyometric training and initial acceleration can possibly be explained through the fact that the athlete must be capable of accelerate his entire body mass maximally during the take-off phase as well as during the initial acceleration phase.

In his book, Bompa (2000:73) indicates that 4-8 repetitions of speed over 20-60 metres with a resting interval of 3-4 minutes can be used as an effective method for improving acceleration in children. Running against resistance and along with resistance also are techniques, which can be used to improve speed and acceleration. Training to improve running form is also recommended in the literature as a training method to improve speed and acceleration (Dintiman, 2000:190).

2.7.1.3 Anaerobic capacity (speed and explosive power)

Most coaches agree that resistance training is one of the key aspects in an athlete's training programme (Delecluse *et al.,* 1994:1203). An athlete's strength is not only determined by the size or morphology of his muscles, but also by the ability of the nervous system to activate these muscles. Reilly and Stratton (1995:210) contend that resistance training can lead to an effective improvement in strength in pre-pubertal children without an accompanying increase in muscle mass. It seems that pre-adolescents and adolescents experience the same improvement in strength as adults. In this regard, Reilly and Stratton (1995:210) indicated that a resistance training programme of 20 weeks had led to a 30% increase in torso strength and a 20% increase in abdominal strength. Since it is the aim of a sprinter to optimise his/her explosive power, the fastest motor units need to be activated, and a variety of training methods can be used to improve dynamic execution in this respect (Delecluse *et al.,* 1994:1208). Training to improve speed must also become more specific during puberty. In order to be able to run faster, a variety of elements of speed need to be trained, namely acceleration, maximum speed and speed endurance (Delecluse *et al.*, 1994:1203). Although speed is associated with an individual's genetic potential, it can indeed also be improved through training. Bompa (2000:63) claims in this respect that athletes who do not have a natural talent for speed related activities could improve their speed significantly. Training to improve agility and acceleration contributes to a better adaptation of the nervous system during puberty which leads to increased coordination of the muscles involved in the execution of arm and leg movements (Bompa, 2000:68).

Perez (1981:72) indicated that a large number of interval exercises in a sprinter's training programme could contribute to a higher anaerobic capacity. This researcher explains that, seen from a practical point of view, it seems that movement speed is important for sprinters and therefore interval exercises, which accentuate high intensity training sessions, are important in the training programmes of such athletes.

2.7.1.4 Speed endurance

Speed endurance is described as the ability to cope with exhaustion and to maintain both the stride and the form while an athlete runs at near-to-maximal intensity for relatively short distances (Martin & Coe, 1997:176). Hence the aim of training to improve speed endurance is to maintain maximal speed over longer distances (60-120 metres). Bompa (2000:74) claims that speed endurance should be practised on separate days together with agility and that three to six repetitions with a longer rest interval is an effective method to improve speed endurance in children. Several training methods can further be used to improve speed endurance, namely "pick-up sprints" (gradual increase in speed), intervals (running at maximal speed succeeded by jogging or walking for recovery), "hollow sprints" (two sprinting segments with a period of jogging or walking in between (Dintiman & Ward, 2003:153).

2.7.2 Long-jump

From the task analysis of long-jump (see 2.6.2), it became evident that speed, acceleration, strength and flexibility are the most important motor components which play a role during long-jump. Subsequently, a discussion will take place of the training methods for the different components.

2.7.2.1 Speed and acceleration

The development of the approach in the long-jump must be seen as the most important aspect during a long-jump athlete's training, since good execution of the approach is important for good take-off and technique during the flight (Kiefer, 2004). An important element of the approach is good running technique, which begins with a gradual acceleration (Bowerman & Freeman, 1991:139), whereby the ideal is that acceleration should take place from the beginning to the end of the approach. Stride length and stride frequency must consequently be improved through training.

Thus strength and explosive power exercises are essential for developing a good basis, which will optimise the improvement of acceleration and speed (Dintiman, 2000:175). Literature recommends that the first six to eight weeks should be devoted to resistance training, with the focus on strength, speed and endurance. This programme must consist of general exercises for the arms, back, shoulders, torso, arms, abdomen and neck at 60% of a person's one repetition maximum. Plyometric exercises can also be used to improve strength and explosive power in the muscles involved in running (Dintiman, 2000:175). Running against and with resistance also are methods, which can be used to improve speed and acceleration. Additionally, exercises to improve running form are recommended in the literature as a training method to improve speed and acceleration (Dintiman, 2000:190).

2.7.2.2 Strength and explosive power

Moura and Fernades de Paula Moura (2001:1) reported a negative relation between the development of maximal strength and explosive power in young elite Italian athletes. These researchers recommend that resistance exercises should be limited to a maximum of eight weeks, and that maximal strength exercises should not be completely eliminated. After eight weeks, an undesired, ultra-structural change occurs in the muscles, such as hypertrophy of type one tissues, which can handicap elite performance. Before such changes occur, other types of training methods to improve type two tissues should thus replace maximum strength exercises.

During training for the improvement of strength it is important to concentrate on the development of specific qualities necessary for long-jump. These qualities are based on three factors, namely explosive power, jumping endurance and "special strength" (Tellez & James, 2000:150). Explosive power refers to the maximal explosive ability of the leg and back muscles during the approach and take-off. Jumping endurance points to the ability of the muscles to repeatedly be capable of executing hop and jump actions whereas "special strength" is used to bridge the gap between strength and explosive power. "Special strength" furnished the athlete with the control over all the mechanics of the leg and back muscles used during the execution of horizontal jumps (Tellez & James, 2000:150). These researchers pointed out that the most important factor during training to improve strength for the long-jump athlete is the method which is used. Training by using plyometrics combined with resistance exercises is considered the most effective method (Tellez & James, 2000:150). Moura and Fernades de Paula Moura (2001:3) substantiates the use of plyometric training to improve muscle strength and explosive power. Although plyometric exercises should not replace resistance exercises, variations of plyometric exercises are far more effective to improve the rate of strength development than using weights. The aim of plyometric exercises in sprints and long-jump is to develop the neuromuscular system in such a manner that improvement in strength can be incorporated with speed. During plyometrics two methods can be used, namely long jumps and short jumps. Long jumps are used during the first six weeks and are used to condition the athlete and to improve speed endurance. These jumps can be divided into low intensity long jumps and high intensity long jumps. Both these jumps are executed over a distance of more than 30 metres, but it is executed at a lower height or as fast as possible. Short jumps are explosively executed over a shorter distance (less than 30 metres). Tellez and James (2000:151) indicated that plyometrics need to be trained twice a week with approximately two days' rest in between. Resistance exercises combined with explosive power exercises lead to a faster increase in strength, without an increase in muscle mass. This initial adaptation can be ascribed to better use of motor units and is described as neural adaptation (learning) (Moura & Fernades de Paula Moura, 2001:3). Therefore strength training for jump items should aim at developing maximal strength within a short time span.

2.7.2.3 Flexibility

Flexibility improves an athlete's development of coordination and technique and the ability of the proprioceptors to receive stimuli (Apostolopoulos, 2000:49). According to Kiefer (2004), it is also seen as the protector of the long-jump athlete. Flexibility therefore is responsible for protecting the muscles, connecting tissues and joints which play a primary role during the ballistic load placed on an athlete by long-jump (Kiefer, 2004). Literature indicates that flexibility needs to be trained at least three times a week, with each stretch being held for approximately 60 seconds (Apostolopoulos, 2000:53).

2.8 Conclusion

From the literature, as discussed above, it is clear that talent identification without accompanying talent development has limited value. Among others, talent identification is influenced by anthropometric, physiological and psychological characteristics, genetic and sociological factors and biological maturation. The literature study indicated that several factors exist which should be taken into account during talent development, namely the relative age effect, sensitive periods, the role of coaching, the influence of parents and cultural factors.

Moreover, the literature study brought to light that poverty stricken circumstances in disadvantaged communities hamper sport development, seeing that financial resources are needed to address the immediate social crises pertaining to family, crime, violence, an own identity and limitations with respect to participation in sport. Such populations are often limited to self-made facilities and apparatus, and a lack of transport also consequently leads to them not participating in sport.

The respective task analyses of the demands set by sprints and long-jump in order to be able to perform brought to light that successful participation in the items require a variety of physical and motor abilities, namely speed, strength, explosive power, acceleration, speed endurance, reaction time and flexibility. Apart from these abilities, an athlete's anthropometric characteristics can also affect performance in participation in sprints and long-jump.

Literature further indicates that physical and motor abilities can indeed be improved in children by means of sport specific training methods, which in turn will lead to improved performance. From the literature it also became apparent that underlying abilities needed for sprints and long-jump largely overlap. Hence it can be deduced that sprinters and long-jump athletes can be subjected to similar training programmes.

Furthermore, the research literature indicated that different maturation levels can occur in a group of individuals of the same chronological age and that these maturation levels can be either beneficial or detrimental in terms of performance in specific sporting codes. Additionally, the literature study indicated that explosive power; speed, muscle strength and endurance improve from the onset of puberty in boys, while opposed to this; speed and muscle strength improves in girls, after which speed reaches a plateau or even decreases after puberty. These tendencies should be considered in the compilation of training programmes, especially in the age group of 10-15 years, which is the focus of this study.

With this literature study as background, a discussion of the results of the study will subsequently follow.

2.9 References

ABBOTT, A. & COLLINS, D. 2002. A theoretical and empirical analysis of a 'state of the art' talent identification model. *High ability studies*, 13(2):157-178.

APOSTOLOPOULOS, N. 2000. Performance flexibility. (*In* Foran, B. *ed.* High-performance sports conditioning. Champaign, IL. : Human Kinetic Publishers. p. 49-62.)

AUSTRALIAN SPORTS COMMISSION. 1995. School teacher manual. Australia : Paragon Printers. 34p.

BADENHORST, E. & PIENAAR, A.E. 2000. 'n Voorspellingsfunksie vir die klassifisering van sokkervermoëns by 16-jarige seuns in die Noordwes provinsie/A predictionfunction for the classification of soccer abilites among 16-year old boys in the Nort-West province. *South African journal for research in sport, physical education and recreation*, 22(1):1-16.

BAKER, J., HORTON, S., ROBERTSON-WILSON, J. & WALL, M. 2003. Nurturing sport expertise: factors influencing the development of elite athlete. *Journal of sports science and medicine*, 2:1-9.

BALE, P. 1991. Anthropometric, body composition and performance variables of young elite female basketball players. *Journal of sports medicine and physical fitness*, 31(2):173-177, Jun.

BARNSLEY, R.H. & THOMPSON, A.H. 1985. Gifted or learning disabled? The age of entering school may make the difference. Early childhood education, 18:11-14.

BOILEAU, R.A. & LOHMAN, T.G. 1977. The measurement of human physique and its effect on physical performance. *Orthopedic clinical North American journal*, 8:563-581.

BOMPA, T.O. 1985. Talent identification. Sports periodical on research and technology in sport. 1-11. Feb.

BOMPA, T.O. 1999. Periodization, theory and methodology of training. 4th ed. Champaign IL. : Human Kinetics Publishers. 413 p.

BOMPA, T.O. 2000. Total training for young champions. Champaign, IL. : Human Kinetics Publishers. 211 p.

BOWERMAN, B. & FREEMAN, B. 1991. High-performance training for track and field. 2nd ed. Champaign, IL. : Leisure Press. 243 p.

BRET, C., RAHMANI, A., DUFOUR, A.B., MESSONNIER, L. & LACOUR, J.R. 2002. Leg strength and stiffness as ability factors in 100 m sprint running. *Journal of sports medicine and physical fitness,* 42(3):274-281, Sept.

BURNETT, C. & HOLLANDER, W. 1999. Sport development and the United Kingdom-South Africa Sports Initiative: A pre-evaluation report. *Journal of sport management,* 13:237-251.

CARLSON, B.R., CARTER, J.E., PATTERSON, P., PETTI, K., ORFANOS, S.M. & NOFFAL, G.J. 1994. Physique and motor performance characteristics of US national rugby players. *Journal of sports sciences,* 12(4):403-412, Aug.

CARR, G. 1999. Fundamentals of track & field. 2nd ed. Champaign, IL. : Human Kinetics Publishers. 284 p.

CHAPPEL, R. 2004. Sports development in Botswana, Africa. *The sport journal,* 7(2):1-11, Spring.

CISSIK, J.M. & BARNES, M. 2004. Sport speed and agility training. Monterey : Coaches choice. 256 p.

COLLET, C. 1999. Strategic aspects of reaction time in world-class sprinters. *Perceptual and motor skills,* 88:65-75.

CôTé, J. 1999. The influence of the family in the development of talent in sports. *The sport psychologist,* 13:395-417.

DELECLUSE, C., VAN COPPENOLLE, H., WILLEMS, E., VAN LEEMPUTTE, M., DIELS, R. & GORIS, M. 1994. Influence of high-resistance and high-velocity training on sprinting performance. *Medicine and science in sports and exercise,* 27(8):1203-1209. Aug.

DINTIMAN, G.B. 2000. Acceleration and speed. (*In* Foran, B. *ed.* High-performance sports conditioning. Champaign, IL. : Human Kinetics Publishers. p. 167-192.)

DINTIMAN, G.B. & WARD, R.D. 2003. Sportspeed. 3rd ed. Champaign, IL. : Human Kinetics Publishers. 271 p.

FACCIONI, A. 2004. Modern speed training: a comprehensive guide. [Web:] http://www.ebook.contentsall.htm [Accessed: 7 April 2005].

GABBETT, T.J. 2002. Physiological characteristics of junior and senior rugby league players. *British journal of sports medicine,* 36:334-339, Apr.

GOSLIN, A. 1996. Human resource management as a fundamental aspect of a sport development strategy in South African communities. *Journal of sport management,* 10(2):207-217, Apr.

HEADLY, N. 1993. Sports talent identification and development – a situational analysis. Port Elizabeth : University of Port Elizabeth. (Thesis – M.A.) 321p.

HEADLEY, N. 2000. Indicators of potential performance in track and field athletics. Port Elizabeth : University of Port Elizabeth (Thesis – Ph.D.) 735p.

HOUTKOOPER, L.B. & GOING, S.B. 1994. Body composition: how should it be measured? Does it affect sport performance? *Sport science exchange,* 7(5):1-7.

JACOBY, E. & FRALEY, B. 1995. Complete book of jumps. Champaign, IL. : United Graphics. 146 p.

KIEFER, J. 2004. Training and drills for the running long-jump. [Web:] http://www.coach.org [Accessed: 2 August 2005].

KUKOLJ, M., ROPRET, R., UGARKOVIC, D. & JARIC, S. 1999. Anthropometric, strength, and power predictors of sprinting performance. *Journal of sport medicine and physical fitness,* 39(2):120-122, Jun.

LEONE, M., LARIVIERE, G. & COMTOIS, A.S. 2002. Discriminant analysis of anthropometric and biomotor variables among elite adolescent female athletes in four sports. *Journal of sports sciences*, 20(6):443-449, Jun.

LOKO, J., AULE, R., SIKKUT, T., ERELINE, J. & VIRU, A. 2002. Age differences in growth and physical abilities in trained and untrained girls 10-17 years of age. *American journal of human biology*, 15:72-77.

LUNA, E. 2005. Training your horizontal jumpers. [Web:] www.coacheseducation.com/horiz/ljl [Accessed: 2 August 2005]

MALINA, R.M., BOUCHARD, C. & BAR-OR, O. 2004. Growth, maturation, and physical activity. 2nd ed. Champaign, IL. : Human Kinetics Publishers. 712 p.

MARTIN, D.E. & COE, P.N. 1997. Better training for distance runners. Champaign, IL. : Human Kinetics Publishers. 434 p.

MECKEL, Y., ATTERBOM, H., GRODJINOVSKY, A., BEN-SIRA, D. & ROTSTEIN, A. 1995. Physiological characteristics of female 100 meter sprinters of different performance levels. *Journal of sports medicine and physical fitness,* 35(3):169-175, Sept.

MERO, A., KAUHANEN, H., PELTOLA, E., VUORIMAA, T. & KOMI, P.V. 1990. Physiological performance capacity in different prepubescent athletics groups. *Journal of sports medicine and physical fitness,* 30(1):57-66, Mar.

MERO, A., KOMI, P.V. & GREGOR, R.J. 1992. Biomechanics of sprint running. *Sports medicine*, 13(6):376-392.

MORIN, J.B. & BELLI, A. 2003. Mechanical factors of 100 m sprint performance in trained athletes. *Science and sports*, 18:161-163.

MOURA, N.A. & FERNANDES DE PAULA MOURA, T. 2001. Training principles for jumpers: implications for special strength development. *New studies in athletics*, 4:1-11.

MURPHY, A.J., LOCKIE, R.G. & COUTTS, A.J. 2003. Kinematic determinants of early acceleration in field sport athletes. *Journal of sports science and medicine*, 2:144-150.

OSINSKI, W. 1988. The study of running speed in the cause-effect system of path analysis. *The journal of sports medicine and physical fitness*, 28:280-286. Sept.

PATE, R.R., SLENTZ, C.A. & KATZ, D.P. 1989. Relationships between skinfold thickness and performance of health related fitness test items. *Research quarterly for exercise and sport*, 60:183-189.

PELTOLA, E. 1992. Talent identification. *New studies in athletics*, 7(3):7-12. Sept.

PEREZ, H.R. 1981. Specificity of training: selective aspects of running. *Journal of sports medicine*, 21:68-73.

PERKINS, E. 2003. Long jump and triple jump. (*In* Guthrie, M., *ed.* Coaching track & field successfully. Champaign, IL. : Custom Color Graphics. p. 149-155.)

PIENAAR, A.E., SPAMER, M.J. & STEYN, H.J. 1998. Identifying and developing rugby talent among 10-year-old boys: A practical model. *Journal of sport sciences*, 16:691-699. Aug.

REILLY, T. & STRATTON, G. 1995. Children and adolescents in sport: physiological considerations. *Sports exercise and injury*, 1:207-213.

RIEZEBOS, M.L., PATERSON, D.H., HALL, C.R. & YUHASZ, M.S. 1983. Relationship of selected variables to performance in women's basketball. *Canadian journal of applied sports sciences*, 8(1):34-40, Mar.

SAWYER, D.T., OSTARELLO, J.Z., SUESS, E.A. & DEMPSEY, M. 2002. Relationship between football playing ability and selected performance measures. *Journal of strength and conditioning research*, 16(4):611-616, Nov.

SMITH, D.J. 2003. A framework for understanding the training process leading to elite performance. *Sports medicine*, 33(15):1103-1126.

SMITH, H.K. & THOMAS, S.G. 1991. Physiological characteristics of elite female basketball players. *Canadian journal of sports sciences,* 16(4):289-295, Dec.

ST-AUBIN, M.A. & SIDNEY, K. 1996. A rationale for talent detection in youth sports. *Cahperd : Journal de l'acsepld,* Spring, 9-12.

TARAS, H.L., CIMINO, D.A., McGRATH, J.W., MURRAY, R.D., YANKUS, W.A. & YOUNG, T.L. 2001. Organized sports for children and preadolescents. *Pediatrics,* 107(6):1459-1462, Jun.

TELLEZ, K. & JAMES, K. 2000. Long jump. (*In* USA Track & Field coaching manual. Champaign, IL. : Human Kinetics Publishers. p. 141-157.)

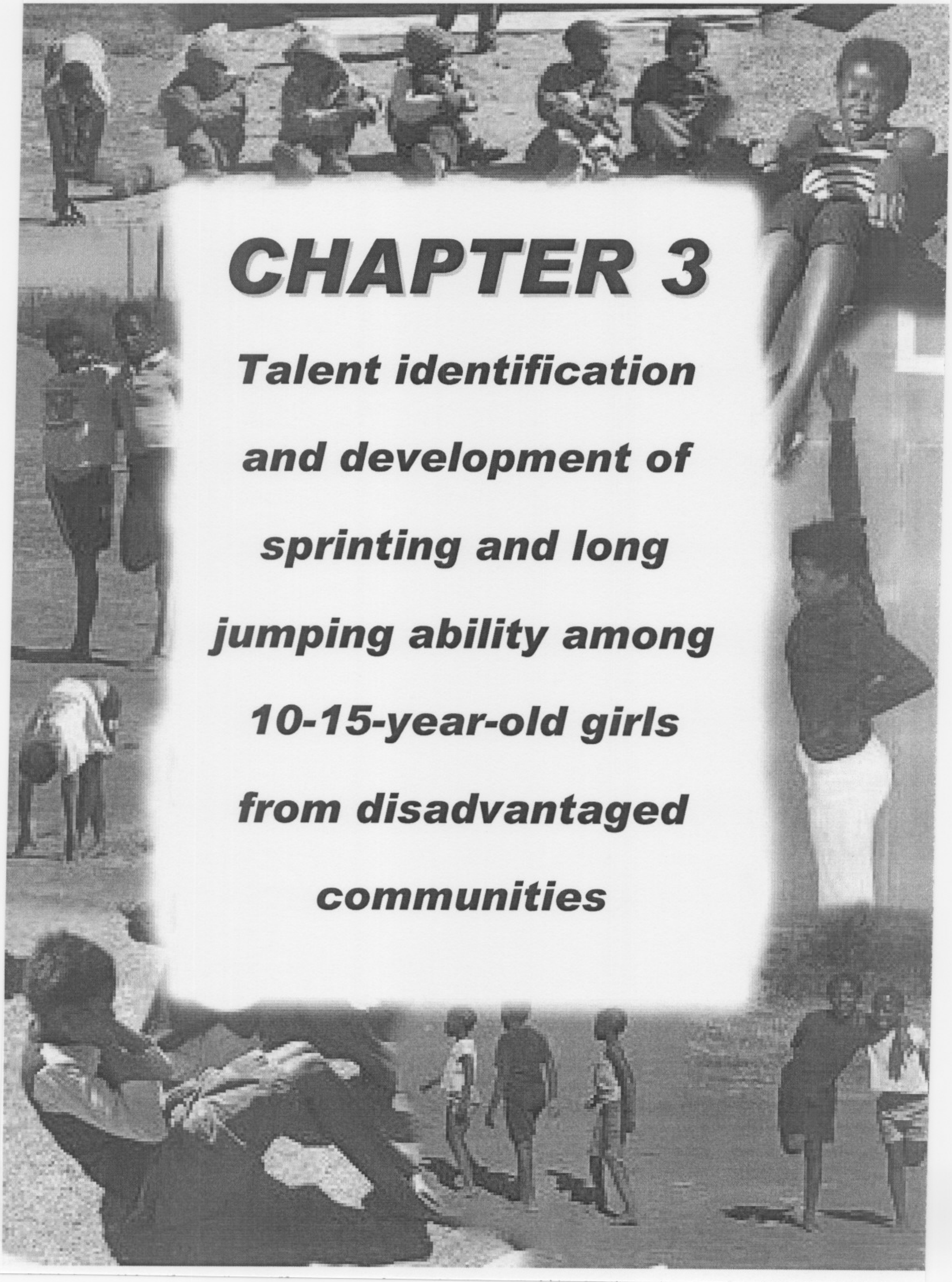
USA TRACK & FIELD COACHING MANUAL. 2000. Champaign, IL. : Human Kinetics Publishers. 316 p.

VAN DER MERWE, C.A. 1997. Talentidentifisering en –ontwikkeling in rugby by 11-jarige swart seuns/ Talentidentification and development in rugby among 11-year-old black boys. Potchefstroom : PU vir CHO (Thesis – Ph.D.) 207p.

VOLVER, A., VIRU, A. & VIRU M. 2000. Improvement of motor abilities in pubertal girls. *Journal of sport medicine and physical fitness*, 40(1):17-25.

WOODMAN, L. 1986. Talent identification – is competition enough? *Sports Coach,* 9(1):49-57.

YOUNG, W., McLEAN, B. & ARDAGNA, J. 1995. Relationship between strength qualities and sprinting performance. *The journal of sports medicine and physical fitness,* 35(1):13-19, Mar.



CHAPTER 3

Talent identification and development of sprinting and long jumping ability among 10-15-year-old girls from disadvantaged communities

Talent identification and development of sprinting and long jumping ability among 10-15-year-old girls from disadvantaged communities

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Funding: The National Research Foundation

Acknowledgements: The authors would like to thank Prof. Faans Steyn for assistance with the statistical analysis of the data.

Abstract

Background

Development of previously disadvantaged communities in South Africa was identified as a national priority as far back as 1994. In so doing, sport among others, was used as a medium in the strategy to try and improve and change the circumstances of people from such backgrounds. Sport development for deprived athletes is, therefore, essential because without such ongoing support of the identified talented athletes, their potential would remain undeveloped.

Research question

To determine the value of a sport talent identification and development programme to improve speed and long jump abilities among talented girls from disadvantaged communities.

Type of study

A pre-test/post-test 2-group research design.

Methods

Subjects

All girls between the ages 10 and 15 from two schools (N=66) who consented to participate in the study.

Experimental procedure

Subjects were tested by means of the Australian Talent Search protocol and the most talented girls (top 30%) (N=66) in each school were selected by rank order to determine further testing by means of a sport specific test battery of ten tests for speed and long jump ability. The experimental group (N=19) underwent a development programme for ten weeks conducted twice a week for one hour. Their results were compared with the control group (N=18) who did not follow a development programme. The results were analysed by means of independent t-testing and the practical significance of differences was determined by means of effect size. An analysis of covariance (ANCOVA) was performed to adjust for pre-testing differences.

Results

It was found that the development programme contributed to improved motor abilities and skills important for performance in both sprints and long jump. Flexibility ($p<0.05$), explosive power ($p<0.05$), muscle endurance ($p<0.05$), reaction time ($p<0.05$), speed ($p<0.05$), speed endurance ($p<0.05$), acceleration ($p<0.05$) and long jump ($p<0.05$) improved, while abdominal strength and stride length did not. Compared to jumping ability, speed was less adressed by the programme.

Conclusions

The programme can successfully condition long jump and to a lesser degree sprinting ability despite poor circumstances and infrastructure. Small adjustments to improve the quality of the programme were recommended.

Key Words: athletic, performance, speed, sprint, long jump, motor development

Introduction

With transformation as a priority, the new South African government in 1994 identified the development of the previously disadvantaged communities in South Africa as a national priority. In so doing, sport was used as one means to improve and change the circumstances of people from such backgrounds.[1] It was stated that sport development in disadvantaged communities is regarded as essential because without the ongoing support of these talented athletes, their potential will remain undeveloped.[2] Consequently, potentially talented athletes will be lost, thus affecting the quality and composition of the national sports teams. It will also reflect negatively on the transformation in South African sport.

Sport participation has a positive influence on several aspects of a child's development. Amongst others, it contributes to the development of life skills within the sport environment, such as problem-solving, decision-making and analytic behaviour.[3] Other advantages are an improved health status and a better self-image among children.[4] The identification of a child's talent in sport may contribute to this development as well as giving direction to the child's potential.

Bompa [5] stated that children can already specialise in sprints at the age of 14-16 years old and in the long jump between 17 - 19 years old. Both these athletic events can be linked to the natural development of children. Herbst and Huysamen [6] indicated that children from disadvantaged communities excel in gross motor skills, such as running, jumping and ball games. Related to this, researchers [7,8] have pointed out that children from poorer socio-economic environments are physically more active, whilst children who grow up more independently have greater opportunities of being physically active, which can lead to a better ability of developing basic motor skills.

Speed, explosive power, muscle strength and endurance are important fitness components that play a role in sport performance.[9] These researchers are of the opinion that the abovementioned components can also specifically be used to determine potential in specific activities and/or sport codes. When attempting to improve the abilities and skills that are essential for sport performance, training drills, therefore, need to be specific to the sport code. In this regard, Penfold and Jenkins

[10] stated that a thorough analysis of the speed requirements for a sprinter must form the basis of any speed development programme. They concluded that reaction time, acceleration, maximum speed, balance, agility and speed endurance must be trained for an athlete's speed to develop to its maximum.[10]

The long jump, compared to other athletic events, requires a great amount of athletic ability.[11] An elite long jumper must have the ability to reach world-class speed as well as to execute specific motor skills at a high rate. Power and flexibility are two very important motor abilities contributing to long jump performance. Power allows the athlete to control the change in the pathway of the centre of gravity, whilst flexibility allows the athlete to participate without injury.[11] Strength is also an important physical attribute in jumping events. Moura and Fernandes de Paula Moura [12] indicate that proper levels of strength endurance and maximal strength should be developed to ensure that a solid base is established for the improvement of special strength attributes and for the prevention of injuries.

Limited research has been published that is related to the specificity of training drills and the development of various physical abilities and skills that are important for performance in sprints and the long jump among children and young athletes. This study, therefore, aims at determining the influence of a talent development programme for improving speed and long jump skills among 10- to 15-year old potentially talented girls from disadvantaged communities.

Method

Subjects

Sixty-six girls between ages 10 and 15 voluntarily participated in the study. This study received ethical approval from the North-West University (Number 04M12). Both the children and their parents were informed about the nature of the project, and the parents signed an Informed Consent form. Thirty-seven of the 40 experimental subjects who were initially in the experimental (n=20) and control (n=20) groups completed the study. The information of one girl in the experimental group and two in the control group were incomplete, and consequently their data had to be omitted.

After all the girls were subjected to a talent search testing protocol, potentially talented athletes (n=19), with an average age of 12.3±1.63 years, at a farm school were assigned to the experimental group. Furthermore, a control group was selected consisting of 18 girls from another farm school, with an average age of 12.8±1.59 years. The socio-economic status of the children involved in the study can be regarded as equal, since they are mainly children of farm workers in the vicinity or of those living on farms close to the school.

Test procedure

All girls between 10 and 15 years in both the experimental (n=38) and control (n=28) groups were tested by means of the Australian Talent Search protocol.[2] It is an existing protocol that is used to identify general sporting talent and consists of 10 test elements namely, body mass, stature, sitting height, arm span, basket ball throwing, throwing and catching, vertical jump, 40-metre sprint, agility and endurance. The most talented children were identified on the grounds of percentile scales that were compiled for children in the North West Province with the protocol from the Thusa Bana study.[13] These tests were used to identify the most talented (top 30%) girls from the 66 initial participants. This resulted in 19 girls in the experimental and 18 girls in the control group respectively. These girls were then tested again with a sport-specific test battery that consisted of 10 sport-specific tests, with subtests for speed and the long jump. These tests were:

Flexibility: Straight leg hamstring, iliopsoas, quadriceps and ankle flexibility (r=0.85-0.99)determined by means of a goniometer in accordance with the method of Harvey and Mansfield.[14] A smaller value in thigh and iliopsoas muscle flexibility indicates improvement, whereas a larger value in the quadriceps and ankle values indicates improvement.

Motor ability components*:* Explosive power was determined by means of the vertical (r=0.93) and horizontal jumps[15] (r=0.88-0.99). The better of two attempts was recorded. Reaction time was determined by means of the ruler test (r=not reported) as described and used by Mckenzie.[16] The better of five attempts on the right and left side was recorded. A maximum speed test (r=0.95) was done across 0-5, 0-10, 0-60, 0-80 and 0-100 metres respectively. Electronic speed timing lights were used in this test and the better of two attempts was recorded.

Strength: Abdominal muscle strength was determined by means of the 7-level abdominal muscle power test.[17]

Muscle endurance: Muscle endurance was determined by doing sit-ups (r=0.94) and modified push-ups (r=0.93) until exhaustion.[15] Speed endurance was tested with the 150 metre speed endurance test as described by Mackenzie.[18]

Stride length: The stride length of the participants was determined by means of the stride length test, as prescribed by Dintiman and Ward.[19] The better of two attempts was recorded.

Acceleration: Acceleration was determined by using a formula described for this purpose by McGinnis.[20] Speed was initially recorded, after which acceleration was calculated.

Speed = distance (m)/time (sec) = m/sec

Acceleration = speed (m/sec)/time (sec) = m/sec/sec

Long jump ability: The long jump ability of the participants was determined by means of a long jump with a 7-stride approach, undertaken without any prior technical coaching.

The experimental group participated in the development intervention programme twice a week during school hours for a period of 10 weeks. The duration of the intervention programme was approximately one- and–a-half hours each day. The experimental and control groups were re-tested after 10 weeks to determine the effect of the development programme.

Development programme

Motor skills	Duration	Exercise
Warm-up	15 minutes	Jog – 2 minutes Aerobic circuit programme Static stretches Ballistic stretches
Speed and reaction time [21,22]	20 minutes	File relay – speed Pass – speed

		Skipping-running – speed Bean bag relay – speed Reaction exercises – reaction time Fox and squirrel – reaction time Underhand slap – reaction time Tail catching – reaction time
Running form drills [19]	10 minutes	Butt kickers Down and offs Ladders African dance Drum major
Speed endurance [19]	10 minutes	"Hollow sprints"
Plyometry [23]	10 minutes	Plyometric circuit programme Bunny hops Hop scotch Lateral leaps Single runs Double leg bound Single leg bound
Power [23]	10 minutes	Leg power Half squat jumps Straddles Core stabilisers Crunches – knees up Bridges

Figure 1: A schematic representation of an intervention session in the development programme

Static and ballistic stretches were done for approximately 10 to 15 minutes before and after the practice session. The practice session consisted of different exercises to develop speed and reaction time in the form of a game, while sport-specific exercises were used to improve running form. The correct execution and technique of the exercises were strongly accentuated.

Speed endurance was exercised by means of "hollow sprints" where the learners started with two sets of 25 metres. Throughout the programme, sets were gradually increased by one set every second week until the experimental subject had performed 7 sets of 25 metres by week 10. One set consists of a 25-metre sprint, 25-metre jog, 25-metre sprint, 25-metre walk. The walk served as the recovery period. A plyometric circuit programme was used to improve explosive power. Two repetitions of the plyometric circuit programme were executed during the practice session with a one-minute rest between each repetition. Leg strength training consisted of half squats (10 in weeks 1-5 and 20 in weeks 6-10) and straddles (20 in weeks 1-5 and 30 in weeks 6-10). Strength and power training was never given on the same day. Core stabilisers were strengthened by means of crunches (2 sets of 10 repetitions in weeks 1-5 and 2 sets of 15 repetitions in weeks 6-10 with a 45-second rest between sets) and bridges (3 repetitions where each had to be maintained for 15 seconds).

Statistical analysis

The Statistica for Windows computer programme, StatSoft [24] was used to analyse the results. A dependent t-test (Table 1) was used to determine the differences between the post-test results of the experimental and control groups respectively. Inter-group comparisons were done by means of an independent t-test in order to indicate statistically significant differences between the experimental and control groups' pre and post-test results. The practical significance of differences between the pre- and post-tests was determined by means of effect sizes (ES) (0.3 is seen as small, 0.5 as moderate and 0.8 as large). As differences were found in the experimental and control groups' pre-test values, an ANCOVA was done to equalise the two groups to determine the effect of the development programme. Adjusted means (Table 2) were calculated with the ANCOVA [25] with the pre-test as co-variable to determine the effect of the development programme. The level of significance was set at $p<0.05$.

Results

The average attendance rate of the 19 girls in the experimental group who participated in the development programme was 85%. Table 1 reflects the results of the experimental and control groups with regard to the pre- and post-test as well as the statistical significance of differences between the respective tests.

The results in Table 1 indicate that the development programme produced practically significant improvement in flexibility, explosive power, abdominal muscle endurance, reaction time, speed, acceleration, speed endurance and the long jump (using a 7-stride approach). Although statistically not significant, the development programme also led to an improvement in the vertical jump, push-ups until exhaustion, as well as in the reaction time on the right-hand side.

The physical attributes that showed no improvement at the end of the development programme were flexibility of the quadriceps (left and right), neutral position of the ankle (left), plantarflexion of the ankle (left) and dorsiflexion of the ankle (left and right).

Abdominal power, 0-5m speed and stride length are motor and physical attributes that decreased. These changes, however, need to be compared to what happened to the control group during this period in order to determine which of the changes can be ascribed to the programme.

Table 1: Comparison of results between the pre- and post-test in the experimental and control groups

Sport-specific tests	**Experimental group (n=19)**				**Control group (n=18)**			
	Pre-test		**Post-test**		**Pre-test**		**Post-test**	
	M	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**
Flexibility (grades)								
Hamstring (L)	91.53	12.63	85.26*	8.25	90.72	10.66	87.06	7.99
Hamstring (R)	93.0	10.99	85.47*	6.91	92.22	6.30	92.11	9.27
Iliopsoas (L)	1.63	9.85	-11.89*	8.53	-11.11	7.86	8.22	6.29
Iliopsoas (R)	-1.0	10.86	-7.68*	9.26	-6.78	4.25	7.28	6.42
Quadriceps (L)	62.47	12.64	61.00	10.29	49.83	12.99	63.06*	10.91
Quadriceps (R)	61.95	14.75	66.37	15.21	56.50	11.38	61.22	12.60
Neutral position of ankle (L)	46.05	7.43	45.26	8.94	57.89	9.04	51.83*	7.85
Neutral position of ankle (R)	45.16	8.24	49.79*	6.70	53.50	6.38	53.50	9.53
Plantarflexion of ankle (L)	74.21	7.66	72.37	7.68	76.72	5.96	71.50*	5.11
Plantarflexion of ankle (R)	71.63	8.07	74.74*	6.00	72.00	6.91	70.94	7.48
Dorsiflexion of ankle (L)	18.11	7.26	19.37	8.22	26.72	9.38	27.56	12.54
Dorsiflexion of ankle (R)	18.21	7.22	17.89	9.55	24.21	8.55	21.11	9.48

Table 1 (continue): Comparison of results between the pre- and post-test in the experimental and control groups

Sport-specific tests	Experimental group (n=19)				Control group (n=18)			
	Pre-test		Post-test		Pre-test		Post-test	
	M	SD	M	SD	M	SD	M	SD
Explosive power (cm)								
Vertical jump	27.16	5.78	29.11	9.43	27.06	4.22	28.61	5.69
Horizontal jump	153.21	15.50	163.84*	14.62	156.56	19.06	158.44	23.35
Strength (levels)								
Abdominal strength (7-level)	3.79	1.72	3.05*	1.93	1.28	1.36	1.22	1.35
Muscle endurance (number)								
Sit-ups	10.84	5.64	24.37*	5.79	28.83	6.76	27.33	5.30
Push-ups	19.26	6.80	22.63	9.74	21.50	5.85	12.33*	6.77
Reaction time (cm)								
Ruler test (L)	18.11	7.90	13.37*	5.35	23.22	8.51	20.39	7.25
Ruler test (R)	16.79	9.24	12.05	6.48	21.03	8.03	19.97	6.87

Table 1 (continue): Comparison of results between the pre- and post-test in the experimental and control groups

Sport-specific tests	Experimental group (n=19)				Control group (n=18)			
	Pre-test		Post-test		Pre-test		Post-test	
	M	SD	M	SD	M	SD	M	SD
Speed (seconds)								
0-5 metre	1.68	0.14	1.73	0.17	1.37	0.11	1.33	0.09
0-60 metre	10.88	0.77	10.52*	0.79	10.40	0.71	10.08*	0.66
0-80 metre	14.35	1.06	13.77*	1.03	13.80	0.95	13.32*	0.89
0-100 metre	18.03	1.37	17.32*	1.34	17.56	1.33	16.82*	1.13
Speed endurance (sec)								
150- m speed endurance	29.96	2.46	26.49*	1.96	27.27	2.09	27.69	1.95
Stride length (cm)								
Stride length (left to right)	179.42	19.57	166.68*	19.00	177.33	22.68	177.89	23.04
Stride length (right to left)	178.63	16.85	173.00	23.84	187.06	27.40	176.56	23.06
Acceleration (m/sec/sec)	0.31	0.05	0.34*	0.06	0.33	0.05	0.36*	0.05
Long jump (metres)								
Long jump with 7-stride approach	314.47	44.53	341.32*	38.00	345.17	54.95	339.39	40.44

* $p<0.05$, (R) - right side, (L) – left side, M – mean, SD – standard deviati

Table 2: Adapted means calculated with an ANCOVA with the pre-test as co-variable

Variables	Group	N	M	SE
Flexibility (grades)				
Straight-leg hamstring (R)	1	19	85.29	1.59
	2	18	92.31	1.63
Ankle plantarflexion (R)	1	19	74.83	1.25
	2	18	70.84	1.28
Muscle endurance (number)				
Modified push-ups	1	19	23.32	1.74
	2	18	11.61	1.79
Reaction time (cm)				
Reaction time (L)	1	19	13.82	1.47
	2	18	19.92	1.51
Reaction time (R)	1	19	12.09	1.58
	2	18	19.93	1.62
Speed (seconds)				
0-5 metre speed	1	19	1.66	0.04
	2	18	1.41	0.04
Speed endurance (seconds)				
150-metre speed endurance	1	19	25.59	0.30
	2	18	28.63	0.31
Long jump (metres)				
Long jump with 7-stride approach	1	19	349.94	6.34
	2	18	330.29	6.52

1 = Experimental group; 2 = Control group; M = adjusted mean; SE = standard error; (R) = right side; (L) = left side

It is evident from Table 1 that certain components also improved statistically significantly in the control group, namely flexibility of the quadriceps on the left side ($p<0.05$), 0-60 metres speed ($p<0.05$), 0-80 metres speed ($p<0.05$), as well as 0-100 metres speed ($p<0.05$). The neutral position of the ankle on the left, plantarflexion of the ankle on the left, as well as push-ups to exhaustion is some of the components that reflected a statistically significant decrease in the control group.

According to the ANCOVA, where the pre-test was used as co-variable in the analysis, the development programme led to a significant increase in two components of flexibility, muscle endurance, reaction time, speed, speed endurance as well as the long jump ability. With regard to flexibility, the development programme contributed to increased flexibility in the right hamstring $F(1.34)=9.49(p=0.004)$, which also recorded a large practical significance (ES=1.01). Plantarflexion of the right ankle also demonstrated improvement $F(1.34)=4.97(p=0.03)$ with a moderate practical significance (ES=0.73). The development programme also contributed to improved upper body muscle endurance with an increased number of modified push-ups $F(1.34)=21.64(p=0.00)$, which reflected a large practical significance (ES=1.56). With regard to reaction time, the development programme contributed to improved reaction time on the left $F(1.34)=7.96(p=0.01)$ and the right $F(1.34)=11.67(p=0.00)$. Both differences in reaction time of the left (ES=0.97) and right (ES=1.16) displayed large practical significance. Furthermore, the development programme contributed to an improvement in the 0-5 metre speed $F(1.34)=14.32(p=0.00)$, which also reflected a large practical significance (ES=1.77). The development programme also led to an improved time in the 150 metre speed endurance $F(1.34)=44.25(p=0.00)$, which also reflected a large practical significance (ES=2.6). With regard to the actual long jump ability, the development programme contributed to an improved distance in the long jump with a 7-stride approach $F(1.34)=4.46(p=0.04)$, which reflected a moderate practical significance (ES=0.73).

Discussion

The improvement of flexibility in six muscle groups in the experimental group compared to one muscle group in the control group can be attributed to the development programme. Furthermore, this is supported by the literature which indicates that flexibility can be improved by regular stretch exercises [5,26]. Plyometric exercises for improving explosive power, which are regarded as an important component for performance in the long jump, contributed to the improvement of both the vertical and horizontal jump ability as supported by various researchers. [19,23,27-32]

The development programme did not bring about an improvement in the abdominal muscle power, probably due to insufficient intensity of the exercise or that the frequency and period of training was too short. Improvement in muscle endurance as depicted by maximum sit-ups can be attributed to the 10 week development programme, since no improvement occurred in the muscle endurance of the control group. The control group had a significant decrease, which can be attributed to the lack of training. The literature indicates that training at least three times per week is necessary to improve muscle endurance.[33,34]

Improved reaction time occurred in both the experimental and control groups. The improved reaction time in the experimental group can possibly result from the exercises during the development programme, seeing that the improvement is considerably larger than that of the control group. Speed showed a statistically significant improvement in both the experimental and control groups. According to Reilly and Stratton [35], the improvement in the control group's speed can be ascribed to improvement in running speed during puberty in girls. During the research, the girls were, according to their age, in the midst of their puberty. The fact that the girls were also involved in organised physical activities during school hours over the 10 weeks of intervention could have contributed to the overall improvement in running speed. If, however, the pre-tests of both groups are taken into account, it is clear from the results in Table 2 that the development programme did indeed contribute to an improvement in the speed component in the experimental group.

The development programme had a positive influence on speed endurance, as indicated by the statistically significant improvement that occurred in the experimental group in the 150-metre speed endurance ability. No improvement was found in the control group. This is supported by Dintiman and Ward [19] and Schmid and Alejo [36] who pointed out that speed endurance can be improved by means of pick-up sprints, hollow sprints, fartlek and interval exercises.

The development programme did not contribute to the improvement of stride length. The reduction in the stride length of both groups can probably be contributed to the significant improvement in the acceleration, since the faster movement associated with acceleration causes a reduction in stride length.[37]

The improvement in reaction time in the experimental group is attributed to the development programme, seeing that no improvement was recorded in the control group.

Conclusion

From the results of this study, it is clear that a 10-week sport talent development programme can be applied successfully in practice to improve long jump and sprinting abilities in 10- to 15-year old girls in disadvantaged circumstances. Motor and physical abilities and skills, which are important for performance in long jump, were addressed positively in this programme.

However, sprinting ability benefited from the programme to a lesser degree. This can be ascribed to different reasons. The programme can, consequently, be improved through slight adjustments with regard to abdominal power, speed, stride length and acceleration. With regard to the long jump, more time can be devoted to explosive power and leg power, while additional and/or more sport specific exercises for improving speed can be implemented in order to improve sprinting performance. The fact that leg power training was included twice a week in this study instead of three times a week can partly be advanced as an argument for the decrease in stride length. Seeing that leg power and flexibility are two important qualifiers of stride length[38], leg power needs to be exercised at least three times a week. Consequently, it is recommended that the programme should be presented at least three times a week. The site on which this programme was presented was also of such a nature that no surface was longer than 25 metres.

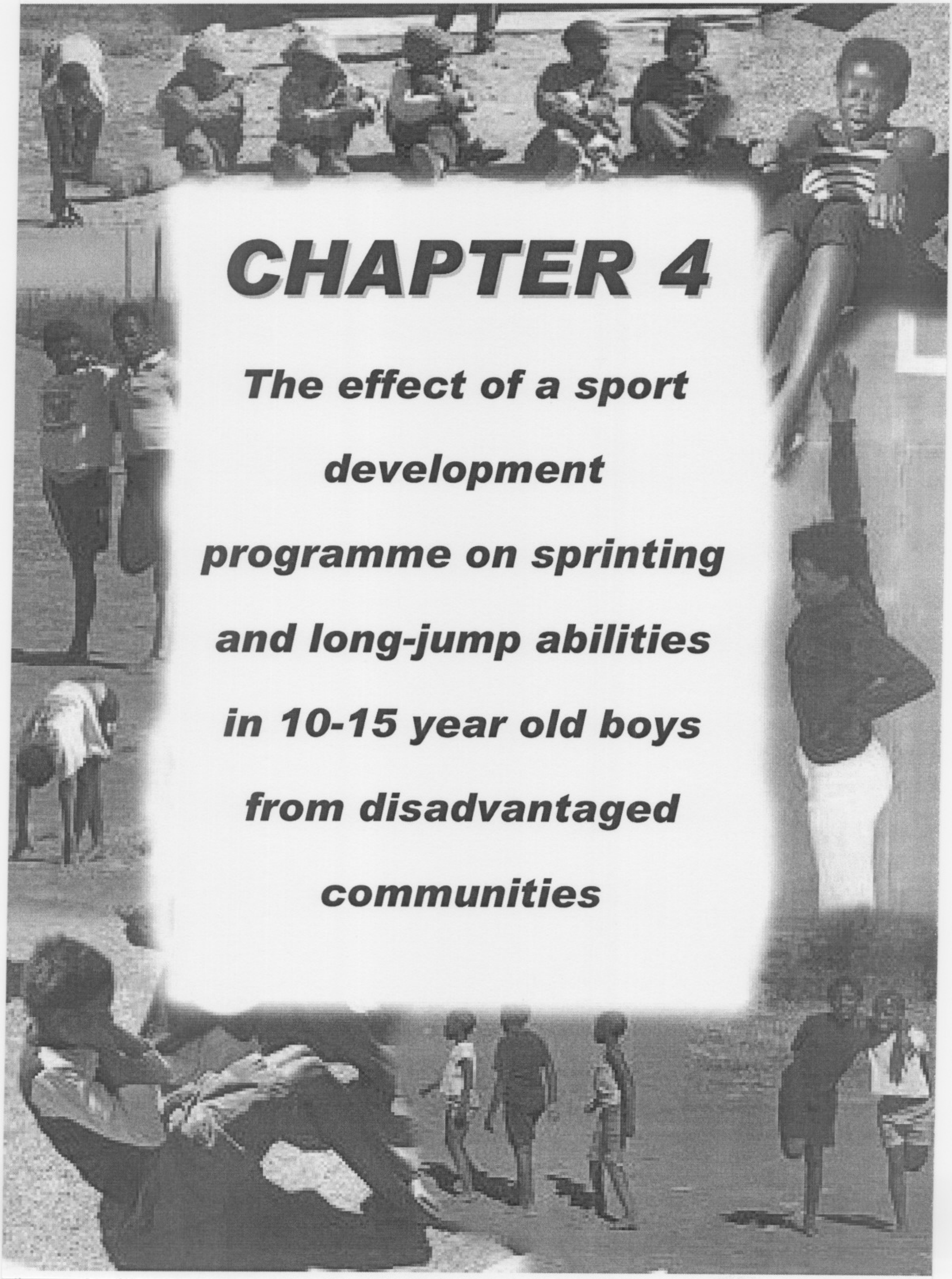
The results, consequently, indicate that a 10-week programme that is presented twice a week for sport talent development (with the necessary adjustments) is an effective method for conditioning motor and physical abilities and skills that are important for performance in sprinting and long jump in talented 10 to 15-year old girls, in spite of poor socio-economic circumstances and environment.

References

1. Boshoff GBE. "Barefoot" sports administrators: laying the foundation for sports development in South Africa. J Sport Manag 1997; 11:69-79.
2. Australian Sports Commission. School teacher manual. Australia: Paragon Printers. 1995. 34p.
3. Danish SJ, Nellen VC. New roles for sport psychologists: teaching life skills through sport to at-risk youth. Nat Ass Phys Educ Higher Educ 1997; 49:100-113.
4. Boreham C, Riddoch C. The physical activity, fitness and health of children. J Sport Sci 2001: 19:915-929.
5. Bompa TO. Periodization, theory and methodology of training. 4th ed. Champaign, IL.: Human Kinetics Publishers, 1999. 413p.
6. Herbst I, Huysamen GK. The construction and validation of developmental scales for environmentally disadvantage preschool children. S Afr J Psychol 2000; 30:19-25.
7. Lee AM. Child-rearing practices and motor performance of black and white children. Res Q Exercise Sport 1980; 54:494-500.
8. Prista A, Marques AT, Maia J. Relationship between physical activity, socioeconomic status, and physical fitness of 8-15-year-old youth from Mozambique. Am J Hum Biol 1997; 9:449-457.
9. Hakkinen K, Mero A, KAuhanen H. Specificity of endurance, sprint and strength training on physical performance capacity in young athletes. J Sports Med Phys Fitness 1989; 29:27-35.
10. Penfold L, Jenkins D. Training for speed. In: Reaburn P, Jenkins D. eds. Training for speed and endurance. NSW, Australia: Southwood Press, 1996: 24-41.
11. Kiefer J. Training and drills for the running long jump. Available at: http://www.coach.org. Accessed 2 August 2004.
12. Moura, N. & Fernandes De Paula Moura, T. Training principles for jumpers: implications for special strength development. Available at: http://www.coachr.org/tpjrs.htm. Accessed 3 October 2005.
13. Van Gent MM. Anthropometrical, physical and motor fitness characteristics of 10- to 15-year old girls in the North West Province. Thesis (M.A.) – PU for CHE, 2001.

14. Harvey D, Mansfield C. Measuring flexibility for performance and injury prevention. In: Gore CJ. ed. Physiological tests for elite athletes. Champaign, IL.: Human Kinetics Publishers, 2000: 98-113.
15. Kirby RF. Kirby's guide to fitness and motor performance tests. Cape Girardeau, Missouri: BenOak Publishing Company, 1991. 454p.
16. Mackenzie B. Reaction time. Available at: http://www.brainmac.demon.co.uk/reaction time.htm. Accessed 2 August 2004.
17. Ellis L, Gastin P, Lawrence S, et al. Protocols for the physiological assessment of team sport players. In: Gore CJ, ed. Physiological tests for elite athletes. Champaign, IL.: Human Kinetics Publishers. 2000: 128-144.
18. Mackenzie B. 150 meter endurance test. Available at: http://www.brainmac.demon.co.uk/end150.htm. Accessed 2 August 2004.
19. Dintiman GB, Ward RD. Sportspeed. 3rd ed. Champaign, IL.: Human Kinetics Publishers, 2003. 271p.
20. McGinnis PM. Biomechanics of sport and exercise. Champaign, IL.: Human Kinetics Publishers, 1999. 406p.
21. Botha H, De Villiers, C. Atletiekpret vir die jongspan. Ficksburg: Ficksburgpers. 1979. 180 pp.
22. Bompa TO. Total training for young champions. Champaign, IL.: Human Kinetics Publishers, 2000. 211p.
23. Chu DA. Jumping into plyometrics. 2nd ed. Champaign, IL.: Human Kinetics Publishers, 1998. 177p.
24. StatSoft. Statistica for Windows: General conventions and statistics. Tilsa, OK: StatSoft; 2004.
25. Thomas JR, Nelson JK. Research methods in physical activity. Champaign, IL.: Human Kinetics Publishers, 1996. 439p.
26. Bloomfield J, Wilson G. Flexibility in sport. In: Elliot, B & Mester, J, eds. Training in sport. Applying sport science. West Sussex, England: John Wiley & Sons Ltd, 1998: 239-284.
27. McNaughton L. Plyometric training exercises for team sports. SC 1988; 11:15-18.
28. Hancock J. Double your strength. RW 1993; 27:42-48.
29. Othersen M. Hops, skips and jumps. RW, 1992; 27:30-31

30. Delecluse C, Van Coppenolle H, Willems E, et al. Influence of high-resistance and high-velocity training on sprint performance. Med Sci Sports Exerc 1994; 1203-1209.
31. Jacoby E, Fraley B. Complete book of jumps. Champaign, IL.: United Graphics, 1995. 146p.
32. Fulcher K, Fox P. Fit for sport. Great Britain, London: Metro Books, 1998. 248p.
33. Wilmore JH, Costill DL. Physiology of sport and exercise.3rd ed. Champaign IL.: Human Kinetics Publishers. 2004. 744p.
34. Howley ET, Franks BD. Health fitness instructor's handbook. Champaign, IL.: Human Kinetics Publishers, 2003. 537p
35. Reilly T, Stratton G. Children and adolescents in sport: physiological considerations. Sports Exerc Injury 1995; 1:207-213.
36. Schmid S, Alejo B. Complete conditioning for soccer. Champaign, IL.: Human Kinetics Publishers, 2002. 184p.
37. Van Holmes C. Running. Available at: http://ihs-ultimate.home.attbi.com/fundamentals/running.html Accessed 1 November 2005.
38. Korchemny R. Training with the objective to improve stride length. Natl Str Cond Assoc J 1988; 10:21-25.



CHAPTER 4

The effect of a sport development programme on sprinting and long-jump abilities in 10-15 year old boys from disadvantaged communities

The effect of a sport development programme on sprinting and long-jump abilities in 10-15 year old boys from disadvantaged communities

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Funding: The National Research Foundation

Acknowledgements: The authors would like to thank Prof. Faans Steyn for assistance with the statistical analysis of the data.

Abstract

Aim. Participation in sport and sport development in disadvantaged communities are hampered by social crises with regard to family, crime, violence, own identity and limitations on recreation and participation in sport. In the rural areas, youth is usually limited to self-built facilities and a lack of the necessary equipment results in almost no opportunity for participation in sport. The aim of this study was to determine the effect of a sport specific athletic development programme for sprinters and long-jumpers for 10 to 15 year old boys.

Methods. The Australian Talent Search protocol was used to identify general sport talent. The talented children then underwent a specific test battery designed for sprinting and long jump. Sixty-two boys between the age of 10 and 15 years from two different farm schools in the Potchefstroom district voluntarily participated in the study. After all the boys (n=62) were subjected to a Talent Search testing protocol, potentially talented athletes (n=21), with a mean age of 12.0 ± 1.67 years, at one of the farm schools were randomly assigned to the experimental group. Furthermore, a control group was selected in the same way consisting of equally talented boys from the other farm school, with an average age of 12.1 ± 1.26 years. Maturity of the boys was determined by means of a maturity questionnaire based on the Tanner stages for pubic hair and genital development.

Results. The results of this study indicate that the development programme contributed statistically significant to flexibility, muscle endurance, 0-40 meter speed and long-jump ability. The components that did not improved were explosive power, reaction time, speed endurance, acceleration and stride length.

Conclusion. The results revealed that a development programme of 10 weeks had a positive effect on the conditioning of motor and physical abilities and skills for sprinting and long-jump in talented 10 to 15 year old boys, regardless of poor socio-economic circumstances and a limited environment.

KEY WORDS: athletics - performance - speed - sprint - long jump - motor development - talent identification

Introduction

Youth from disadvantaged communities in South Africa are confronted with social crises with regard to family, crime, violence, own identity and limitations on recreation and participation in sport. The community, especially in the rural areas, is usually limited to self-built facilities and a lack of the necessary equipment results in almost no opportunity for participation in sport.(1) Furthermore, Chappel (2) is of the opinion that the level of poverty in these disadvantaged communities places a further hindrance on participation in sport, as financial resources are used primarily to address the immediate social problems.

Except for socio-economic status, an individual's participation in sport is often determined by social factors, tradition, ideals, desire to participate in popular types of sport, parental pressure, a teacher's expertise and the availability of the necessary infra-structure and sporting facilities.(3) Other factors that could also influence participation in sport are the physiological, anthropometrical and psychological factors and heredity.(4-7)

Biological maturation, which is prevalent in boys between the ages of 11.75 and 14.85 years of age, is a further important factor which can influence sport performance abilities, especially in the adolescent years.(8) The rate at which biological maturation takes place is, therefore, not necessarily the same as the child's chronological age. In some instances some children are biologically more advanced than their chronological age (early developers), while the opposite is also true (late developers). As a result these differences in individuals with the same chronological age can affect their performance abilities.(8)

It is often argued that the outcome of a competition is the best form of talent identification because the best or most talented athletes usually perform at these events.(6) Biological maturation is not taken into account in these events and the opportunity for children from disadvantage communities to participate in these events is relatively small, taking into account that transport and financial supportt is not readily available.(9) This can lead to children who are not exposed to competitions are overlooked and in so doing potential talent is lost to the world of sport. It could also be possible that those who do not show potential during the competitions as well as those who show a degree of potential, could have the potential to perform well in another sport, but not know this as they have never been evaluated. From this discussion it is clear that many potentially talented children in disadvantaged communities sometimes do not receive the opportunity to participate in sport due to the restrictions placed on them, which eventually leads to their talent never being discovered or developed. This is an indication of the importance of talent identification in disadvantaged communities, which must be conducted in a scientific manner, as well as the development of these athletes who have been identified with potential.

Motor and physical abilities such as speed, explosive power, muscle strength and endurance are important contributors to performance in sport.(10) If abilities and skills with regard to performance in a specific sport are to be improved in a development programme, then the training must be specific with regard to that type of sport.(11)

An analysis of sprinting indicated that it is comprised of various components, e.g. the take-off, acceleration, maximum speed and speed endurance.(12) According to Dick, as quoted by Bowerman and Freeman (13) for a sprinter to perform he must posess a good sprinting technique as well as motor and physical characteristics which consist of aerobic endurance, strength and speed abilities, maximum strength and speed. Penfold and Jenkins (11) concur by indicating that reaction time, increased velocity, maximum speed, balance, flexibility and speed endurance must be trained to enable the athlete to develop maximum speed.

With regard to long-jump, Kiefer (14) indicates that this item, in relation to other athletic items, demands a large amount of athletic abilities. Researchers (14 15) indicate that speed, explosive power, strength and flexibility are important motor abilities that can contribute to performance in long-jump. A long-jump athlete must be able to obtain maximal speed, which is of great importance during the run-up. Explosive power allows the athlete to control the direction of the centre of gravity, while flexibility allows the athlete to participate without injury to the muscles, connective tissue and joints which plays a major role during the ballistic input placed on an athlete during long-jump.(14) Strength endurance and maximum strength form an important foundation for the improvement of special strength aspects as well as the prevention of injuries.[15] From the abovementioned, it is clear that sprinting and long-jump possess many similar underlying components.

Limited research findings with regard to the specificity of training and development of various physical and motor abilities that are important for performance in sprinting and long-jump in young athletes has, however, been published. Little research also exists on the effect of the level of maturity on performance in young athletes with potential. As a result, the aim of this study is to determine the influence of a sport development programme to improve sprinting and long-jump ability in 10 to 15 year old potentially talented boys from disadvantaged communities.

Materials and methods

Subjects

Sixty-two boys between the age of 10 and 15 years from two different farm schools in the Potchefstroom district 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 of or those living on farms close to the schools. Both the children and their parents were informed as to the nature of the project and the parents signed an informed consent form. This study received ethical approval from the North-West University (Number 04M12). Thirty-two of the 39 experimental subjects who were initially in the experimental and control groups completed the study. The information of five boys in the experimental group and of two in the control group was incomplete consequently their data had to be omitted and resulted in an experimental group of 16 and a control group of 16. After all the boys (n=62) were subjected to a talent search testing protocol, potentially talented athletes (n=21) with a mean age of 12.0 ± 1.67 years at one of the farm schools were randomly assigned to the experimental group. Furthermore, a control group was selected in the same way consisting of 18 boys from another farm school, with an average age of 12.1 ± 1.26 years. Maturity of the boys was determined by means of a maturity questionnaire (by means of a black interpreter) based on the Tanner stages for pubic hair and genital development.[8] This biological maturity (BMQ) questionnaire is based on the study of Duke et al.[16] and Ricky et al.[17], as well as the recommendations of Docherty.[18] The above maturity classification was determined by means of two questions that each of the subjects had to answer.

They were asked to choose a line diagram (from the five Tanner stages) that represented their own genital (G1-G5) and pubic hair (PH1-PH5) development the most. Thirty boys (of the initial 39) consented to complete the maturity questionnaire.

The five general stages for pubic hair and genital maturation as described by Tanner [8] are described as follows: Stage 1 indicates the prepubertal state or the absence of development of each characteristic. Stage 2 indicates the early puberty state or the initial, overt development of each characteristic. Stage 3 and 4 indicate the midpuberty state which indicates continued maturation of each characteristic, while stage 5 indicates the adult of mature state for each characteristic.

Experimental protocol

All the boys between 10 and 15 years in the experimental (n=31) and control (n=31) groups were tested by means of the Australian Talent Search protocol.[19] It is an existing protocol that is used to identify general sports talent and consists of 10 test elements namely, body mass, stature, sitting height, arm span, basket ball throwing, throwing and catching, vertical jump, 40-metre sprint, flexibility and endurance. The most talented children were identified based on percentile scales that were compiled for boys between 10 and 15 years in the North West Province with the protocol from the Thusa Bana study. These percentiles were used to identify the most talented (top 30%) boys from the 62 initial participants. Rank order of the results in the 100 metre and long-jump tests was also used to identify the potential talented children. This resulted in 21 boys in the experimental group and 18 boys in the control group respectively. These boys were then tested again by a sport specific test battery that consisted of 10 sport specific tests with subtests for speed and long-jump. These tests were:

Flexibility: The sit-and-reach test (r=0.99) was used to determine the flexibility of the hamstrings, while flexibility of the iliopsoas, quadriceps and ankle (r=0.85-0.99) was determined by means of a goniometer in accordance with the method of Harvey and Mansfield.[20] A smaller value in thigh and iliopsoas muscle flexibility indicates improvement whereas a larger value in the hamstring, quadriceps and ankle values indicates improvement.

Motor ability components: Explosive power of the leg muscles was determined by means of the vertical (r=0.93) and horizontal jumps[21] (r=0.88-0.99). The better of two attempts was recorded. Reaction time was determined by means of a 0-5m speed test. The test was started with the blow of a whistle while the participant was in a crouched position. Maximum speed (r=0.95) over 100 metres was measured with speedlights on 40, 60, 80 and 100 metres. Electronic timing lights (Brower timing systems) were used in this test and the better of two attempts was recorded.

Endurance: Abdominal (a) and upper body muscle endurance (b) were respectively determined by means of sit-ups (r=0.94) (a), push-ups (r=0.93) and pull-ups (r=0.89) (b) until exhaustion.[21] Speed endurance was tested by the 120 metre speed endurance test as prescribed by Dintiman and Ward.[22]

Stride length: The stride length of the participants was determined by means of the stride length test, as prescribed by Dintiman and Ward.[22] The better of two attempts was recorded.

Acceleration: Acceleration was determined by using a formula described for this purpose by Dintiman and Ward.[22] Subtract the flying 40m time from the stationary 40m time. The difference between the stationary 40m time and the flying 40m time is the time delay required to accelerate.

Long jump ability: 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.

Intervention programme

The experimental group participated in the sprint and long jump developmental programme three times a week during school hours for a period of 10 weeks (30 sessions). The duration of the programme was approximately half an hour on two days and an hour and a half on one of the allocated days. These times were determined by available time that was allocated by the school. Both the experimental and control group (who didn't participated in any programme) were retested after 10 weeks to determine the effect of the development programme. The program consisted of exercises aimed to develop both long jump and sprinting ability. Table I provides a brief outline of this programme.

TABLE I. - *Outline of the development programme*

Components	Activity	Intensity	Frequency
Warm-up 10-15 minutes	Jog Aerobic circuit programme Static stretches Ballistic stretches		3 x per week
Speed and reaction time [7 23] 15 minutes	0-5 metres on whistle from different positions Underhand slap 50 metre sprints Beenbag relay	1-10 repetitions 5 repetitions, increased with one every second week	3 x per week
Running form drills [22] 10 minutes	Sitting & standing arm swings Butt kickers Down and offs African dance Drum major Ladder drills	3 x 15 sec, 15 sec rest 3 x 20m 3 x 20m 3 x 20m 3 x 20m 3 x 4m ladder	3 x per week
Speed endurance [22] 15 minutes	60-80 metres with walk back as recovery, progress, jog back as recovery	Week 1-5 3 x 60m 3 x 80m Week 6-10 80m repetitions increased with one every second week up to 6 x 80m	3 x per week

TABLE I (cont.). - *Outline of the development programme*

Components	Activity	Intensity	Frequency
Plyometry [24] 15 minutes	Plyometric circuit programme • Bunny hops • Hop scotch • Lateral leaps • Single runs • Double leg bound • Single leg bound	Week 5 – 10 2 x with 1 minute rest	2 x per week
Strength [24] 15 minutes	Leg strength Assisted squats Walking lunges Core strength Medicine ball crunches Partner leg raise	3 sets of 5 reps, increase to 3 sets of 15 reps 2 sets of 10 reps increased by 2 reps every second week	1 x per week
Warming down 10 minutes	Jog Static stretches (as in warm-up)		3 X per week

The practice session focused on exercises aimed to develop both sprint and long-jump ability and consisted of different exercises to develop running form, speed, reaction time, leg strength, power and speed endurance. The correct execution and technique of the exercises were strongly accentuated.

Running form was exercised by using sitting and standing arm swings, buttock kicks, down and offs, African dance, drum major and stick drills.[22] Reaction time was exercised by letting the participant lie in different positions and when the coach blows the whistle, the children had to react as quickly as possible and run towards a beacon 5 metres further. Reaction time was exercised in a playful manner together with the above mentioned exercises. Speed was exercised using maximum sprints over 50 metres with 3-5 minutes rest between each exercise. Once a week speed was also exercised in a playful manner based on exercises described by Bompa [7] together with the maximum sprint exercises.

Statistical analysis

The Statistica for Windows computer programme [25] was used to analyze the results. Scatter plot graphs based on a regression analysis were used to determine the effect, if any, of maturity on the post-test of both groups. However, although differences occurred in the maturity status of the group (see Table II), this analysis indicated that these differences had no effect on the post-test results and was therefore not further used in the analysis. Inter-group comparisons (Table III) were done by means of an independent t-test in order to indicate statistically significant differences between the experimental and control group's pre- and post-test results. The practical significance of differences between the pre- and post-test was determined by means of effect sizes (ES) (0.3 is seen as small, 0.5 as moderate and 0.8 as large). Differences were found between the pre-test values of the experimental and control group, therefore an ANCOVA was done to even the two groups in order to determine the effect of the development programme. Adjusted means (Table IV) were, therefore, calculated for the post-test with an ANCOVA [26] where the pre-test was used as a co-variable to determine the effect of the development programme. The level of significance was set at $p<0.05$.

Results

Table II gives an indication of the age distribution as well as the mean maturing levels of the various subjects (Tanner phases G1-G5 en PH1 – PH5). From this it is clear that the genital development of the boys in the control group was at a slightly more mature stage than those of the boys in the experimental group, due to the development of these test subjects being distributed between phases two and four, whereas all the development of the subjects in the experimental group fall within phases 1 and 3. With regard to the pubic hair development, both groups fall within phases one to three which is an indication that the two groups were more or less on the same maturity level. The slightly higher maturity level of the control group can possibly be attributed to the fact that the control group had more 13 year olds and one 14 year old, whereas the experimental group consisted of a higher number of 10 and 11 year old boys. It must, however, be taken into account that seven boys (13, 14 and 15 years of age) in the experimental group and two in the control group (10 and 12 years) would not give permission to complete the questionnaire.

TABLE II.- *Age distribution and mean maturation levels of the test subjects*

		Experimental group									
Age	*n*	Genital development					Development of pubic hair				
		G1	G2	G3	G4	G5	PH1	PH2	PH3	PH4	PH5
10	5	4		1			4		1		
11	6	1	3	2			2	2	2		
12	2	1	1				1	1			
13	1		1						1		
14											
Total	14	6	5	3	0	0	7	3	4	0	0
		Control group									
10	2		1	1				1	1		
11	2		2					2			
12	1	1						1			
13	10		3	4	3		1	4	5		
14	1			1				1			
Total	16	1	6	6	3	0	1	9	6	0	0

G1-G5 = Stages for genital maturation; PH1-PH5 = Stages for pubic hair

The average attendance of the 16 boys in the experimental group in the development programme was 89%. The results of the experimental and control groups with regard to the pre- and post-tests, as well as the statistical significance within group differences between the pre- and post-tests in each group are displayed in Table III. These results indicate significant improvements in the experimental group, compared to significant weakening in the control group in some of the variables.

TABLE III.- *Intra-group differences between the pre-test and post-test in the experimental and control groups*

	Experimental group (n=16)				Control group (n=16)			
Sport specific tests	Pre-test		Post-test		Pre-test		Post-test	
	M	SD	M	SD	M	SD	M	SD
Flexibility								
Sit and reach (cm)	41.66	5.91	47.29*	5.56	45.06	4.05	44.98	4.83
Iliopsoas(°)(L)	-1.00	5.50	-2.00	4.92	-0.75	7.39	2.31	5.71
Iliopsoas (°)(R)	3.38	6.75	0.75	4.49	-0.38	9.07	-1.97	3.97
Quadriceps(°)(L)	70.56	11.87	76.44	9.36	72.44	1.26	75.56	6.68
Quadriceps(°)(R)	70.63	5.98	77.81*	6.67	72.69	13.57	75.19	9.32
Ankle flexibility(°)(L)	51.00	10.97	55.31	8.50	53.56	8.11	57.56	8.87
Ankle flexibility(°) (R)	47.56	8.84	55.25*	10.08	48.81	6.62	53.75	9.42
Explosive power (cm)								
Vertical jump	29.31	5.49	32.31	7.42	26.63	4.27	27.13	4.43
Horizontal jump	151.25	21.60	167.19*	21.18	150.06	16.02	155.31	16.94
Muscle endurance (maximum number)								
Sit-ups	40.19	15.00	46.06	15.94	51.75	20.85	43.06	16.02
Pull-ups	3.75	2.86	5.25	3.07	3.44	2.39	2.06	2.14
Push-ups	14.69	6.00	18.06	7.13	14.69	8.56	10.63	5.84
Reaction time (sec)								
0-5 m test	1.86	0.14	1.70*	0.09	1.76	0.15	1.82	2.20

TABLE III (cont.).- *Intra-group differences between the pre-test and post-test in the experimental and control groups*

Sport specific tests	Experimental group (n=16)				Control group (n=16)			
	Pre-test		Post-test		Pre-test		Post-test	
	M	SD	M	SD	M	SD	M	SD
Running speed (seconds)								
0-40 m	7.41	0.48	7.3	0.46	7.44	0.42	7.60	0.44
0-60 m	10.52	0.76	10.38	0.74	10.79	0.66	10.91	0.62
0-80 m	13.75	1.09	13.60	1.04	14.25	0.90	14.27	0.96
0-100 m	17.11	1.39	16.94	1.37	17.75	1.14	17.76	1.29
Speed endurance (sec)								
Speed endurance	0.91	0.29	0.78	0.23	0.44	0.24	0.66	0.43
Acceleration (sec)	1.07	0.26	1.03	0.12	0.64	0.26	0.99*	0.37
Stride length (cm)								
Stride length (left to right)	139.69	21.73	143.88	18.40	131.63	15.69	136.00	13.12
Stride length (right to left)	138.06	16.35	146.81	23.93	132.25	20.79	143.75	18.84
Long jump (meters)								
Long jump with 7-stride approach	314.94	32.01	332.38	34.79	312.38	26.32	287.75*	34.18

* $p<0.05$, (R) - right side, (L) – left side, M – mean, SD – standard deviation

Because there were significant inter-group differences in the pre-testing of the experimental and control groups, an ANCOVA was performed where statistical adjustments were made to correct for the differences to eventually verify the effect of the programme. Statistically significant pre-testings differences identified in this manner were also tested with regard to the practical significant effect thereof.

According to the results analyzed in this manner and displayed in Table IV, the development programme led to statistically significant improvements in aspects of flexibility, muscle endurance, speed and long-jump ability. Although not statistically significant, the development programme also contributed to improvement in the vertical jump, muscle endurance, speed, speed endurance, acceleration, stride length and long-jump with a seven stride run-up of the children in the experimental group (Table III). The only two significant changes that were apparent in the control group (but which indicated a weakening) were in velocity and long-jump with a seven stride run-up.

TABLE IV.- *Significant differences in the adjusted post-test means of the experimental group (n=16)*

Variables	Group	M	SE	ES
Flexibility				
Sit and reach	1	48.90	0.52	
	2	43.36	0.52	2.75
Iliopsoas (L)	1	-1.62	1.29	
	2	2.30	1.29	0.76
Iliopsoas (R)	1	0.24	0.94	
	2	5.01	0.94	1.29
Muscle endurance				
Pull-ups	1	5.12	0.40	
	2	2.19	0.40	1.84
Push-ups	1	18.06	1.33	
	2	10.63	1.33	1.39
Running speed				
0-40 metres	1	7.32	0.64	
	2	7.59	0.64	1.04
Long-jump ability	1	331.30	6.13	
Long-jump with 7 stride approach	2	288.83	6.13	0.73

1 = Experimental group; 2 = Control group; M = adjusted mean; SE = standard error; ES = effect size; (R) = right side; (L) = left side

According to the results of the ANCOVA (Table IV), where the pre-test was used as a co-variable in the analysis of the corrected pre-test differences between the groups, it is apparent from the adapted post-test means that the development programme contributed to a significant improvement in three components of flexibility, two of muscle endurance, speed and long-jump with a seven stride run-up. With regard to flexibility, the development programme contributed to improved flexibility in the hamstring groups F(1.29)=53.88(p=0.000), with a large practical significance (ES=2.75). Improvement in flexibility of the left iliopsoas F(1.29)=4.63(p=0.04) as well as the right iliopsoas F(1.29)=12.55(p=0.001) indicated a large practical significance of EG=0.76 and ES=1.29 respectively. The development programme also contributed to an improvement in muscle endurance in the upper body, as determined by an improved number of pull-ups F(1.29)=26.93(p=0.000) and push-ups F(1.29)=15.56(p=0.000) up to exhaustion. Improvements in both pull-ups (ES=1.84) and push-ups (ES=1.39) showed a large practical significance. With regard to the running speed, the development programme also contributed to a significant improvement F(1.29)=8.72(p=0.006) with a large practical significance (ES=1.04). Lastly the development programme led to the improvement of the boys' long-jump abilities as determined in the seven stride run-up F(1.29)=23.97(p=0.000) with a moderate practical significance (ES=0.73).

Discussion

The practically significant improvement of flexibility in the experimental group corresponds with the findings of Bloomfield and Wilson [27], Bompa [28] and Dintiman and Ward.[22] The improvement in muscle endurance abilities can also be attributed to the development programme, as no improvement (mean values indicate a weakening) in the muscle endurance of the control group was apparent. The literature indicates that training three times per week is necessary to accomplish an improvement in muscle endurance abilities.[29 30]

The statistically significant improvement in the 0-40 metre speed (Table IV) can be attributed to the development programme, as no improvement was visible in the control group. Dintiman and Ward [22] indicate that optimal speed can be improved by repeated sprints with sufficient rest between each attempt. These findings support the fact that speed can be improved by way of training, regardless of the fact that genes play a large role in the individual's natural speed talent.[7]

With regard to the long-jump with a seven stride run-up it is clear that the development programme contributed to the improvement in the experimental group, as there was a statistically significant weakening in the control group. McNaughton [31], Hancock [32], Othersen [33], Delecluse et al. [11], Jacoby and Fraley [34], Chu [23], Fulcher and Fox [35] and Dintiman and Ward [22] are of the opinion that the use of plyometric exercises such as those used in this exercise program can contribute to the practically significant improvement in long-jump distance.

Conclusions

From the results obtained in this study it is clear that the item specific development programme of 10 weeks that was developed for this study can be applied in practice to improve the long-jump and sprinting potential in 10-15 year old potentially talented boys from disadvantaged communities. The programme exhibits a few shortcomings that need to be addressed to improve the effectiveness thereof further.

As running speed exhibited no statistically significant improvement (except in the 0-40m), a recommendation is made that an adaptation be made to this component of the programme to ensure development. Sessions of a longer duration or more sessions per week with specific exercises to improve speed and speed endurance are also recommended. With regard to abdominal muscle endurance, it is recommended that more sessions be done with the specific exercise, as it is clear that one session per week is not sufficient to improve the abdominal muscle strength and endurance.

As growth and development still take place at the ages of 10 to 15 years and, therefore, can still contribute to individual differences, it must be taken into account that this specific development programme could possibly only have an application value on boys at a specific maturity level and may not have the same effect if applied to younger or older boys.

When judging the generalization of the study, it must be remembered that the programme was developed from the information obtained from a group of athletes from disadvantaged communities. Exercises were adapted to the infrastructure and terrain that was available. This could result in the sport development programme having a different effect on children from privileged communities with the necessary infrastructure and terrain on which to train. Therefore, it is recommended that follow-up studies be performed to analyze the practical value of this development programme further. A further recommendation is that more subjects be used to be able to make more generalized assumptions. The programme should also be adapted with regard to the maturity levels of the boys and it might be better to have less variance in the maturity levels.

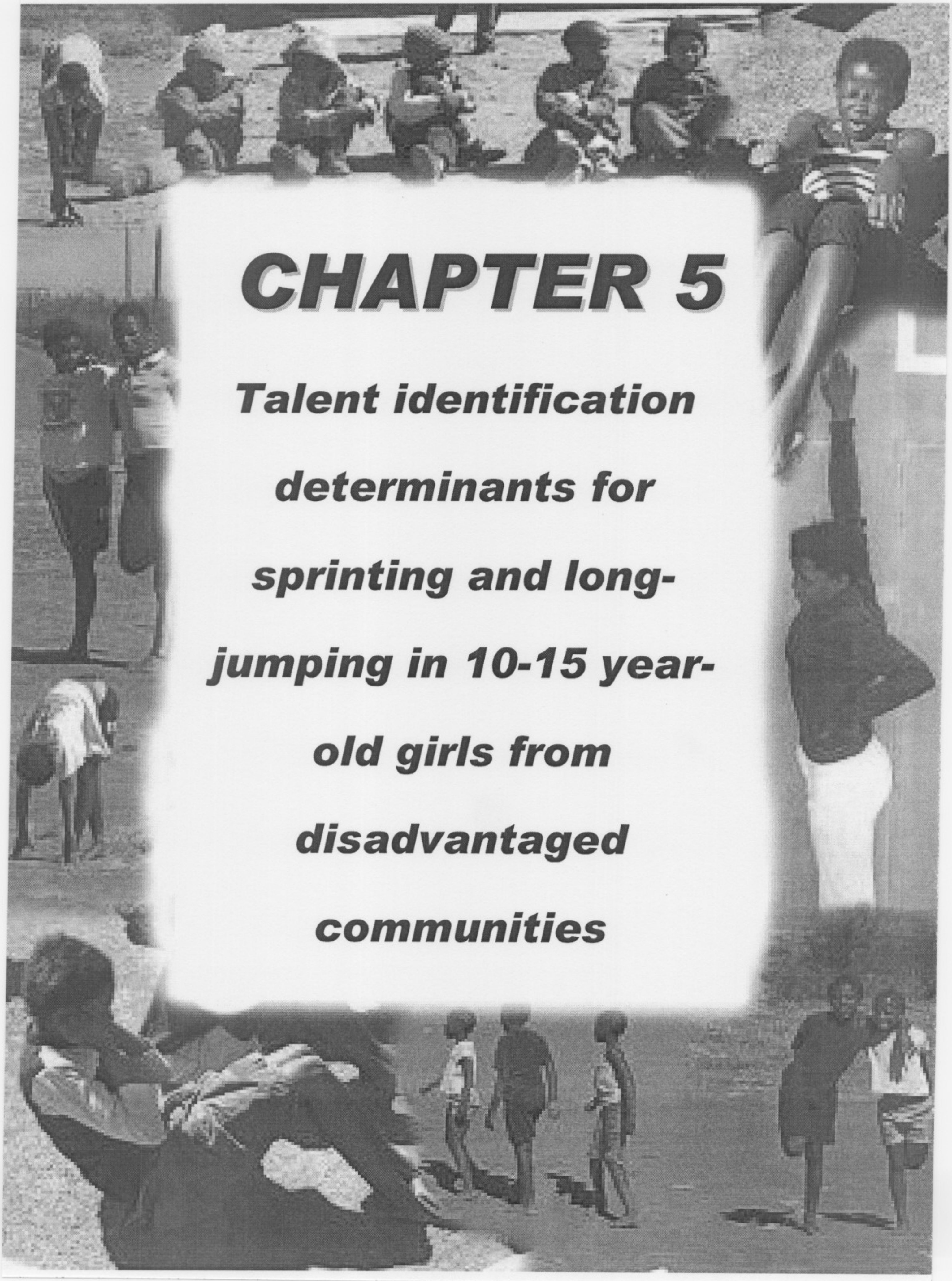
The results, however, indicate that an item specific development programme of 10 weeks, which is offered three times a week with the aim of developing sprinting and long-jump talent, had a positive effect on the conditioning of motor and physical abilities and skills in talented 10 to 15 year old boys, regardless of poor socio-economic circumstances and a restricted environment.

References

1. Goslin A. Human resource management as a fundamental aspect of a sport development strategy in South African communities. J Sport Manag 1996; 2:207-217.
2. Chappel R. Sports development in Botswana, Africa. The Sport Journal 2004; 7.
3. Burgess R. Talent identification. Available at URL: http://www.faccioni.com/reviews.talentid.htm. Accessed 2 Augustus 2005.
4. Jarver J. Do we need talent identification? Mod Athlete Coach 1982; 1:7-8..
5. Hahn A. Identification and selection of talent in Australian Rowing. Excel 1990; 3:5-11.
6. Peltola E. Talent Identification. New Stud Athlet 1992; 3:7-12.
7. Bompa TO. Total training for young champions. Champaign, IL.: Human Kinetics Publishers; 2000.
8. Malina RM, Bouchard C, Bar-Or O. Growth, maturation, and physical activity. 2nd ed. Champaign, IL.: Human Kinetics Publishers; 2004.
9. Burnett C, Hollander W. Sport development and the United Kingdom-South Africa Sports Initiative: A preevaluation report. J Sport Manag 1999; 13:237-51.
10. Hakkinen K, Mero A, Kauhanen H. Specificity of endurance, sprint and strength training on physical performance capacity in young athletes. J Sports Med Phys Fit 1989; 1:27-35.
11. Penfold L, Jenkins D. Training for speed. In: Reaburn P, Jenkins D, editors. Training for speed and endurance. NSW, Australia: Southwood Press; 1996.p.24-41.
12. Delecluse C, Van Coppenolle H, Willems E, Van Leemputte M, Diels R, Goris M. Influence of high-resistance and high-velocity training on sprint performance. Med Sci Sports Exerc 1994; 8:1203-9.
13. Bowerman B, Freeman B. High-performance training for track and field. 2nd ed. Champaign, IL.: Leisure Press. 1991.
14. Kiefer J. Training and drills for the running long jump. Available at URL: http://www.coach.org. Accessed 2 August 2004.
15. Moura NA, Fernandes De Paula Moura T, Borin JP. Approach speed and performance in the horizontal jump: what do Brazilian athletes do? Available at URL: www.global-athletics.com. Accessed 2 September 2005.

16. Duke PM, Litt IF, Gross RT. Adolescents' self-assessment of sexual maturation. Pediatr 1980; 66:918-20.
17. Ricky L, Williams RL, Cheyne KL, Houtkooper LK, Lohman TG. Adolescent self-assessment of sexual maturation: effects of fatness classification and actual sexual maturation stage. J Adol Health Care 1988; 6:480-82.
18. Docherty D. Measurement in pediatric exercise science. Champaign, IL.: Human Kinetic Publishers; 1996.
19. Australian Sports Commission. School teacher manual. Australia: Paragon Printers, 1995.
20. Harvey D, Mansfield C. Measuring flexibility for performance and injury prevention. In: Gore CJ, editor. Physiological tests for elite athletes. Champaign., IL.: Human Kinetics Publishers; 2000.p. 98-113.
21. Kirby RF. Kirby's guide to fitness and motor performance tests. USA: BenOak Publishing Company; 1991.
22. Dintiman GB, Ward RD. Sportspeed. 3rd ed. Champaign, IL.: Human Kinetics Publishers; 2003.
23. Botha H, De Villiers C. Atletiekpret vir die jongspan. Ficksburg: Ficksburgpers. 1979.
24. Chu DA. Jumping into plyometrics. 2nd ed. Champaign, IL.: Human Kinetics Publishers; 1998.
25. StatSoft. Statistica for Windows: General conventions and statistics. Tilsa, OK: StatSoft; 2004.
26. Thomas JR, Nelson JK. Research methods in physical activity, Champaign, IL.: Human Kinetics; 1990.
27. Bloomfield J, Wilson G. Flexibility in sport. In: Elliot B, Mester J, editors. Training in sport. Applying sport science. West Sussex, England: John Wiley & Sons Ltd; 1998.p. 239-84.
28. Bompa TO. Periodization, theory and methodology of training. 4th ed. Champaign, IL.: Human Kinetics Publishers; 1999.
29. Howley ET, Franks BD. Health fitness instructor's handbook. Champaign, IL: Human Kinetics Publishers; 2003.
30. Wilmore JH, Costill DL. Physiology of sport and exercise. 3rd ed. Champaign IL.: Human Kinetics Publishers; 2004.

31. McNaughton, L. Plyometric training exercises for team sports. Sports Coach, 1988; 4:15-18.
32. Hancock J. Double your strength. RW 1993; 3:42-8.
33. Othersen M. Hops, skips and jumps. RW 1992; 10:30-1.
34. Jacoby E, Fraley B. Complete book of jumps. Champaign, IL.: United Graphics; 1995.
35. Fulcher K, Fox P. Fit for sport. Great Britain, Wales: CPD Group; 1998.



CHAPTER 5

Talent identification determinants for sprinting and long-jumping in 10-15 year-old girls from disadvantaged communities

Talent identification determinants for sprinting and long-jumping in 10-15 year-old girls from disadvantaged communities

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Funding: The National Research Foundation

Acknowledgements: The authors would like to thank Prof. Faans Steyn for assistance with the statistical analysis of the data.

Abstract

Background

The development of young athletes with talent for sprinting and long-jumping can benefit from scientific talent identification (TID), but limited research exists pertaining to TID among young girl athletes and specifically those from disadvantaged communities.

Objective

The aim of the study was to identify kinanthropometric, physical and motor variables important for performance in sprinting and long-jump in 10 to 15 year-old girls from disadvantaged communities.

Type of study

Once-off cross sectional research design.

Methods

Subjects

All girls between ages 10 and 15 from two schools (N=66) who consented to participate in the study.

Experimental procedure

Sixty-six girls (N=66) were subjected to the Australian Talent Search protocol to identify general sports talent. A sport specific test battery was compiled from the analysis of the demands set by these two sports codes (sprint and long jump) by means of which the performance potential for sprinting and long-jump can be tested. This battery of tests includes five kinanthropometric measurements and 28 physical and motor tests. The most talented girls (n=37) were then subjected to this sport specific protocol. The Pearson correlation coefficient method was used to reduce the number of initially selected variables from 33 to 17. Stepwise multiple regression analysis was then performed to determine the variables with the largest contribution to sprinting and long-jumping ability from this best selected subset of 18 variables. Effect sizes were subsequently determined to establish the practical significance of the contribution of each of the variables.

Results

The results indicated that long-jump with a 7-stride approach, push-ups to the point of exhaustion, 7-level abdominal strength, 0-5 metre speed, ankle dorsiflexion, stature and age contributed to 84% of the total variance in 100 metres sprinting. With regard to long-jump, the results indicated that 0-100 metres speed, stature, 7-level abdominal strength, push-ups, ankle dorsiflexion, standing long-jump and body mass contributed to 79% of the total variance.

Conclusions

This study indicated that kinanthropometric, physical and motor variables are all important performance determinants in sprinting and long-jump. The identified seven determinants for sprinting and long-jumping, can enable coaches and sports scientists to further classify girls who display talent as sprinting and long-jump athletes, and then develop the potential of the athletes accordingly.

Key Words: talent identification, sprinting, long-jump, prediction of performance, physical and motor fitness, kinanthropometry

Introduction

Talent identification (TID) in sport based on scientific principles is still relatively new in South Africa[1], although talent identification through participation in competitive sports has already been used for a considerable period.[2] The former East Block countries such as the German Democratic Republic, Soviet Union, Bulgaria and Romania are examples of countries which have already systematically been using talent identification programmes as early as the 1960s and 1970s.[3] The success achieved through this in sport in Eastern Europe has led to systematic talent identification processes increasing world wide.[4]

As part of the talent identification process in sport, researchers have pointed out that when sport specific talent identification models need to be developed, several aspects such as kinanthropometric, physical, motor and psychological characteristics should be taken into account.[3-6] In this regard, Bompa[3] indicated that performance in sprinting and long-jump depends on physical factors such as reaction time, explosive power, a good anaerobic capacity, a long stature to torso ratio with long lower limbs.

Several studies have already reported prediction functions on female athletes for sports code such as tennis[7], swimming[7], ice-skating[7], volleyball[7], and basketball.[8-10] Concerning athletics, only one study could be found, which was conducted on 12-18 year-old girls.[11]

The question which consequently needs to be answered through this research is which kinanthropometric, physical and motor components play such a role in the age group 10 to 15 years that it can predict performance in sprinting and long-jump in girls. Answering this question will not only make available more knowledge pertaining to important talent identification determinants for sprinting and long-jump at an early age in girls, but it can also enable coaches to compile training programmes for developing the components which are specifically important for performance in sprinting and long-jump at this age.

Methods

Subjects

Sixty-six girls between ages 10 and 15 from two different farm schools in the Potchefstroom district 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 of those living on farms close to the school. This study received ethical approval from the North-West University (Number 04M12). Both the parents and their children were informed as to the nature of the project, and the parents of the 66 children signed an informed consent form.

Test procedure

The 37 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 in order to establish which factors play a role in sprinting and long-jump performance. This analysis served as a criterion for the selection of the five kinanthropometric measurements and 28 physical and motor tests as well as a biological maturation questionnaire. Subsequently a more complete description of these 33 tests will be rendered.

Kinanthropometric talent identification prediction measurements

The measurement protocol, as recommended by the International Work Group on Kinanthropometric Analyses (IGWK) was used in this study.[12] Since the group consisted of 10-15 year-old girls, age was used as a variable and the following kinanthropometric 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.[13]

Physical and motor tests

Flexibility: The sit and reach test (r=0.99) was used to determine the flexibility of the hamstrings as described by Kirby.[14] Iliopsoas, quadriceps and ankle flexibility (r=0.85-0.99) were determined by means of a goniometer in accordance with the method of Harvey and Mansfield.[15] A smaller value in the iliopsoas and hamstring muscle flexibility indicates better performance, whereas a larger value in the quadriceps and ankle values indicates better performance.

Strength: Abdominal muscle strength was determined by means of the 7-level abdominal muscle strength test.[16]

Motor components:

Explosive power was determined by means of the vertical (r=0.93) and horizontal jumps (r=0.88-0.99) as described by Kirby.[14] The better of two attempts was recorded.

Reaction time was determined by means of a 0-5m 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** (r=0.95) test was done across 0-40, 0-60, 0-80 and 0-100 metres 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 (r=0.94), push-ups (r=0.93) and pull-ups (r=0.89) to the point of exhaustion, as described by Kirby.[14]

Speed endurance was tested with the 120 metres speed endurance test as described by Dintiman and Ward.[17] A formula was used to determine speed endurance where the flying 40m time was compared against the 80m and 120m times. If the flying 40m time differs by more than 0.2 seconds from the 80m-120m time, endurance is considered to be poor.

Anaerobic power: Anaerobic power was determined by using the RAST (running-based anaerobic sprint test)[18] (r=0.90). Power output (force x velocity) for the six sprints (with 10 seconds rest between each sprint) over 35 metres 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.[17] The better of two attempts was recorded.
Acceleration: Acceleration was determined by using a formula described for this purpose by Dintiman and Ward.[17] To determine acceleration, the flying 40m time was subtracted from the stationary 40m time and the difference between the stationary 40m time and the flying 40m 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.

Statistical analysis

The "Statistica for Windows" computer programme StatSoft[19] as well as SAS[20] was used to analyse the results. Descriptive statistics were calculated for the total group for the relevant variables of the study.

Subsequently, Pearson's correlation coefficients [21] were used to reduce the number of initially selected variables of 33. This procedure was performed to establish whether some of the variables also evaluate underlying aspects of other components, seeing that such variables can be eliminated. If two variables had a high correlation, only the most relevant variable was included for further analysis. An additional reason for this step was that the number of variables was too high, compared to the number of experimental subjects who were tested, hence this large variety of variables could influence the validity of the multiple regression analysis that was performed on the data. Based on this analysis, sixteen variables could be omitted from the further multiple regression analysis. The variables which were then used in the regression analysis were: age, body mass index (BMI), body mass, stature, sitting height, hamstring flexibility (right), iliopsoas flexibility (right), quadriceps flexibility (right), ankle plantar flexion (right), ankle dorsiflexion (right), horizontal jump, 7-level abdominal strength, 1-minute sit-ups, push-ups, 0-5 metres speed, 0-100 metres speed, stride length (left and right) and long-jump with a 7-stride approach. In order to determine the best subset of the remaining variables, the all-possible subset regressions were used.

A stepwise multiple regression was then performed on the best selected subset of 17 variables by means of Statistica to determine the contribution of each of the variables to sprinting and long-jump respectively. The effect sizes were subsequently established in accordance with the method of Cohen[22] so as to determine the practical significance of the contribution of the variables. An effect size of 0.02 refers to a small effect, 0.15 to a moderate effect and 0.35 to a large effect.

Results and discussion

The descriptive statistics of the variables, which were used for the multiple regression analysis, are reported in Table 1.

Table 1: Descriptive statistics of the kinanthropometric, physical and motor components of 10-15 year-old girls

Variable	**N**	***M***	**SD**	**Min**	**Max**
Age (years)	37	12.5	1.61	10.0	15.0
BMI	37	17.53	1.85	13.3	21.7
Body mass (kg)	37	38.5	7.14	25.6	51.3
Stature (cm)	37	147.5	9.84	125.0	168.0
Sitting height (cm)	37	72.7	6.68	44.0	81.0
Hamstring flexibility (R) (^{o})	37	92.6	8.91	72.0	122.0
Iliopsoas flexibility (R) (^{o})	37	-3.8	8.72	-17.0	18.0
Quadriceps flexibility (R) (^{o})	37	59.3	13.32	38.0	84.0
Ankle plantar flexion (R) (^{o})	37	71.8	7.43	55.0	89.0
Ankle dorsiflexion (R) (^{o})	37	21.3	8.42	8.0	36.0
Horizontal jump (cm)	37	154.8	17.16	119.0	184.0
7-level abdominal strength (level)	37	2.6	1.99	0.0	7.0
1 minute sit-ups (number)	37	20.4	10.98	4.0	40.0
Push-ups (number)	37	20.4	6.37	5.0	34.0
0-5 metres speed (sec)	37	1.5	0.20	1.2	1.9
0-100 metres speed (sec)	37	17.8	1.35	15.3	20.3
Pace length (L-R) (cm)	37	178.4	20.87	139.0	235.0
Long-jump with 7-pace approach (cm)	37	329.4	51.57	240.0	440.0

N = number of subjects; M = mean; SD = standard deviation; max = maximum; min = minimum

A stepwise multiple regression analysis was applied to the variables in Table 1 as a next step so that, in so doing, those variables could be determined which probably contributed most to performance ability in the 100 metres and long-jump respectively. The results found in this respect with regard to sprinting are reported in Table 2.

Table 2: Stepwise regression analysis of the variables which contribute to the 100 metres sprint

Step	Variable	R^2	Contribution to R^2	F – to enter	F^2 (effect size)
1	Long-jump with 7-stride approach	0.6375	0.6375	61.56	1.76*
2	Push-ups	0.6829	0.0453	4.87	0.14*
3	7-level abdominal strength	0.7188	0.0359	4.21	0.13*
4	0-5 metres speed	0.7751	0.0562	8.01	0.25*
5	Ankle dorsiflexion	0.8035	0.0283	4.47	0.14*
6	Stature	0.8133	0.0099	1.58	0.05
7	Age	0.8401	0.0268	4.87	0.17

* $p<0.05$

In this analysis, seven variables (as determined by means of an all possible subset regression) contributed to 84.01% of the total variance of the 100 metres sprint. Long-jump, push-ups, 7-level abdominal strength, 0-5 metres speed, ankle dorsiflexion and age had a statistically significant influence on the 100 metres sprint. Long-jump with a 7-stride approach alone, contributed to 63% of the total variance, and this contribution had a large practical significance (F^2=1.76). Meckel *et al.*[23] substantiate that explosive power and maximal leg strength are regarded as some of the most important contributions for predicting speed during the 100 metres sprint. During the 100 m sprint, an athlete takes an average of 48 – 54 strides, depending on the stride length, contributing to each foot making contact with the ground 24–27 times.[24] Consequently, sprinters should be able to perform powerful explosive leg actions repeatedly. In order to be able to perform these actions, the athlete needs a high power output and the ability to repeat the actions 20–30 times. Strength endurance therefore is of the utmost importance, according to Seagrave.[24] Table 2 confirms this finding, namely that explosive power, as determined in this study by means of, among others, long-jump with a 7-stride approach, appeared to be the most important physical contributor to speed.

Although an athlete's arms and legs work in opposition to one another, it must be coordinated with the leg action for maximum sprint effectiveness.[17] A powerful driving action with the arms, which contributes to acceleration, will in turn contribute to faster and more powerful leg extention.[25] The deduction that can consequently be made from this is that torso strength and endurance, as determined in this study by the push-up test, with moderate practical significance (F^2=0.14), is an important determinant for performance in sprint items. It is confirmed by the fact that push-ups contributed 4.53% to the variance in the 2nd step of the regression analysis (Table 2). This contribution was made with long-jump already in the regression model.

As indicated in Table 2, abdominal strength, with moderate practical significance (F^2=0.13), further contributed significantly to a young girl sprinter's performance, since it represents the third step in the regression analysis and increases the prediction with 3.59%. The proper development of the mid-torso strength and the hip flexors are, according to Dintiman and Ward[17] important for maximal speed development. The hip flexors must be capable of contracting maximally with the mid-torso which controls such contraction by minimizing ineffective movement in the hip area. During the powerful driving action with the arms during sprints, a large amount of rotating power is applied to the mid-torso. If sufficient stability is lacking in this area, excessive rotation of the pelvis will occur to compensate for shoulder rotation, which in turn will lead to poor running technique and ineffective power exertion which, in total, will contribute to a slower sprinter.[25]

As displayed in Table 2, reaction time (0-5m speed) with moderate practical significance (F^2=0.25), significantly contributes to sprinting performance (5.62%), as deduced during the inclusion of the test as a 4^{th} step, after long-jump, push-ups and abdominal strength already in the regression analysis. In this respect, Collet[26] established that a faster reaction time resulted in an improvement in the 10m and 80m time of male sprinters. Earlier, Mero *et al.*[27] could, however, find no correlation between reaction time and sprinting performance, which therefore is contrary to the findings of this study.

Table 2 depicts that ankle flexibility also makes an important contribution (with moderate practical significance (F^2=0.14) to the performance of a young girl sprinter, since it represents the 5^{th} step in the regression analysis and increases the prediction with 2.83%. In this regard, Bennet[28] points out that flexibility as well as strengthening the dorsi flexors reduces the risk of injuring the tibia.

With regard to stature, literature indicates that taller individuals, with longer levers (limbs) and a higher centre of gravity have an advantage during sprint items.[3,29] Although stature did not make a statistically significant contribution to sprinting performance, it is included in the regression analysis as a 6[th] sixth step and showed a small practical significance (F^2=0.05) with a contribution of 0.99%. This contribution was made with long-jump, push-ups, abdominal strength, reaction time and ankle flexibility already in the regression analysis. A further analysis of the stature of the group (not reported) did indeed indicate that the longer the subjects' stature, the better their time in the 100 metres sprint.

As for age, which was also included in the regression model, research has indicated an improvement in speed during late puberty and early post-puberty in girls.[30,31] After this age, is seems that a plateau is reached which can last through the post-pubertal years.[30] In this study age, with moderate practical significance (F^2=0.17), contributed statistically significantly to performance in the 100 m, which confirms the findings in this respect, seeing that the mean 100 m speed of the older girls (14 & 15 year-olds, 16.49 seconds), was better than that of the younger girls (10 year-olds, 18.75 seconds). This contribution was made with all the above-mentioned variables already in the regression analysis.

A stepwise multiple regression analysis was also performed for long-jump and the results are reported in Table 3.

Table 3: Stepwise regression analysis of the variables which contribute to success in long-jump

Step	Variable	R^2	Contribution to R^2	F – to enter	F^2 (effect size)
1	0-100 metres speed	0.6375	0.6375	61.56	1.76*
2	Stature	0.7191	0.0816	9.88	0.29*
3	7-level abdominal strength	0.7329	0.0137	1.70	0.05
4	Push-ups	0.7516	0.0187	2.41	0.08
5	Ankle dorsiflexion	0.7669	0.0153	2.04	0.07
6	Standing long-jump	0.7799	0.0131	1.78	0.06
7	Body mass	0.7896	0.0096	1.32	0.05

* $p<0.05$

Seven variables (as determined by means of an all possible subset regressions) contributed to 79% of the total variance of long-jump performance in the multiple regression analysis. However, only two of the variables, namely 0-100 metres speed and stature showed a statistically significant contribution to long-jump ability.

Kiefer[32] points out that long-jump is an item which demands a larger variety of athletic abilities than any other item in athletics. The approach is deemed the most important phase during long-jump, during which the athlete must be capable of reaching maximal speed.[32] Table 3 confirms the findings that the contribution of speed, with a large practical significance (F^2=1.76) is the most important motor component, which can predict long-jump ability, since performance in the 100 metres explained 64% of the variance.

Stature contributed 8.16% to long-jump performance and this contribution had a moderate practical significance (F^2=0.29). The findings of Perez[33] indicating that sprinters are tall and lean athletes substantiate this. Bompa[3] compiled certain selection criteria according to which potential sprinters and long-jumpers can be identified. According to these criteria, both sprinters and long-jumpers should be tall athletes with relatively long legs, with good explosive power and reaction time.

Although not statistically significant, abdominal muscle strength (F^2=0.05), muscle endurance (F^2=0.08), ankle flexibility (F^2=0.06), explosive power (F^2=0.06) and body mass (F^2=0.05) each had a small practical significant contribution and, combined, contributed to 7.05% to the total variance. This total contribution was made with stature already in the regression model. An analysis of the data of the 37 girls indicated that the larger the body mass of the girls, the faster their time becomes in the 0-100 metres sprint. If the body mass index (BMI) of these girls is compared to the norms, the mean BMI is classified as normal. It can therefore be accepted that an increase in body mass can be ascribed to the increase in muscle mass and not to fat mass.

Conclusion

This study, which was completed with a group of 10-15 year-old black girls from rural and disadvantaged communities, showed that certain kinanthropometric, physical and motor components can be used for predicting successful participation in sprints and long-jump at this age. From this study it seems that girl sprinting and long-jump athletes between ages 10 and 15 have more or less the same physical motor skills, since the majority of the motor abilities needed for sprinting and long jumping performance overlap. Similar training programmes can therefore also be used for sprinters and long-jumpers, but with slight modifications regarding technique for the different items.

When the possible generalisation of the results of the study are evaluated, one must remember that it is developed from the data of a group of athletes from disadvantaged communities who do not have the infrastructure and equipment necessary for developing potential. It can bring about that other variables will make a larger contribution to performance if the study is done on children who live in better circumstances.

Hence 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. Although all the girls in the 10-15 year-old category at the schools which were involved were approached and the majority indeed participated in the study, the number of subjects was relatively small. An additional recommendation, which ensued from this, is that more subjects need to be involved in order to generalise the results. Determining maturation status in girls is important if the model is to be applied to 10-15 year-old girls, since this is the period during which girls progress into their pubertal phase. Age was also highlighted as a performance predictor in the prediction function, which confirms this recommendation.

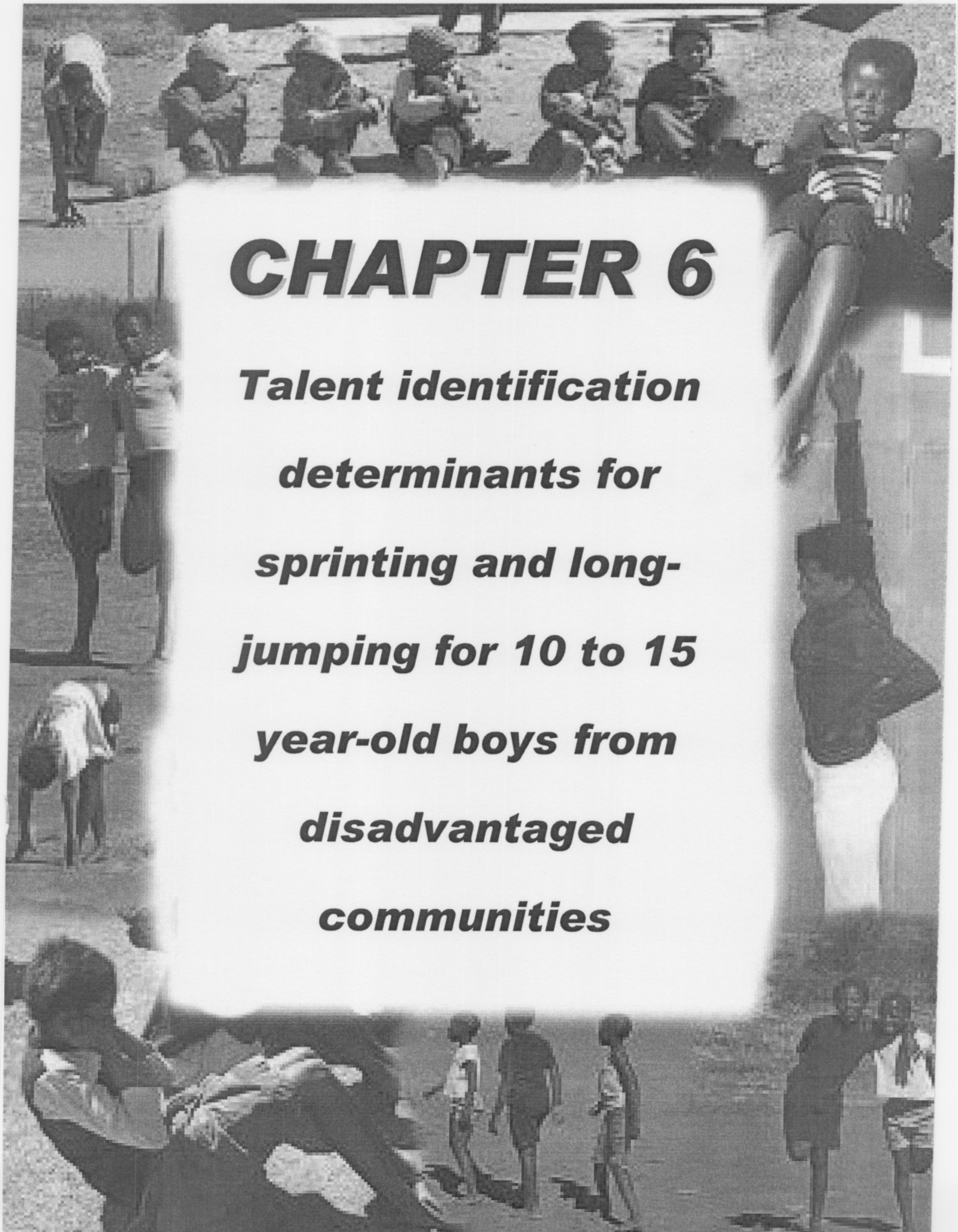
Findings from the study can, however, enable coaches and sport scientists to further classify girls who display talent based on selected kinanthropometric, physical and motor components and then develop the ability of the athlete accordingly.

References

1. Badenhorst E, Pienaar AE. *'n Voorspellingsfunksie vir die klassifisering van sokkervermoëns by 16-jarige seuns in die Noordwes provinsie/A prediction function for the classification of soccer abilities among 16-year old boys in the North West province.* S Afr J Res Sport Phys Ed & Recr 2000; 22: 1-16.
2. Burgess R. Talent identification. Available at: URL: http://www.faccioni.com/reviews.talentid.htm. Accessed 2 August 2005.
3. Bompa TO. *Periodization, theory and methodology of training.* 4th ed. Champaign, IL.: Human Kinetics Publishers, 1999. 413p.
4. Abbott A, Collins D. A theoretical and empirical analysis of a 'state of the art' talent identification model. High Ability Studies 2002; 13: 157-178.
5. Bloomfield J, Ackland TR, Elliot BC. *Applied anatomy and biomechanics in sport.* London: Blackwell Scientific Publications, 1994.
6. Regnier G, Salmela JH. A model for sport talent detection. Sci Period Res Tech Sport 1983; 1: 1-8.
7. Leone M, Lariviere G, Comtois AS. Discriminant analysis of anthropometric and biomotor variables among elite adolescent female athletes in four sports. J Sport Sci 2002; 20: 443-449.
8. Bale P. Anthropometric, body composition and performance variables of young elite female basketball players. J Sports Med Phys 1991; 31: 173-177.
9. Riezebos ML, Paterson DH, Hall CR, Yuhasz MS. Relationship of selected variables to performance in women's basketball. Can J Appl Sport Sci 1983; 8: 34-40.
10. Smith HK, Thomas SG. Physiological characteristics of elite female basketball players. Can J Appl Sport Sci 1991; 16: 289-295.
11. Headley N. *Indicators of potential performance in track and field athletics.* Thesis (Ph.D.) – UPE, 2000.
12. De Ridder JH. *'n Morfologiese profiel van junior en senior Cravenweek rugbyspelers/A morphological profile of junior and senior Craven week rubyplayers.* PU for CHE, 1993.
13. Heyward VH, Stolarczyk LM. *Applied body composition assessment.* Champaign., IL.: Human Kinetics Publishers, 1996. 221p.

14. Kirby RF. *Kirby's guide to fitness and motor performance tests.* USA: BenOak Publishing Company, 1991. 454p.
15. Harvey D, Mansfield C. In Gore CJ, ed. *Physiological tests for elite athletes.* Champaign., IL.: Human Kinetics Publishers, 2000: 98-113.
16. Ellis L, Gastin P, Lawrence S, Savage B, Buckeridge A, Stapff A, Tumilty D, Quinn A, Woolford S, Young W. In: Gore CJ, ed. *Physiological tests for elite athletes.* Champaign., IL.: Human Kinetics Publishers, 2000: 128-144.
17. Dintiman GB, Ward RD. Sportspeed. 3rd ed. Champaign, IL.: Human Kinetics Publishers, 2003. 271p.
18. Mackenzie, B. Running based anaerobic sprint test. Available at: URL: http://www.brainmac.demon.co.uk/rulerdrop.htm. Accessed 2 August 2004.
19. StatSoft. *Statistica for Windows: General conventions and statistics.* Tilsa, OK: StatSoft, 2004.
20. SAS Institute Inc. *The SAS system for Windows release* 9.1 TS Level 1M0. SAS Institute Inc, Cary, NC, USA. 2002-2005.
21. Thomas JR, Nelson JK. *Research methods in physical activity*, Champaign, IL.: Human Kinetic Publishers, 1990. 439p.
22. Cohen J. *Statistical power analysis for the behavioural sciences.* 2nd ed. Hillsdale, NJ.: Erlbaum, 1988.
23. Meckel Y, Atterbom H, Grodjinovsky A, Ben-sira D, Rotstein A. Physiological characteristics of female 100 meter sprinters of different performance levels. J Sports Med Phys Fit 1995; 35: 169-175.
24. Seagrave L. Introduction to sprinting. New Stud Athlet 1996; 2-3: 93-102.
25. Faccioni A. Modern speed training: a comprehensive guide. Available at: URL: http://www.ebook.contentsall.htm. Accessed 7 April 2005.
26. Collet C. Strategic aspects of reaction time in world-class sprinters. Percept Motor Skills 1999; 88: 65-75.
27. Mero A, Kauhanen H, Peltola E, Vuorimaa T, Komi PV. Physiological performance capacity in different prepubescent athletics groups. J Sports Med Phys Fit 1990; 30: 57-66.
28. Bennett S. Training kids for speed. Available at: URL: www.ebook:trainingkidsforspeed1.htm. Accessed 2 August 2005.
29. Houtkooper LB, Going SB. Body composition: how should it be measured? Does it affect sport performance? Sports Sci Exch 1994; 7.

30. Malina RM, Bouchard C, Bar-or O. *Growth, maturation, and physical activity.* 2^{nd} ed. Champaign, IL.: Human Kinetics Publishers, 2004. 712p.
31. Bompa TO. *Total training for young champions.* Champaign, IL.: Human Kinetics Publishers, 2000. 211p.
32. Kiefer, J. Training and drills for the running long-jump. Available at: URL: http://www.coach.org. Accessed 2 August 2004.
33. Perez HR. Specificity of training: selective aspects of running. J Sport Med 1981; 21: 68-73.



CHAPTER 6

Talent identification determinants for sprinting and long-jumping for 10 to 15 year-old boys from disadvantaged communities

Talent identification determinants for sprinting and long-jumping for 10 to 15 year-old boys from disadvantaged communities

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Acknowledgements: The authors would like to thank Prof. Faans Steyn for assistance with the statistical analysis of the data.

Aim. Talent identification (TID) which is based on scientific principles is still relatively new in South Africa. Historically, coaches have used their own knowledge and experience of the characteristics which should lead to success in sport and participation in competitions for TID purposes. The aim of the study was to identify kinanthropometric, physical and motor variables which are important for performance in sprinting and long-jump among 10 to 15 year-old boys from disadvantaged communities.

Method. Sixty-six boys (N=66) were subjected to the Australian Talent Search protocol to identify general sports talent. A sport specific test battery was compiled from the analysis of the demands set by these two sports codes (sprint and long jump) by means of which the performance potential for sprinting and long-jump can be tested. This battery of tests includes five kinanthropometric measurements and 16 physical and motor tests. The most talented boys (n=39) were then subjected to this sport specific protocol. The Pearson correlation coefficient method was used to reduce the number of initially selected variables from 34 to 21. Stepwise multiple regression analysis was then performed to determine the variables with the largest contribution to sprinting and long-jumping ability from this best selected subset of 21 variables. Effect sizes were subsequently determined to establish the practical significance of the contribution of each of the variables.

Results. The results which were determined by means of regression analysis, 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 metre sprint. Horizontal jump, age, acceleration and ankle flexibility contributed to 81.5% of the total variance in the performance of the long jump.

Conclusions. These kinantropometric, 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.[1] The possibility of the disadvantaged participating in competitions is often limited due to the fact that a factor such as lack of transport and financial support contribute to the situation.[2] It can therefore cause potential athletes from these communities to not receive the necessary exposure to sports gatherings; and therefore are lost for sport. The poverty-stricken circumstances in disadvantaged communities also further contribute to a lack of sport development. Chappel [3] 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 Bompa [4] indicates that specialization in sprinting and long-jump can start at ages 14-16 and 17-19 respectively, it is important to already establish at these ages which physical, motor or kinanthropometric 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 sports codes for boys have already been documented. This includes football, [5] soccer [6] and rugby.[7 8 9] When it comes to athletics, only one study could be found which was done on 12-18 year-old boys [10] and a few on adult and/or elite athletes.[11 12 13 14 15]

According to the literature, [11 14 15] aerobic endurance, 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.[16] This assumption is based on the fact that a long-jump athlete should be capable of reaching optimal speed during the approach phase [14] which in turn can indicate good acceleration ability, and simultaneously is also an important component during sprinting. Several components of body build, namely 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.[17 18 19 20] Biological differences in maturation among boys can also have an influence on performance during the development years.[21] 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 consequently needs to be answered through this research is which kinanthropometric, 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 knowledge 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 66 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 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 ethics approval from the North-West University (Number 04M12).

Test procedure

The 39 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 in order to establish which factors play a role in sprinting and long-jump performance.[22] This analysis served as a criterion for the selection of the five kinanthropometric 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.

Kinanthropometric measurements

The measurement protocol, as recommended by the International Work Group on Kinanthropometric Analyses (IWGK) was used in this study.[23] Since the group existed of 10 to 15 year-old boys, age was used as a variable and the following kinanthropometric 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.[24]

Physical and motor tests

Flexibility: The sit and reach test (r=0.99) was used to determine the flexibility of the hamstrings as described by Kirby.[25] Iliopsoas, quadriceps and ankle flexibility (r=0.85-0.99) were determined by means of a goniometer in accordance with the method of Harvey and Mansfield.[26] 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.[27]

Motor components:

Explosive power was determined by means of the vertical (r=0.93) and horizontal (r=0.88-0.99) jumps as described by Kirby.[25] The better of two attempts was recorded.

Reaction time was determined by means of a 0-5m 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 (r=0.95) was done across 0-40, 0-60, 0-80 and 0-100 metres 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 (r=0.94), push-ups (r=0.93) and pull-ups (r=0.89) until exhaustion, as described by Kirby.(25)

Speed endurance was tested with the 120 meter speed endurance test, as prescribed by Dintiman and Ward.(28) A formula was used to determine speed endurance where the flying 40m time was compared against the 80m and 120m times. If the flying 40m time differs by more than 0.2 seconds from the 80m-120m time, endurance is considered poor.

Anaerobic power: Anaerobic power was determined by using the RAST (running-based anaerobic sprint test(29) (r=0.90). Power output (force x velocity) for the six sprints (with 10 seconds rest between each sprint) over 35 meters 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.(28) The better of two attempts was recorded.

Acceleration: Acceleration was determined by using a formula described for this purpose by Dintiman and Ward.(28) To determine acceleration, the flying 40m time was subtracted from the stationary 40m time and the difference between the stationary 40m time and the flying 40m 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

Maturity of the boys was determined by means of a maturity questionnaire (by means of a black interpreter) based on the Tanner stages for pubic hair and genital development. This biological maturity (BMQ) questionnaire is based on the study of Duke *et al.*[30] and Ricky *et al.*[31], as well as the recommendations of Docherty.[32] The above maturity classification was determined by means of two questions that each of the subjects had to answer. They were asked to choose a line diagram (from the five Tanner stages) that represented their own genital (G1-G5) and pubic hair (PH1-PH5) development the most. Thirty boys (of the initial 39) consented to complete the maturity questionnaire.

The five general stages for pubic hair and genital maturation as described by Tanner [21] are described as follows: Stage 1 indicates the prepubertal state or the absence of development of each characteristic. Stage 2 indicates the early puberty state or the initial, overt development of each characteristic. Stage 3 and 4 indicate the midpuberty state which indicates continued maturation of each characteristic, while stage 5 indicates the adult of mature state for each characteristic.

Statistical analysis

The "Statistica for Windows" computer programme [33] as well as SAS [34] 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 [35] 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.

An 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. The variables which were selected in this manner include 5 kinanthropometric 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), average 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 metre 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 [36] 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 medium practical significance and 0.35 to a large practical significance.

Results and discussion

Table I presents the chronological age and the biological maturation status of the group. It appears that the majority of the subjects were in phase two of development with regard to testicle 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 one, whilst that of one subject was in phase two and that of two subjects in phase three. With regard to the 11 and 12 year-olds, the majority was in phase two of development. Most of the 13 year-olds were in phase three of development, whilst the one 14 year-old indicated development phases two. The fact that the biological 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 (three boys), 12 (two boys), 13 (two boys), 14 (one boy) and 15 (one boy) 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 [34] 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.[34]

TABLE I.- *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 II.

TABLE II.- *Descriptive statistics of the kinanthropometric, physical and motor components in 10-15 year-old boys*

Variable	N	M	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 length (cm)	39	141.3	11.0	115.5	161.0
Sitting height (cm)	39	70.9	5.2	60.5	83.5
Hamstring flexibility (°)	39	43.1	6.0	22.5	51.5
Iliopsoas flexibility (R) (°)	39	0.1	8.0	-12.0	30.0
Quadriceps flexibility (R) (°)	39	71.8	10.0	50.0	100.0
Ankle flexibility (R) (°)	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 metre speed (sec)	39	1.8	0.2	1.5	2.1
0-100 metre 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; **M = mean**; SD = standard deviation; max = maximum; min = minimum

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

TABLE III.- *Variables which contribute to performance in 100 metre 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 metres in the stepwise multiple regression analysis. Average anaerobic power output, acceleration and body mass, as the first three steps, displayed statistically significant influences on the 100 metres, according to Table III. As shown in Table III, average anaerobic power output alone contributed to 57.1% of the total variance, and the effect showed large practical significance. As confirmation, literature indicates that anaerobic power and capacity shows a high correlation with sprinting and consequently plays an important role in predicting performance in the 100 metres sprint.[37 38 39]

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 metres time minus stationary 40 metres time) in the second step of the variance analysis contributed 12.3% to the variance (Table III). The contribution also showed large practical significance. As indicated by the first 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 en Loovis [(40)] who declared 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) [(11)] 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 third step, significantly contributed to sprinting performance with 7.4% of the variance. A number of researchers [(17 18)] 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 the increase in muscle mass during adolescence.[(21)] An analysis of the results of this study (not indicated in article) indicates 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 metres. According tot the BMI (body mass index) of these children, the increase in body mass can possibly be ascribed to the increase in muscle mass and not to fat mass, seeing that the average BMI of the children is normal.

As displayed in Table III, 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 average anaerobic power output and acceleration already in the regression model.

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

TABLE VI.- *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 first step, contributed 71.1% of the variance to long-jump performance with a large practical significance. As confirmation of the result, Kiefer [14] 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.*[41] and Newton and Kraemer [42] confirm 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 [14] points out that the long-jump athlete must have the ability to reach his/her maximum speed during the approach, and Bompa [43] adds that a drastic 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.[43] From the results displayed in Table I, which indicate the maturation levels of the subjects, it appears that, on average, the group is in development phases 1-3. Research indicates that an increase in average anaerobic power occurs from the pre-pubertal (10.00-12.08 years) up until post-pubertal (13.75-14.92 years) development phases.[21] 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 IV 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 [11], 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.[44] 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 IV indicate that ankle flexibility, with a small practical significance (F^2=0.05), as a 4th 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 kinanthropometric, 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 average 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 kinanthropometric 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, [11 12 13] kinanthropometric 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 that research only focused on motor and physical components. Only in the study of Headley[10] on 12-18 year-old track and field athletes, kinanthropometric measurements were included. The results of this study differ from those of the study of Headley[10] in which only bi-acromial width, frontal thigh circumference and leg length was identified as kinanthropometric variables which can be used during talent identification, whilst body mass and sitting height was the only kinanthropometric variables which were 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,[11] 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 [14] 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 experimental subjects can be involved in similar studies to be able to make more generalisable inferences and these talent identifying determinants can be tested on a new group 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 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 variables largely coincide. 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 kinanthropometric, physical and motor components and then develop the ability of the athlete accordingly.

References

1. Peltola, E. Talent Identification. New Stud Athlet 1992; 7:7-12.
2. Burnett C, Hollander W. Sport development and the United Kingdom-South Africa Sports Initiative: A pre-evaluation report. J Sport Manag 1999; 13:237-51.
3. Chappel R. Sports development in Botswana, Africa. The Sport J 2004; 7(2).
4. Bompa TO. Periodization, theory and methodology of training. 4th ed. Champaign IL.: Human Kinetics Publishers; 1999.
5. Sawyer DT, Ostarello JZ, Suess EA, Dempsey M. Relationship between football playing ability and selected performance measures. J Strength Cond Res 2002; 16:611-16.
6. Badenhorst E, Pienaar AE. 'n Voorspellingsfunksie vir die klassifisering van sokkervermoëns by 16-jarige seuns in die Noordwes provinsie/A prediction function for the classification of soccer abilites among 16-year old boys in the North West Province. SAJR SPER 2000; 22:1-16.
7. Carlson BR, Carter JE, Patterson P, Petti K, Orfanos SM, Noffal GJ. Physique and motor performance characteristics of US national rugby players. J Sport Sci 1994; 12:403-12.
8. Pienaar AE, Spamer MJ, Steyn HJ. Identifying and developing rugby talent among 10-year-old boys: A practical model. J Sport Sci 1998;16:691-99.
9. Gabbett TJ. Physiological characteristics of junior and senior rugby league players. Br J Sport Med 2002; 36:334-39.
10. Headley N.. Indicators of potential performance in track and field athletics. Port Elizabeth: University of Port Elizabeth (Thesis – Ph.D.); 2000.
11. Bowerman B, Freeman B. High-performance training for track and field. 2nd ed. Champaign, IL.: Leisure Press; 1991.
12. Chelly SM, Denis C. Leg power and hopping stiffness: relationship with sprint running performance. Med Sci Sports Exerc 2001; 33:326-33.
13. Bret C, Rahmani A, Dufour AB, Messonnier L, Lacour JR. Leg strength and stiffness as ability factors in 100 m sprint running. J Sports Med Phys Fit 2002; 42:274-81.
14. Kiefer J. Training and drills for the running long-jump. Available at URL: http://www.coach.org [Accessed: 2 Augustus 2005]

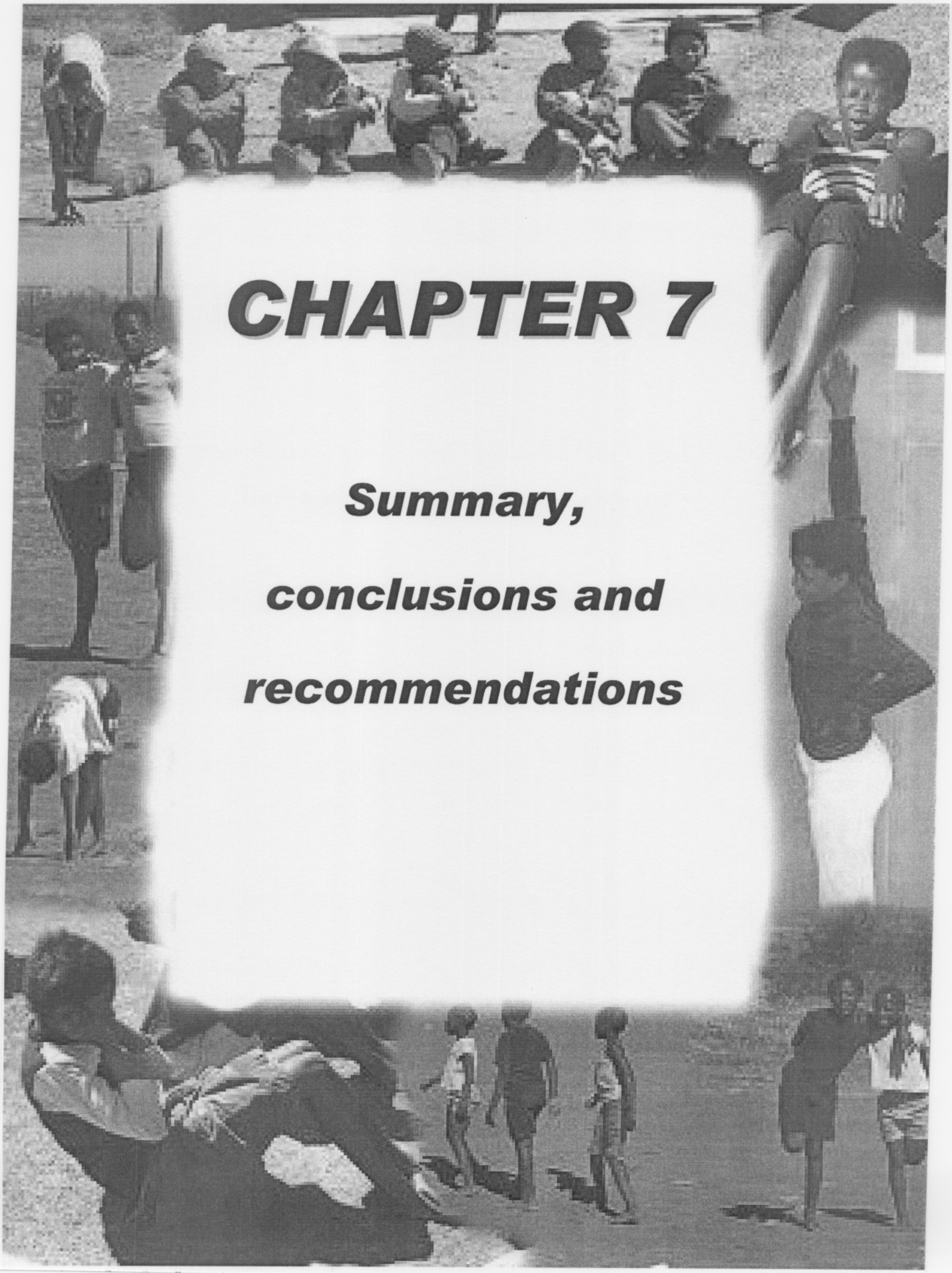
15. Moura NA, Fernandes De Paula Moura T. Training principles for jumpers: implications for special strength development. New Stud Athlet 2001; 4:1-11.
16. Perkins E. Long-jump and triple jump. In: Guthrie M, editor. Coaching track & field successfully. Champaign, IL.: Custom Color Graphics; 2003.p.149-55.
17. Boileau RA, Lohman TG. The measurement of human physique and it's effect on physical performance. Orthop Clin Nor Am J 1977; 8:563-81.
18. Pate RR, Slentz CA, Katz DP. Relationships between skinfold thickness and performance of health related fitness test items. Res Q Exerc Sport 1989; 60:183-89.
19. Harman EA, Frykman PN. The relationship of body size and composition to the performance of physically demanding military tasks. In: Marriott BM, Grumstrup-Scott J, editors. Body composition and physical performance: applications for the military services. Washington D.C.: National academy press; 1992.p.105-18.
20. Houtkooper LB, Going SB. Body composition: how should it be measured? Does it affect sport performance? Sport Sci Exch1994; 7.
21. Malina RM, Bouchard C, Bar-Or O. Growth, maturation, and physical activity. 2nd ed. Champaign, IL.: Human Kinetics Publishers; 2004.
22. Kruger A. Sport specific talent identification determinants and development of sprinting and long-jumping ability among 10-15 year old children from underprivileged communities. Thesis (Ph.D) – North-West University. Unpublished; 2005
23. De Ridder JH. 'n Morfologiese profiel van junior en senior Cravenweek rugbyspelers/ A morphological profile of junior and senior Cravenweek rugbyplayers. Potchefstroom: Potchefstroom University for Christian Higher Education; 1993.
24. Heyward VH, Stolarczyk LM. Applied body composition assessment. Champaign, IL.: Human Kinetics Publishers; 1996.
25. Kirby RF. Kirby's guide to fitness and motor performance tests. USA: BenOak Publishing Company; 1991.
26. Harvey D, Mansfield C. Measuring flexibility for performance and injury prevention. In: Gore CJ, editor. Physiological tests for elite athletes. Champaign., IL.: Human Kinetics Publishers; 2000.p.98-113.
27. Ellis L, Gastin P, Lawrence S, Savage B, Buckeridge A, Stapff A, Tumilty D, Quinn A, Woolford S, Young W. Protocols for the physiological assessment of

team sport players. In: Gore CJ, editor. Physiological tests for elite athletes. Champaign, IL.: Human Kinetics Publishers; 2000.p.128-44.

28. Dintiman GB, Ward RD. Sport speed. 3rd ed. Champaign, IL.: Human Kinetics Publishers; 2003.
29. Mackenzie B. Ten stride test. Available at URL: http://www.brainmac.demon.co.uk/rast.htm [Accessed: 2 August 2004].
30. Duke PM, Litt IF, Gross RT. Adolescents' self-assessment of sexual maturation. Pediatr 1980; 66:918-20.
31. Rickey L, Williams RL, Cheyne KL. Houtkooper LK, Lohman TG. Adolescent self-assessment of sexual maturation: effects of fatness classification and actual sexual maturation stage. J Adol Health Care 1988; 6:480-82.
32. Docherty D. Measurement in pediatric exercise science. Champaign, IL.: Human Kinetic Publisher; 1996.
33. StatSoft. Statistica for Windows: General conventions and statistics. Tilsa, OK: StatSoft; 2004.
34. SAS Institute Inc. The SAS system for Windows release 9.1 TS Level 1M0. SAS Institute Inc, Cary, NC, USA; 2002-2005.
35. Thomas JR, Nelson JK. Research methods in physical activity, Champaign, IL.: Human Kinetics; 1990.
36. Cohen J. Statistical power analysis for the behavioural sciences. 2nd ed. Hillsdale, NJ.: Erlbaum; 1988.
37. Neville M, Boobis L, Brooks S, Williams C. Effect of training on muscle metabolism during treadmill sprinting. J Appl Physiol 1989; 67: 2376- 83.
38. Green S, Dawson B. Measurement of anaerobic capacities in humans. Definitions, limitations and unsolved problems. Sports Med 1993; 15:312-27.
39. Medbo J, Tabata I. Anaerobic energy release in working muscle during 30s to 3 min exhausting bicycling. J Appl Physiol 1993; 75:1654-60.
40. Butterfield SA, Loovis EM. Influence of age, sex, balance, and sport participation on development of kicking by children in grades k-8. Percept Motor Skills 1994; 79:691-97.
41. Manning JM, Dooly-Manning C, Perrin DH. Factor analysis of various anaerobic power tests. J Sport Med Phys Fit 1988; 28:138-44.
42. Newton RV, Kraemer WJ. Developing explosive muscular power: Implications for a mixed methods training strategy. Strength Cond 1994; 20-30.

43. Bompa TO. Total training for young champions. Champaign, IL.: Human Kinetics Publishers; 2000.

44. Jacoby E, Fraley B. Complete book of jumps. Champaign, IL.: United Graphics; 1995.



CHAPTER 7

Summary, conclusions and recommendations

7.1 Summary

Subsequently a brief summary will be given of this study as described in the foregoing chapters, after which the most important conclusions which were drawn in this study will be discussed along with the recommendations ensuing from it. The problem statement and hypotheses of the study were presented in Chapter one.

The first two objectives of this study were to implement a sport specific athletic development programme and to monitor the effect thereof on the abilities and skills of talented 10 to 15 year-old girls and boys respectively who display talent for sprints and long-jump. The results were reported in Chapters three and five. The third and fourth objective of this study was to determine which kinanthropometric, physical and motor components will play such a role at ages 10 to 15 that it can predict performance in sprints and long-jump in girls and boys respectively. These results were reported in Chapters four and six respectively.

Chapter two contains a literature overview on the identification and development of kinanthropometric characteristics and motor and physical skills to improve sport talent. The terms *talent identification* and *talent development* were defined and explained in the literature study, and different factors which influence sport talent identification and development were subsequently discussed comprehensively. The literature on existing prediction functions was also analysed and briefly discussed in order to get an indication of the extent of research in this respect. A task analysis of sprints and long-jump, which is the focus of this study, was further deemed necessary and was executed to determine which kinanthropometric characteristics and motor abilities and skills are important for performance in the different items. Finally, literature on different training methods were analysed which can be used for improving the related physical and motor abilities and skills. The literature study indicated that, to date, very little research has been done on talent identification and development in sprints and long-jump, especially regarding young athletes. The application of talent identificationin sports which is based on scientific principles further seems to be new in South Africa, although talent identification has been used through participation in competitive sport for a considerable length of time. In this respect, literature indicates that former East Block countries used systematic talent identification programmes from as early as the 1960s and 1970s. However, the success achieved with this in sport in Eastern Europe led to systematic talent identification processes increasing world-wide. The literature confirms that a development programme is deemed to be the most important element of the talent identification process. In this regard, literature indicates that it is important that limited support resources should be optimally utilized the moment talented individuals are identified in order to further refine and develop this talent. Without such further support and development of their sport talent, researchers say that the needs of talented children cannot be fulfilled and their potential will consequently remain undeveloped, and the chances are good of them being lost to the sports world.

Chapter three reported the results regarding the effect of a sport talent identification programme, presented over a period of 10 weeks, twice a week, on the abilities and skills of talented 10 to 15 year-old girls with talent for sprints and long-jump. This article was submitted to and provisionally accepted by the International SportMed Journal for publication. The "Australian Talent Search" protocol was used to analyse general sports talent in 66 girls from two different farm schools in the Potchefstroom district. The most talented girls (n=37) in this group were further subjected to a sport specific test battery for sprints and long-jump. Inter- and intra-group comparisons were determined by means of dependent and independent t-testing. As differences were found in the experimental and control groups' pre-test values, an ANCOVA was done to equalise the two groups to determine the effect of the development programme. It was found that the development programme contributed to improved motor abilities and skills important for performance in both sprints and long-jump. Flexibility, explosive power, muscle endurance, reaction time, speed, speed endurance, acceleration and long-jump improved significantly, while abdominal strength and stride length did not. It was concluded that the programme can successfully condition long-jump and to a lesser degree sprinting ability, despite the poor circumstances and infrastructure these children are exposed to. Slight adjustments to improve the quality of the programme were recommended.

In Chapter four, the effect of a sport talent identification and development programme of 10 weeks, three times a week, was determined on the abilities and skills of talented 10 to 15 year-old boys with talent for sprints and long-jump. This article was submitted to the Journal of Sports Medicine and Physical Fitness. The "Australian

Talent Search" protocol was used to analyse the general sports talent in 62 boys from two different farm schools in the Potchefstroom district. The most talented boys (n = 39) were subsequently subjected to a sport specific test battery for sprints and long-jump. Inter- and intra-group comparisons were determined by means of dependent and independent t-testing. As differences were found in the experimental and control groups' pre-test values, an ANCOVA was done to equalise the two groups to determine the effect of the development programme. The results of this study point to the fact that the development programme statistically significantly contributed to an improvement in flexibility, muscle endurance, 0-40 metres speed and long-jump ability. However, some components did not show improvement, namely explosive power, reaction time, speed endurance, acceleration and stride length. It was concluded that the programme can successfully condition long-jump and sprinting ability despite the poor circumstances and infrastructure the children are exposed to. Slight adjustments to improve the quality of the programme were recommended.

Chapter five contains an article regarding talent identification determinants for sprints and long-jump developed on 37 talented 10 to 15 year-old girls from disadvantaged communities. This article was submitted to the International SportMed Journal. The Pearson correlation coefficient method was used to reduce the number of initially selected variables of 33. Variables which also evaluate underlying aspects of other components were eliminated in this manner. The all possible subset regression was used to determine the best possible subset from the remaining variables (age, body mass index (BMI), body mass, stature, sitting height, hamstring (right), iliopsoas (right) and quadriceps flexibility (right), ankle plantar flexion (right), ankle dorsiflexion (right), horizontal jump, 7-level abdominal strength, 1-minute sit-ups, push-ups, 0-5 metres speed, 0-100 metres speed, stride length (left and right) and long-jump with a 7-stride approach). Effect size was determined to establish the practical significance of these selected variables. With regard to the 100 metres sprint, 7 variables contributed 84.0% to the total variance, namely long-jump with a 7-stride approach, push-ups up until exhaustion, 7-level abdominal strength, 0-5 metres speed, ankle dorsiflexion, body length and age. As for long-jump, 7 variables, namely 0-100 metres speed, body length, 7-level abdominal strength, push-ups, ankle dorsiflexion, stationary long-jump and body mass were pointed out to be the most important contributors to performance in this item, with a total contribution of 79% to the total variance.

Chapter six contains an article with regard to talent identification determinants for sprints and long-jump developed on 39 talented 10 to 15 year-old boys from disadvantaged communities. This article was submitted to the Journal of Sports Medicine and Physical Fitness. The Pearson correlation coefficient method was used to reduce the number of initially selected variables of 34. Variables which also evaluate underlying aspects of other components were eliminated in this manner. Sixteen variables were omitted, based on the analysis from the further multiple regression determination. The all possible subset regression was used to determine the best possible subset from the remaining variables (age, body mass, stature, sitting height, hamstring, iliopsoas (right), quadriceps (right) and ankle flexibility (right), average anaerobic power output, exhaustion ration, horizontal jump, 7-level abdominal strength, sit-ups and push-ups up and until exhaustion, 0-5 metres speed, 0-100 metres speed, speed endurance, acceleration, stride length and long-jump with a 7-stride approach). Effect size was determined in order to establish the practical significance of the selected variables. Average anaerobic power output, acceleration and body mass contributed statistically significantly to performance in the 100 metres sprint with a contribution of 86.5% to the total variance, while horizontal jump, age and acceleration contributed statistically significantly to long-jump with a contribution of 81.5% to the total variance.

7.2 Conclusions

7.2.1 Conclusion 1

Hypothesis one stated that a sport specific athletics development programme, based on improving sprinting and long-jump ability, will lead to the improvement of these abilities and skills in 10 to 15 year-old talented girl sprinters and long-jumpers. The results of this study indicated that flexibility, explosive power, muscle endurance, reaction time, speed, speed endurance, acceleration and long-jump improved significantly, while abdominal strength and stride length did not. Compared to the improvement of abilities which can contribute to long-jump ability, the development programme showed a smaller contribution to the development of all the components of speed which especially are needed in sprints. Hence hypothesis one is accepted for long-jump, but only partially for sprints.

7.2.2 Conclusion 2

Hypothesis two states that a sport specific athletics development programme, based on improving sprint and long-jump ability, will lead to the improvement of these abilities and skills in 10 to 15 year-old talented boy sprinters and long-jumpers. The results of this study indicate that the development programme statistically significantly contributed to an improvement in flexibility, muscle endurance, 0-40 metres speed and long-jump ability. Since explosive power, reaction time, speed endurance, acceleration and stride length showed no improvement, hypothesis two is only partially accepted.

7.2.3 Conclusion 3

Hypothesis three states that certain kinanthropometric, physical and motor components can predict performance in sprints and long-jump in girls at ages 10 to15. The results of this study indicate that 6 kinanthropometric, physical and motor components could predict 84.0% of the total variance in sprints and 79.0% of the variance in long-jump. Hypothesis three is accepted, based on the results for both sprints and long-jump.

7.2.4 Conclusion 4

Hypothesis four states that certain kinanthropometric, physical and motor components exist at ages 10 to 15 which will play such a role that it can predict performance in sprints and long-jump in boys. The results of this study indicated that 6 kinanthropometric, physical and motor components could predict 86.5% of the total variance in sprints and 81.5% of the variance in long-jump. Hypothesis four is accepted, based on the results for both sprints and long-jump.

7.3 Recommendations

From the results of the afore-mentioned study, it is evident that the sports development programme which was applied and evaluated in this study can be implemented in schools to improve both the sprinting and long-jump ability of 10 to 15 year-old boys and girls. The results indicated that the intervention programme had brought about a larger improvement in long-jump ability than in sprints; hence it is recommended that more attention be given to the different components of speed when presenting the programme. More training sessions of longer duration are therefore recommended, since only two sessions of an hour and a half for the girls and three sessions of a hour each was allocated during school hours for participation in the training programme. The result was that strength and plyometrics could only be trained once a week, seeing that both these aspects could not be addressed on the same day. It is recommended that up to four sessions of an hour in duration be used in order to bring about optimal development of the motor components.

It is also recommended that the programme be presented by a knowledgeable person such as a sport scientist so that the participants can develop optimally. However, it is recommend that teachers should also be trained and empowered by a sport scientist to present the programme in schools.

The programme for girls was presented in a more playful manner and they had a smaller drop-out figure than what was the case with the boys, to whom the programme was presented in a more sport specific manner. It is thus recommended that the play component can receive more attention in the presentation of the programme for boys as a possible way of preventing children from dropping out.

Although it was evident from the research that the same training programme can be used for both sprints and long-jump, it is recommended that different programmes be used in the later phase of the programme where more attention should be given to the specific aspects such as technique for sprints and long-jump respectively.

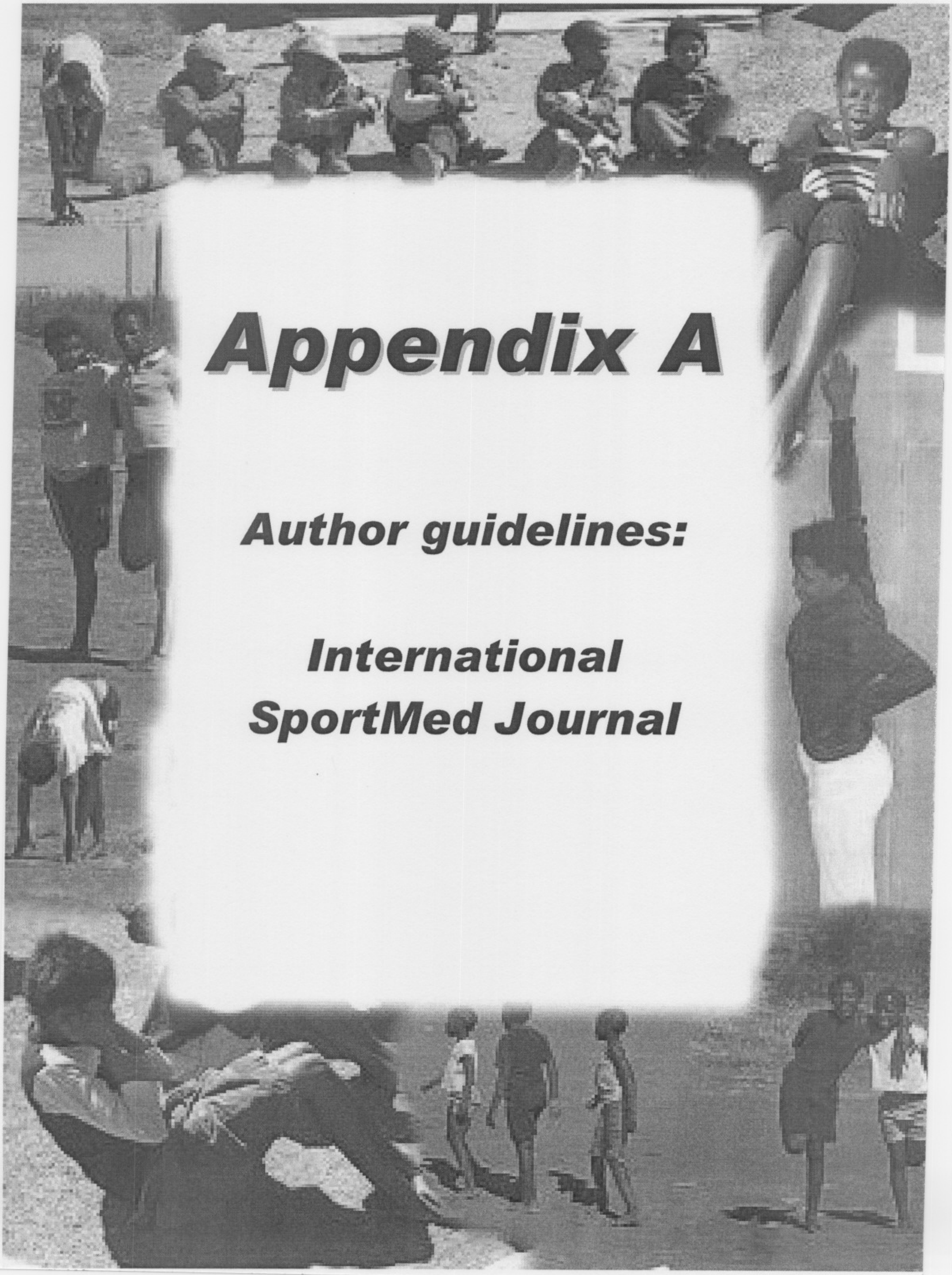
From the results of this study it can finally be recommended that only the tests which were included in the regression analysis, can be used separately in future TID models for boys and girls. Using these tests can contribute to saving time when talent identification is done.

Although this study was thoroughly planned, certain deficiencies were identified which should be kept in mind when doing further research of this nature or when applying these results in practice. The most important aspects will subsequently be highlighted:

7.3.1 Insufficient information was gathered pertaining to the participation patterns of the girls and boys in other sports activities. Had the information been known, they could have been adjusted for these influences. Hence it is recommended that information of this nature be obtained during similar studies by means of relevant questionnaires.

7.3.2 The study was done on, among others, 10 to 15 year-old girls who undergo quite an amount of biological development during this period. It is thus necessary to investigate factors such as biological maturation in similar investigations on young girls. Answers according to the maturation levels of the girls can supply coaches and sports scientists with further guidelines. Hence it is recommended that the maturation levels of girls be pre-determined by means of a relevant maturation questionnaire, and a smaller age difference between the girls is also recommended in order to minimise the effect of development differences.

7.3.3 Cultural preferences for practising sport could have had an influence on the results. It appeared that a lack of motivation and perseverance caused some of the boys and girls to not attend sessions regularly (attendance figure: girls 85%, boys 79%). It is thus recommended that further research done in this respect should take sport preferences and interest of children into account, (especially soccer and netball in similar groups).



Appendix A

Author guidelines:

International SportMed Journal

The International SportMed Journal (ISMJ) is an electronically delivered international, peer-reviewed journal for professionals with a primary interest in sports medicine and exercise science. In addition to invited review articles, the ISMJ publishes original research covering diagnostics, therapeutics and rehabilitation in healthy and physically challenged individuals of all ages and levels of sport and exercise participation.

Manuscripts are welcomed from all countries, and may be submitted for consideration on the understanding that they have not been previously published elsewhere, either in print or electronically, and that they are not under consideration by any other publisher.

All manuscripts must be submitted in English, and original research articles, review articles and short articles are subject to peer review.

Scope

The *International SportMed Journal* invites articles for submission from the areas of: (1) diagnosis, treatment, and rehabilitation of sport- and exercise-related injuries; (2) medical illnesses induced by or exacerbated by exercise; (3) the relationship between exercise and health, including exercise physiology; (4) the medical care of physically active individuals; (5) biomechanics related to sport; (6) sports psychology; (7) sports nutrition; (8) sports pharmacology; (9) sports radiology.

Editorial Office

All manuscripts should be submitted electronically via email, or if this is not possible, send by courier on a stiffy disk or CD to the Technical Editor, Ms Yvonne Blomkamp. Her contact details are:

UCT/MRC Research Unit for Exercise Science and Sports Medicine, Department of Human Biology, University of Cape Town, Sports Science Institute of South Africa, Boundary Road, Newlands 7700, South Africa. Tel. +27 (21) 650 4579; Fax: +27 (21) 686 6213; Email: yblomkam@sports.uct.ac.za

The Editorial Office will assist with any other queries about the journal's requirements.

Preparation of manuscript

Style

Manuscripts should be prepared in accordance with the Uniform Requirements for Manuscripts Submitted to Biomedical Journals as set out by the International Committee of Medical Journal Editors. (Available at: http://www.icmje.org).

When preparing the manuscript, kindly bear the following points in mind:

- The author must be able to certify that he/she participated sufficiently in the work to take responsibility for the content and that the work is valid.
- All affiliations, financial or otherwise, with any organisation or entity with a financial interest in the subject matter or materials discussed in the manuscript must be fully disclosed.
- All financial and material support for the work must be clearly identified.

Submission details

Kindly email manuscripts in electronic format to the Editorial Office for the attention of: Ms Yvonne Blomkamp at the following email address: yblomkam@sports.uct.ac.za . The physical address and other contact details are repeated here: UCT/MRC Research Unit for Exercise Science and Sports Medicine, Department of Human Biology, University of Cape Town, Sports Science Institute of South Africa, Boundary Road, Newlands 7700, South Africa. Tel. +27 (21) 650 4579; Fax: +27 (21) 686 6213

Formatting guidelines for all manuscripts

All manuscripts must be prepared in UK English and produced using one of the following standard word processing formats: Microsoft Word (Version 6-2000) (preferred), WordPerfect 5 or 6, or Rich Text format. The files must be Windows-based.

Double-spaced text, with 2.5 cm (1”) left, right, top and bottom margins, with single line spacing, and 10-point font in Arial should be used.

The manuscript must be typeset and should not contain any extraneous formatting instructions. For example, use hard carriage returns only at the end of paragraphs and display lines (e.g. titles, subheadings). Please observe the following conventions concerning dashes:

- a single hyphen with a space before it for a minus sign,
- a double hyphen (with space before and after) to indicate a 'long dash' in test
- a single hyphen (with no extra space before or after) to indicate a range of numbers (e.g. 23-45).

For clarity, subheadings are recommended wherever appropriate.
Authors should retain a copy of their article for reference, as manuscripts are not routinely returned.

Non-standard characters (Greek letters, mathematical symbols, etc.) should be coded consistently throughout the text. Please make a list of such characters and provide a listing of the codes used at the end of the manuscript.

Abbreviations should be kept to a minimum, and if necessary, should first be written in full with the abbreviation given in brackets afterwards. Thereafter only the abbreviation can be used. Follow the CBE Style Manual (available from the Council of Biology Editors, 9650 Rockville Pike, Bethesda, Maryland 20814, USA) or other standard sources. For abbreviations of journal names, refer to the List of Journals Indexed in Index Medicus (available in .pdf format from: http://www.nlm.nih.gov/tsd/serials/lji.html).

Drug names: Use generic names only on referring to drugs, followed in parentheses after first mention by a commonly used variant generic.

Units of measurement should be in metric (SI) units. Exceptions include calories, hematocrit, blood cell counts, fluid pressures etc. If in doubt, include both with the conventional units in parentheses. Temperature should be expressed in degrees Celsius, blood pressure in millimetres of mercury, and time in terms of the 24-hour clock.

Acknowledgements: These should be made where appropriate, particularly any source of funding provided for the study, technical assistance, and intellectual contributions not associated with authorship.

References: The authors are responsible for the accuracy and completeness of the references. These are to be numbered consecutively in the order that they appear in the text, Tables, Figures, cited in the text by number. List all authors when there are three or fewer. If there are more than three, list the first three followed by et al. The reference section should be typed at the end of the text, following the sample formats given below. Journal titles should be abbreviated according to the abbreviations approved by Index Medicus (http://www.nlm.nih.gov/tsd/serials/lji.html).

All single word journal titles should be spelled out. Complete information should be given for each reference, including titles of journal articles, names of the first three authors followed by et al. and editors, and inclusive pagination. It is the author's responsibility to verify references from the original sources.

Journal article

1. Stratford PW, Miserfi D, Ogilvie R, et al. Assessing the responsiveness of Five KT1000 knee arthrometer measures used to evaluate anterior laxity at the knee joint. Clin J Sport Med 1991; 1: 225-228.

Online journal article

2. Grant S, Corbett K, Todd K, et al. A comparison of physiological responses and rating of perceived exertion in two modes of aerobic exercise in men and women over 50 years of age. BJSM 2002; 36: 276-281. Available at: http://bjsm.bmjjournals.com/cgi/content/full/36/4/276

World Wide Web

3. International Federation of Sports Medicine (FIMS). Ventilatory muscle training in patients with chronic obstructive pulmonary disease (COPD). Available at: http://www.fims.org/position statements. Accessed 30 September 2002.

Book

4. Antonaccio MJ. Cardiovascular Pharmacology. New York: Raven Press, 1990.

Chapter in book

5. Pedersen BK, Rohde T, Bruunsgard H. In: Pedersen BK, ed. Exercise Immunology. Austin, TX: RG Landes, 1997: 89-111.

Unpublished materials: Refer to these as "In press". Authors of such papers should obtain written permission to cite them, and include verification that they have been accepted for publication.

Tables: Tables should be typed neatly, each on a separate page, with the title above and any notes below. Tabs should used to separate columns. Explain all abbreviations. Do not give the same information in Tables and Figures. Each Table should be accompanied by an explicit, detailed legend. Number Tables sequentially as they appear in the text. If any tables submitted have been published elsewhere, written consent to republish them should be obtained by the author from the copyright holder and/or the author(s).

Illustrations (including Images): These must be mentioned in the text and should be referred to as Figures in the text (e.g. Figure 1, Figure 2, etc.). Pictures, photographs, drawings, X-Rays or radiological images should be submitted as attached .jpeg files and should be of a high quality but should not exceed 1MB. Figure legend/s should be clearly indicated and they should be numbered sequentially in the text. There should be no markings on X-Rays before photographing (such as patient's initials, dates, degree markings). Any arrows or lettering must be applied with a professional product. These identifying marks should be large enough to be seen when the photo is reduced. Sequences of radiographs should be of the same magnification. The subject should be centred in clinical photographs. A consent form from the subject must be included, or the subject and case details must be made unidentifiable. Crop out extraneous material and background. Graphs should be submitted as attached **.gif** files.

If any of these illustrations have been published elsewhere, written consent to use them should be obtained by the author from the copyright holder and/or the author(s). Each figure should have a separate, detailed, fully explicit legend. All sections of the figure and all abbreviations and symbols used should be clearly defined.

Articles reporting results on human subjects or patients must be accompanied by a statement that the subject(s) gave written, **informed consent,** and the necessary documentation of approval from the appropriate Ethics Committee.
If necessary, the author(s) must be prepared to produce the data on which the manuscript is based for examination by the Editor-in-Chief.

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This should be clinically relevant original research, and the length of the article should not exceed 3000 words.

All articles should contain original data concerning the course (prognosis), cause (aetiology), diagnosis, treatment, prevention, or economic analysis of a clinical disorder or an intervention to improve the quality of health care.

A structured abstract of no longer than 250 words must be included, using the following headings;

- Background: State in 1-2 sentences the background for performing the study.
- Research question. State the main research question or objective of the study and the major hypothesis tested, if any.
- Type of study: Indicate the type of study design used to answer the question, e.g. randomised controlled study.
- Methods: Describe in 1-2 paragraphs the methodology used to answer the research question. The following sub-headings are useful: subjects (or participants, patients), sampling, experimental procedure (including if any interventions), and main measures of outcome.
- Results: Describe the results, including actual numerical values and statistical test results.
- Conclusions: State only those conclusions of the study that are directly supported by data, along with their clinical application (avoiding over-generalisation) or whether additional study is required before the information should be used in usual clinical settings. Equal emphasis must be given to positive and negative findings of equal scientific merit.

The text of the manuscript with regard to original research articles should be arranged in the following sequence:

- Title page

This should contain the title and sub-title (where relevant) of the article, the full names, highest academic degrees, and affiliations of all authors. The full contact details (including address, tel. no., fax no. and email address), of the corresponding author must appear at the bottom left of the page. An appropriate running title header, not exceeding 45 letters and spaces, should also be included. Unless otherwise indicated, the proofs will be sent to the corresponding author. Information concerning sources of financial support should be placed in the Acknowledgement section.

- Abstract (including 5 keywords)

The page following the title page should include a structured abstract (link this) as described above. The abstract should be followed by 5 keywords (e.g. Keywords:)

- Author biography (ies)

Each author should include a short biography that includes academic title/degrees, affiliation, research focus, awards and societal affiliations, and previous publications of note (not more than 10 of the most recent).

- Introduction

An outline of the article's background and rationale should be included, ending with a clear statement of the research question, where relevant.

- Methods

This should provide sufficient detail for the reader to be able to replicate the study. Published methods should be described in brief, with appropriate citation.

- Results

These should be concise and not contain repetition of the methods. Data in the text should not be replicated in the tables or figures or vice versa.

- Discussion

There should be a distinction between deduction and speculation.

- Conclusions

Only conclusions directly supported by the evidence should be included, as well as applications in clinical and other settings. Implications for further study should also be mentioned. A short section should summarise the clinical relevance of the research.

Suitable Tables and Figures can be included, followed by the References.

2. Review articles

These are systematic, critical assessments of literature and data sources pertaining to the course (prognosis), cause (aetiology), diagnosis, treatment, prevention, or economic analysis of a clinical disorder or an intervention to improve the quality of health care, covering established and new concepts in sports medicine. Their length should be 2500-4000 words.
There should be an abstract of not more than 250 words summarising the main points in the review, under the following headings:

- Objective: State the primary objective of the article.
- Data sources: Describe the data sources that were searched, including dates, terms and constraints.
- Study section: Identify the number of studies reviewed and the criteria used for their selection.
- Data extraction: Summarise guidelines used for abstracting data and how they were applied.
- Data synthesis: State the main results of the review and the methods used to obtain these results.
- Conclusions: State primary conclusions and their clinical applications, avoiding overgeneralization. Suggest areas for additional research if needed.

The abstract should be followed by 5 keywords.

The text of the manuscript with regard to review articles should be arranged in the following sequence:

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- <u>Discussion</u>

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- <u>Conclusions</u>

  Only conclusion directly supported by the evidence should be included, as well as applications in clinical and other settings. Implications for further study should also be mentioned.

  Suitable Tables and Figures can be included, followed by the References.

3. Short articles

These articles can be a case report, an office procedure, or a clinical examination, and should not exceed 2000 words.

The articles should have an unstructured abstract of no more than 200 words that summarizes the objective, main points, and conclusions of the article. The abstract should be followed by up to 5 keywords

In general, the text of the manuscript with regard to short articles should be arranged in the following sequence:

- **<u>Title page</u>**

This should contain the title and sub-title (where relevant) of the article, the full names, highest academic degrees, and affiliations of all authors. The full contact details (including address, tel. no., fax no. and email address), of the corresponding author must appear at the bottom left of the page. An appropriate running title header, not exceeding 45 letters and spaces, should also be included. Unless otherwise indicated, the proofs will be sent to the corresponding author. Information concerning sources of financial support should be placed in the Acknowledgement section.

- **<u>Abstract</u> (including 5 keywords)**

The page following the title page should include a structured abstract (link this) as described above. The abstract should be followed by 5 keywords (e.g. Keywords:)

- **Author biography (ies)**

Each author should include a short biography that includes academic title/degrees, affiliation, research focus, awards and societal affiliations, and previous publications of note (not more than 10 of the most recent).

Then follow the guidelines listed below, based on the type of short article.

Types of short articles:

(a) Case report

An Introduction should outline the unique importance for presenting the case report.

Clinical history should follow (1-2 paragraphs) and the differential diagnosis.

Under Clinical examination, relevant findings (both positive and negative) should be outlined in 1-2 paragraphs, followed by the clinical diagnosis (this can be a list).

Special investigations. If undertaken, their results should be described in 1-2 paragraphs. These can be illustrated with a maximum of 2 images.

Final diagnosis should be expressed in 1-2 lines.

Management should be discussed in 1-2 paragraphs.

(b) Office procedure

This should be discussed under the following headings:

Introduction

Indications and contra-indications

Description of the clinical procedure, including a maximum of 2 images where relevant.

Main clinical importance of the procedure. A summary of the main clinical practice points should conclude the report (i.e. what can a clinician learn from this case).

(c) Clinical examination technique

The following headings can be used as guidelines:

Introduction, discussing the reason(s) for the test.

Indications

Results

Notes on the repeatability and validity of the test.

Where relevant, a maximum of 2 images can be included for illustration.

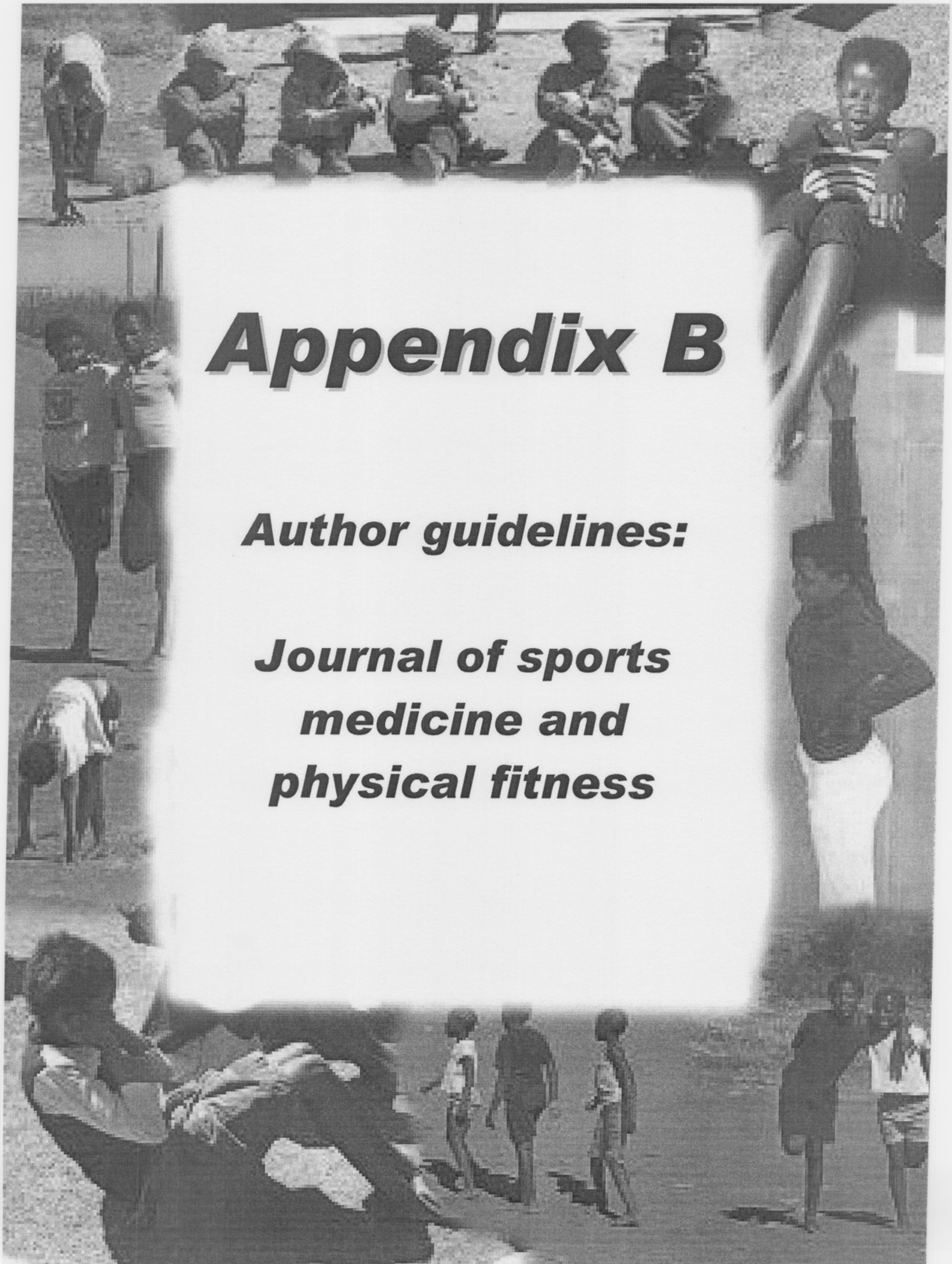
In all cases the length of the articles excludes Tables, Figures, Images and References.

4. **Letters to the Editor**

The ISMJ welcomes letters discussing recent articles published in the journal. They should not exceed 300 words and contain not more than 3 references. The author's name and affiliation, as well as an email address should be included. Letters should be submitted online via the web site.

Important

When articles are submitted to the Editorial Office, kindly include the names of 3 referees, with their contact details (tel./fax numbers, and email addresses.



Appendix B

Author guidelines:

Journal of sports medicine and physical fitness

The Journal of Sports Medicine and Physical Fitness publishes scientific papers relating to the area of the applied physiology, preventive medicine, sports medicine and traumatology, sports psychology. They should be of high scientific interest and also include results of theoretical research and practical application in sports medicine. Contributions may be in the form of editorials, original articles, review articles, case reports, technical notes, therapeutical notes, new technologies, special articles and letters to the Editor. Manuscripts must be prepared in strict compliance with the instructions for Authors published below. These conform with the Uniform Requirements for Manuscripts Submitted to Biomedical Editors (Ann Intern Med 1997;126:36-47), edited by the International Committee of Medical Journal Editors. Articles not conforming to international standards will not be considered. Papers should be sent to the Editors in three copies (including title page, key words, text, figures and tables with legends) with diskette.

Manuscripts, diskette and communications concerning editorial aspects should be sent to:

The Journal of Sports Medicine and Physical Fitness
Institute of Sports Science
Via dei Campi Sportivi, 46
I-00197 Roma (Italy)
E-mail: JSM@Coni.it

Submission of the typed manuscript means that the paper has not already been published and, if accepted, will not be published elsewhere either entirely or in part. All illustrations should be original. Illustrations taken from other publications must be accompanied by the permission of the publisher. The journal adheres to the principles set forth in the Helsinki Declaration and states that all reported research concerning human beings should be conducted in accordance with such principles. The journal also adheres to the International Guiding Principles for Biomedical Research Involving Animals recommended by the WHO and requires that all research on animals be conducted in accordance with them. Papers must be accompanied by the following submission letter, signed by all Authors: "The undersigned Authors transfer the ownership of copyright to The Journal of Sports Medicine and Physical Fitness should their work be published in this journal. They state that the article is original, has not been submitted for publication in other journals and has not already been published. They state that they are responsible for the research that they have designed and carried out; that they have participated in drafting and revising the manuscript submitted, which they approve in its contents. They also state that the research reported in the paper was undertaken in compliance with the Helsinki Declaration and the International Principles governing research on animals". Authors implicitly agree to their paper being submitted to the Editorial Board. In the case of requests for modifications, the new corrected version should be sent to the editorial office either by mail or by e-mail underlining and highlighting the parts that have been modified. The correction of proofs should be limited to a simple check of the printing; any changes to the text will be charged to the Authors. Corrected proofs must be sent back within five days to The Journal of Sports Medicine and Physical Fitness - Edizioni Minerva Medica - Corso Bramante 83-85, I-10126 Torino (Italy). In case of delay, the editorial staff of the journal may correct the proofs on the basis of the original manuscript. Forms for the ordering of reprints are sent together with the proofs.

Kinds of papers accepted

Editorial. Commissioned by the Editor in Chief or Board of Editors, it must deal with a subject of topical interest regarding which the Author expresses his personal opinion. A maximum of 10 typewritten pages and 30 references will be accepted. **Original articles**. These should be original contributions to the subject treated. A maximum of 20 typewritten pages and 60 references will be accepted. The article must be subdivided into the following sections: introduction, materials and methods, results, discussion, conclusions. In the introduction the aim of the study should be clearly summed up.The materials and methods section should describe in logical sequence how the study was designed and carried out, how the data were analysed (what hypothesis was tested, what type of study was carried out, how randomisation was done, how the subjects were recruited and chosen, provide accurate details of the main features of treatment, of the materials used, of drug dosages, of unusual apparatus, of the statistical method ...). In the results section the answers to the questions posed in the introduction should be given.The results should be reported fully, clearly and concisely with figures, graphs and tables. The discussion section should sum up the main results, critically analyse the methods used, compare the results obtained with other data reported in the literature and discuss the implications of the results.

Review articles. These should discuss a topic of current interest, outline current knowledge of the subject treated, analyse the different opinions regarding the problem discussed, be up-to-date on the latest data in the literature. A maximum of 25 typewritten pages and 100 references will be accepted.

Case reports. These give a description of particularly interesting cases. A maximum of 10 typewritten pages and 30 references will be accepted. The article must be subdivided into the following sections: introduction, case report or clinical series, discussion, conclusions.

Technical notes. Description of a new technique or changes to techniques already in use.A maximum of 10 typewritten pages and 30 references will be accepted.

Therapeutical notes. These are intended for the presentation and assessment of new drugs. A maximum of 10 typewritten pages and 30 references will be accepted. The article must be subdivided into the following sections: introduction, materials and methods, results, discussion, conclusion.

New technologies. These should be critical reviews of new equipment. A maximum of 10 typewritten pages and 30 references will be accepted. The paper must be subdivided into the following sections: introduction, materials and methods, results, discussion, conclusions.

Special articles. These present research projects on the history of sports medicine, teaching methods and economic and legislative aspects concerning this field. A maximum of 10 typewritten pages and 30 references will be accepted.

Letters to the Editor. These may refer to articles already published in the journal or to a subject of topical interest that the Authors wish to present to readers in a concise form. A maximum of 2 typewritten pages and 5 references will be accepted.

Preparation of manuscripts

The paper should be typed using double spacing and margins of at least 2.5 cm on 212x297 mm format sheets (ISOA4). Type on one side only. The paper must be divided into the following sections:

Title page

- Title: concise but informative, with no abbreviations.
- First name, surname and signatures of the Authors.
- Institute and University or Department and Hospital where each Author works.
- Name, address, telephone number and e-mail of the Author to whom all correspondence and proofs should be sent.
- Dates of any congress where the paper has already been presented.
- Mention of any funding or research contracts.
- Acknowledgements.

Abstract and key words

Articles should include an abstract of minimum 200 and maximum 250 words. For original articles, therapeutical notes, new technologies it should be structured into the following sections: *background* (aim of the study), *methods* (experimental design, patients and interventions), *results* (what was found), *conclusion* (meaning of the study). Key words should refer to the terms from Medical Subject Headings (MeSH) of the Index Medicus. No abstracts are requested for Editorials and Letters to the Editor.

Text

Identify methodologies, equipment (give name and address of manufacturer in brackets) and procedures with sufficient details to allow other researchers to reproduce results. Specify well-known methods including statistical procedures; mention and provide a brief description of published methods which are not yet well known; describe new or modified methods at length; justify their use and evaluate their limits. All drugs should indicate generic name, dose and how administered. Brand names for drugs should be given in brackets. Units of measurement, symbols and abbreviations must conform to international standards. Measurements of length, height, weight and volume should be given in metric units (metre, kilogram, litre) or their decimal multiples. Temperatures must be expressed in degrees Celsius. Blood pressure must be expressed in millimeters of mercury. All hematological and clinicochemical measurements should be expressed in metric units using the International System of Units (IS). Authors should avoid using little used symbols and abbreviations. They must however be explained when they first appear in the text.

References

It is expected that all cited references will have been read by the Authors. The references must contain only the Authors cited in the text, be numbered using Arabic numerals and in the order in which they are first cited. Bibliographical entries in the text should be quoted using bracketed Arabic numerals. References must be set out in the standard format approved by the International Committee of Medical Journal Editors.

Journals

Each entry must specify the Author's surname and initials (list all Authors up to six. If there are seven or more list only the first six names and add "*et al.*"), the article's original title, the name of the Journal (respecting the abbreviations used by Index Medicus), the year of publication, the number of the volume and the number of the first and last pages.

Follow the international standard punctuation carefully when citing references.

Examples:

— Standard article.

Sutherland DE, Simmons RL, Howard RJ. Intracapsular technique of transplant nephrectomy. Surg Gynecol Obstet 1978;146:951-2.

— Organization as author

International Committee of Medical Journal Editors. Uniform requirements for manuscripts submitted to biomedical journals. Ann Int Med 1988;108:258-65.

— Issue with supplement

Payne DK, Sullivan MD, Massie MJ. Women's psychological reactions to breast cancer. Semin Oncol 1996;23(1 Suppl 2):89-97.

Books and monographs

For occasional publications the names of the Authors, the title, edition, place, publisher and year of publication must be given.

Examples:

Books by one or more Authors

Rossi G. Manual of Otorhinolaryngology. Turin: Edizioni Minerva Medica; 1987.

— Chapter from book

De Meester TR. Gastroesophageal reflux disease. In: Moody FG, Carey LC, Scott Jones R, Ketly KA, Nahrwold DL, Skinner DB, editors. Surgical treatment of digestive diseases. Chicago: Year Book Medical Publishers; 1986.p.132-58.

— Congress proceedings

Kimura J, Shibasaki H, editors. Recent advances in clinical neurophysiology. Proceedings of the 10th International Congress of EMG and Clinical Neurophysiology; 1995 Oct 15-19; Kyoto, Japan. Amsterdam: Elsevier; 1996.

Tables

Each table must be submitted on a separate sheet typed correctly and prepared graphically in keeping with the page layout of the journal, numbered in Roman numerals and accompanied by a short title. Notes should be inserted at the foot of the table and not in the title. Tables should be referenced in the text.

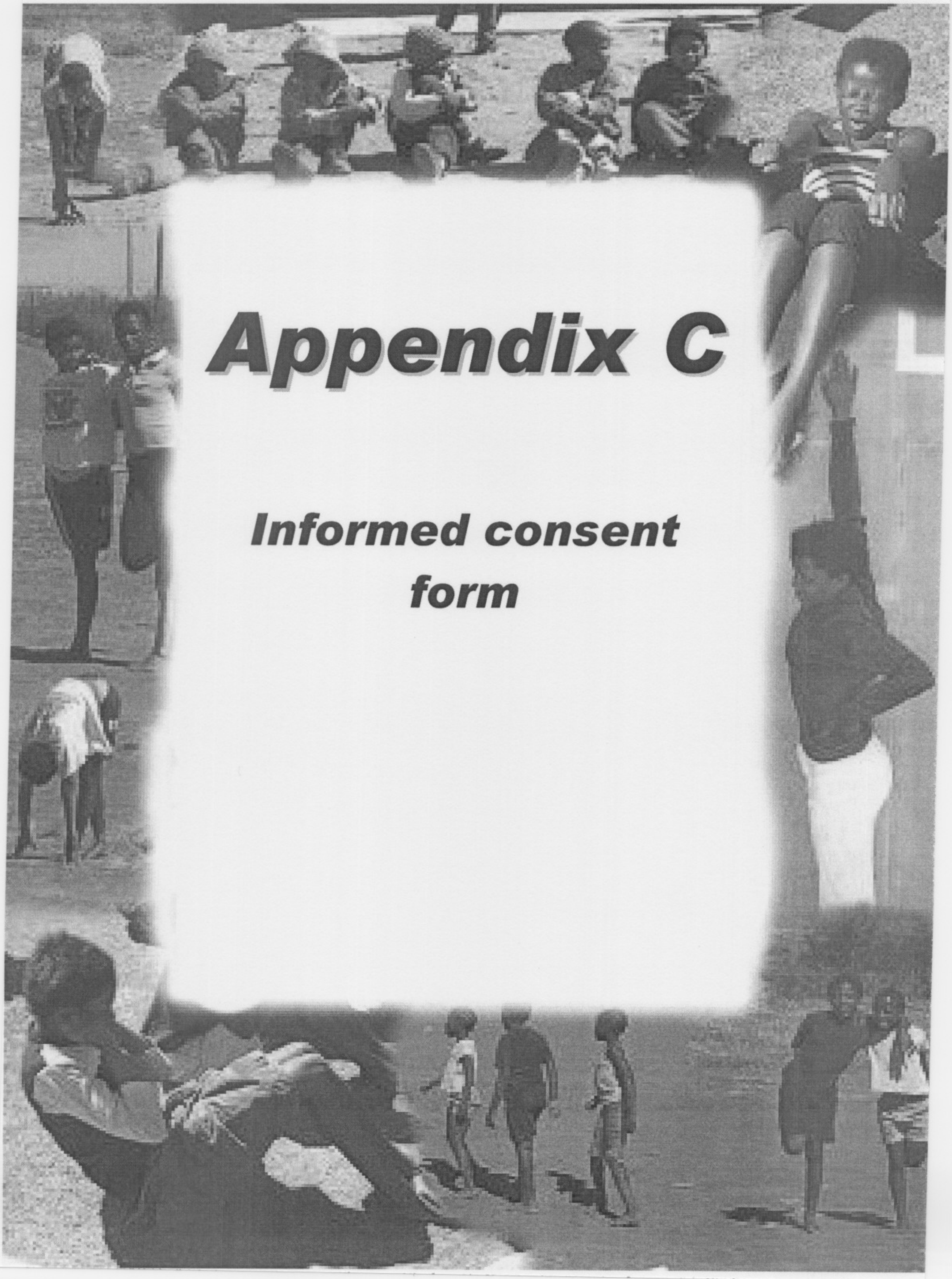
Figures

The photographs must be submitted as glossy prints. The back of each should have a label showing the number (Arabic numerals), the title of the article, the name of the first Author and orientation (top and bottom) and it should be referenced in the text. Do not write on the back of the illustrations or scratch or ruin them by using staples. Reproductions should be limited to the part essential for the purposes of the paper. Histological photographs should always be accompanied by the magnification ratio and staining method. Legends should be typed on a separate sheet. Drawings, graphs and diagrams should be done using a computer. X-ray examinations must be submitted as photographs on paper. Electrocardiograms, electroencephalograms etc. must be sent in their original forms or possibly as photographs, never photocopies. If the figures are in colour it should always be specified whether colour or black and white reproduction is required.

Optimal dimensions for publication in the journal are:
– 8.6 cm (basis) x 4.8 cm (high)
– 8.6 cm (basis) x 9 cm (high)
– 17.6 cm (basis) x 9 cm (high)
– 17.6 cm (basis) x 18.5 cm (high): 1 page.

Instructions for papers typed using a Personal Computer

All papers should be sent to the editorial office in IBM-compatible DOCformat, using the programmes:
– Microsoft Word 2000
– Microsoft Word '97
– Microsoft Word 6.0/95
Tables and graphs may also be sent in IBM-compatible XLS format, using the programmes:
– Microsoft Excel 2000
– Microsoft Excel '97
– Microsoft Excel 5.0/95
Illustrations may be sent in the following formats: BMP, JPG, GIF, TIF. Maximum size of each illustration 300 Kb.
Disks must be labelled as follows:
a) Author's name
b) Title of paper
c) Word processing program used with version number.



Appendix C

Informed consent form

YUNIBESITI YA BOKONE-BOPHIRIMA
NORTH-WEST UNIVERSITY
NOORDWES-UNIVERSITEIT

1 JUNE 2005

INFORMED CONSENT

ATHLETE'S NAME ....

AGE ....

Dear Parent

Your child has been identified as a potential talented athlete. The chosen children will undergo a battery of sport specific tests to evaluate various anthropometric, physical and motor components associated with elite performance in your sport. The children will be transported to the North-West University for one of the testing occasions. The children will be exposed to a sport development program for 10 week 2-3 times a week.

PLEASE READ THE FOLLOWING CAREFULLY

- Participation is voluntary; the child has the right to terminate participation at any time. I, however want to urge you to motivate your child to participate in the program on a regular bases for the program to be advantageous for the child.
- The intensity of the tests and program will vary from comfortable to strenuous. The child could experience slight muscle stiffness due to the flexibility program.
- The results from the different testing procedures can reveal some of the child's physical and motor strengths and weaknesses. In order to permit the tester to formulate a comprehensive programme for improvement, the child's complete cooperation and compliance is essential.
- If you have any questions regarding the project, please do not hesitate to contact me (082 851 3127).

I hereby declare that:

- To the best of my knowledge my child is currently free form existing medical conditions/other complaints or injury that would preclude him/her from full participation in this programme.
- I give permission to the tester that my child can be tested and participate in the sport development programme for 10 weeks 2-3 times a week.
- I indemnify the tester and/or the University against any injury, death or damages which might stem from participation in the programme.

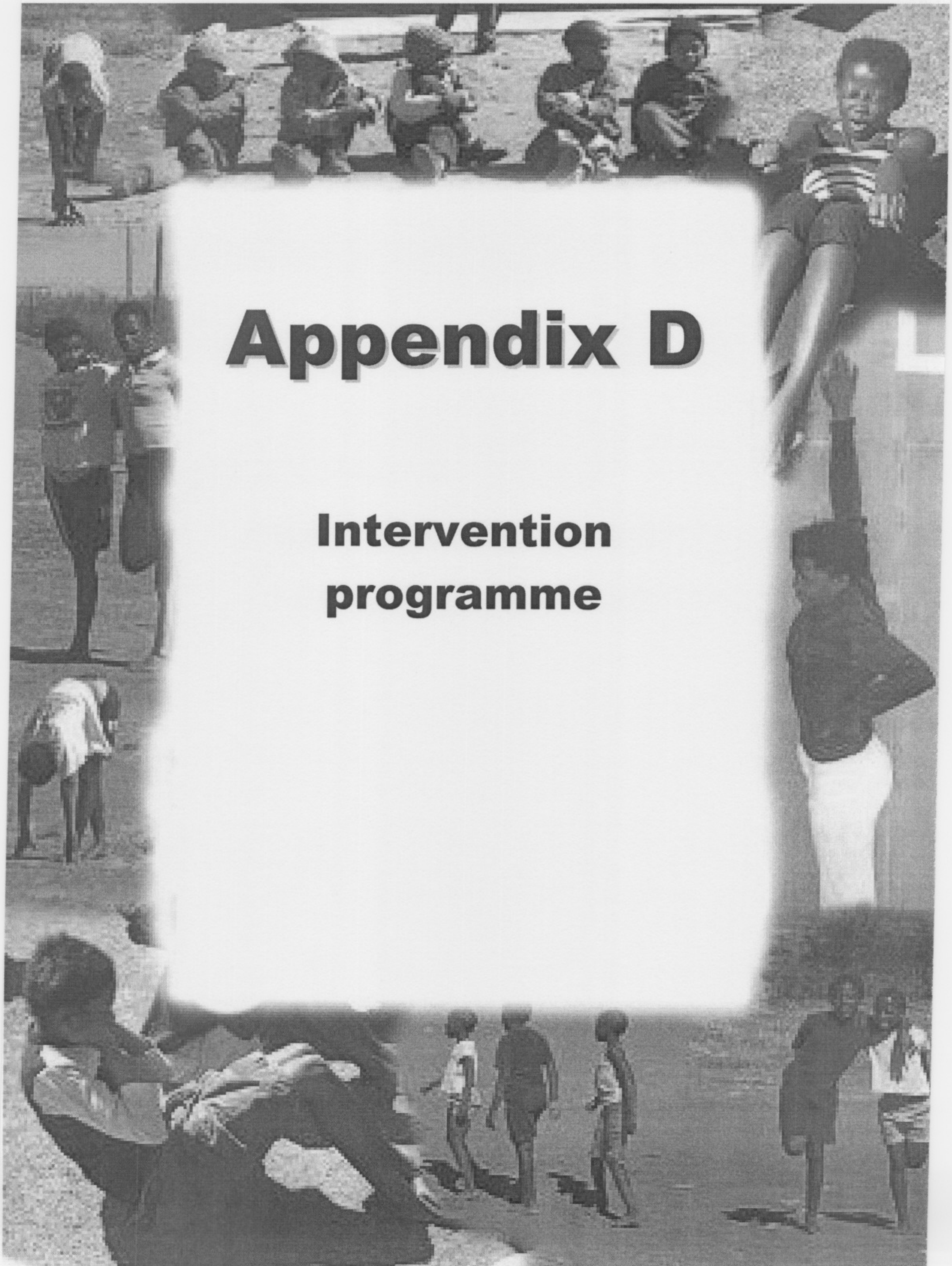
Guardian's signature ....

Date ....

Thank you for allowing your child to participate in this research project.

Ankebé Kruger

Sport Scientist



Appendix D

Intervention programme

GIRLS										
Motor skill	**Week 1**	**Week 2**	**Week 3**	**Week 4**	**Week 5**	**Week 6**	**Week 7**	**Week 8**	**Week 9**	**Week 10**
Warming up (15 min) • Jog (2 min) • Static stretches o Posterior neck o Triceps o Posterior deltoid o Pectoralis o Upper back o Hips & gluteus o Adductors o Hamstrings o Quadriceps o Calfs o Ankles • Ballistic stretches o Russian walk o Butt kicks	Each static stretch was held for 30 seconds									
Speed (20 min) • File relay	X	X	X	X	X					

• Pass	X	X	X	X	X					
• Skipping running						X	X	X	X	X
• Beanbag relay						X	X	X	X	X
Reaction time										
• Reaction drill	X	X	X	X	X					
• Fox and squirrel	X	X	X	X	X					
• Underhand slap						X	X	X	X	X
• Tail catching						X	X	X	X	X
Running form (10 min)										
• Butt kickers	2 reps	2 reps	2 reps	2 reps	2 reps	3 reps	3 reps	3 reps	3 reps	3 reps
• Down and offs	2 reps	2 reps	2 reps	2 reps	2 reps	3 reps	3 reps	3 reps	3 reps	3 reps
• Ladders (4m)	2 reps	2 reps	2 reps	2 reps	2 reps	3 reps	3 reps	3 reps	3 reps	3 reps
• African dance	2 reps	2 reps	2 reps	2 reps	2 reps	3 reps	3 reps	3 reps	3 reps	3 reps
• Drum major	2 reps	2 reps	2 reps	2 reps	2 reps	3 reps	3 reps	3 reps	3 reps	3 reps
Speed endurance (10 min)										
• "Hollow sprints" (25 meters)	2 sets	3 sets	3 sets	4 sets	4 sets	5 sets	5 sets	6 sets	6 sets	7 sets

Plyometry (10 min)	2 reps	2 reps	2 reps	2 reps	2 reps	2 reps	2 reps	2 reps	2 reps	2 reps
• Bunny hops										
• Hop scotch										
• Lateral jumps										
• Single runs										
• Double leg bound										
• Single leg bound										
Strength (10 min)										
• **Leg strength**										
o Half squat jumps	10 reps	10 reps	10 reps	10 reps	10 reps	20 reps	20 reps	20 reps	20 reps	20 reps
o Straddles	20 reps	20 reps	20 reps	20 reps	20 reps	30 reps	30 reps	30 reps	30 reps	30 reps
• **Core**										
o Crunches – knees up	2 sets of 10 reps	2 sets of 10 reps	2 sets of 10 reps	2 sets of 10 reps	2 sets of 10 reps	2 sets of 15 reps	2 sets of 15 reps	2 sets of 15 reps	2 sets of 15 reps	2 sets of 15 reps
o Bridges	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps
Warming down	Static stretches as in warm-up									

X: Games used in the indicated week

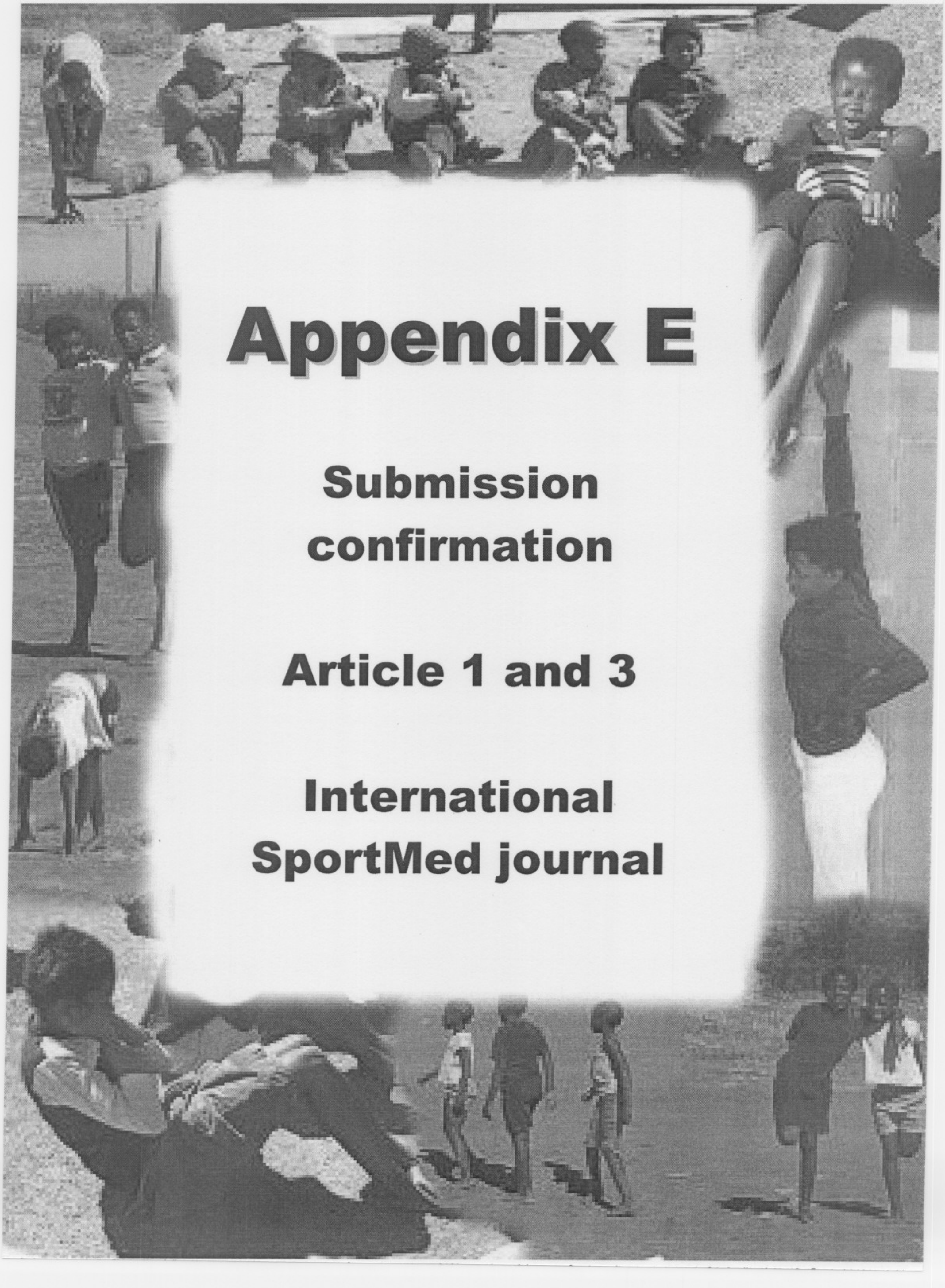
BOYS										
Motor skill	**Week 1**	**Week 2**	**Week 3**	**Week 4**	**Week 5**	**Week 6**	**Week 7**	**Week 8**	**Week 9**	**Week 10**
Warming up (15 minutes) • Jog (2 minutes) • Static stretches ○ Posterior neck ○ Triceps ○ Posterior deltoid ○ Pectoralis ○ Upper back ○ Hips & gluteus ○ Adductors ○ Hamstrings ○ Quadriceps ○ Calfs ○ Ankles • Ballistic stretches ○ Russian walk ○ Butt kicks	Each static stretch was held for 30 seconds.									
Speed (15 minutes) • 50m sprints	5 reps	5 reps	6 reps	6 reps	7 reps	7 reps	8 reps	8 reps	9 reps	9 reps

• Beanbag relay	X	X	X	X	X	X	X	X	X	X
Reaction time										
• 0-5m on whistle from different positions	5 reps	5 reps	6 reps	6 reps	7 reps	7 reps	8 reps	9 reps	10 reps	10 reps
• Underhand slap	X	X	X	X	X	X	X	X	X	X
Running form (10 minutes)										
• Sitting and standing arm swing	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps
• Butt kickers	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps
• Down and offs	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps
• Ladders (4m)	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps
• African dance	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps
• Drum major	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps
Speed endurance (15 minutes)										
• 60m	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps	3 reps
• 80m	3 reps	3 reps	3 reps	3 reps	3 reps	4 reps	4 reps	5 reps	5 reps	6 reps
• with walk back as recovery, progress, jog back as recovery										
Plyometry (15 minutes)	-	-	-	-	2 reps	2 reps	2 reps	2 reps	2 reps	2 reps
• Bunny hops										
• Hop scotch										
• Lateral jumps										

• Single runs • Double leg bound • Single leg bound										
Strength (15 minutes)										
• **Leg strength**										
o Assisted squats	3 x 5	3 x 7	3 x 8	3 x 9	3 x 10	3 x 11	3 x 12	3 x 13	3 x 14	3 x 15
o Walking lunges	3 x 5	3 x 7	3 x 8	3 x 9	3 x 10	3 x 11	3 x 12	3 x 13	3 x 14	3 x 15
• **Core**										
o Medicine ball crunches	2 x 10	2 x 10	2 x 12	2 x 12	2 x 14	2 x 14	2 x 16	2 x 16	2 x 18	2 x 18
o Partner leg raise	2 x 10	2 x 10	2 x 12	2 x 12	2 x 14	2 x 14	2 x 16	2 x 16	2 x 18	2 x 18
Warming down	Static stretches as in warm-up									

X: Games used every Wednesday during the 10 weeks

Example: 3 X 5 = 3 sets of 5 repetitions



Appendix E

Submission confirmation

Article 1 and 3

International SportMed journal

Date of submission: 23rd November 2005

Dear Ms Kruger

Thank you for sending us your research manuscript entitled "Talent identification and development of sprinting and long jumping ability among 10-15-year old girls from disadvantaged communities". This is just to let you know that the manuscript has been provisionally accepted for publication in the International SportMed Journal.

However, the reviewers and the Editorial Committee have requested certain changes, and I will send these requested changes through to you tomorrow (Wednesday).

Kind regards

Yvonne

Yvonne Blomkamp B.A. H Lib. Dip. M.A.
Technical Editor/Editorial Manager
International SportMed Journal
Sports Science Institute of South Africa
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7700 NEWLANDS
South Africa
Tel.: +27 (21) 650 4579
Fax.: +27 (21) 686 6213
Email: yblomkam@sports.uct.ac.za
ISMJ web site: http://www.ismj.com

Date of submission: 27th June 2006

Dear Ankebe

I acknowledge receipt of your article "Talent identification determinants for sprinting and long-jumping in 10-15 year old girls from disadvantaged communities" submitted to the International SportMed Journal. We shall be in contact with you shortly.

Kind regards

Yvonne

Yvonne Blomkamp B.A. H Lib. Dip. M.A.
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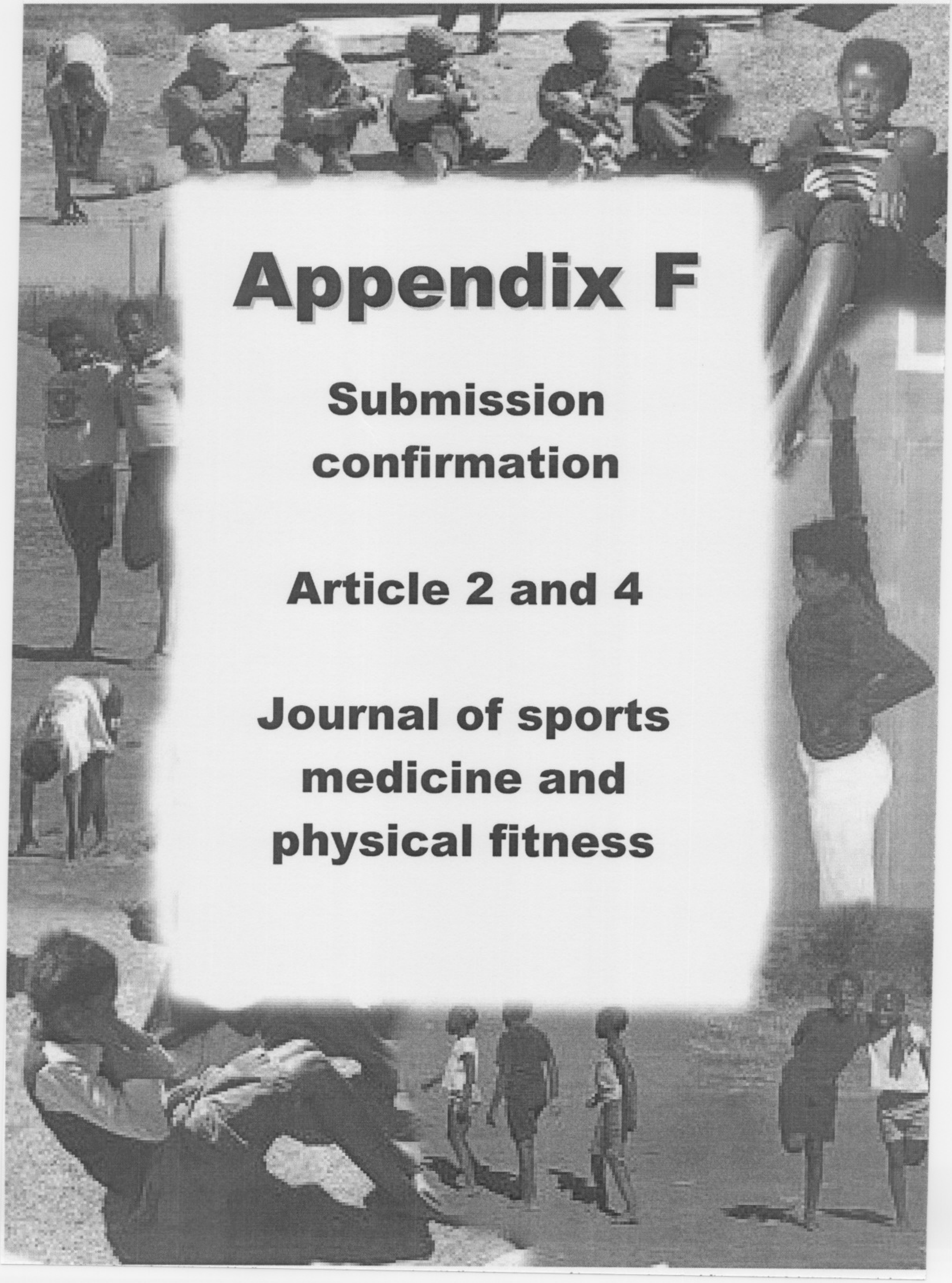
ISMJ web site: http://www.ismj.com



Appendix F

Submission confirmation

Article 2 and 4

Journal of sports medicine and physical fitness

Date of submission: 9th June 2006

Subject: Scientific paper no. 2252 - J. SPORTS MEDICINE PHYS.FITN.

Dear DR. KRUGER ANKEBE,

I am pleased to inform you that I have received your paper entitled:

THE EFFECT OF A SPORT DEVELOPMENT PROGRAMME ON SPRINTING AND LONG-JUMP ABILITIES IN 10-15 YEAR OLD BOYS FROM DISADVANTAGED COMMUNITIES

submitted to J. SPORTS MEDICINE PHYS.FITN. and registered with the number 2252.

I would ask you to kindly use this reference number for future correspondence.

The paper is now being examined by the referees and you will be notified of the decision of the Editorial Committee as soon as possible.

I thank you and your colleagues for your interest in Edizioni Minerva Medica journals and send you my very best regards.

Managing Editor
Prof. Alberto Oliaro

Date of submission: 30th June 2006

Subject: Scientific paper no. 2263 - J. SPORTS MEDICINE PHYS.FITN.

Dear DR. KRUGER ANKEBE,

I am pleased to inform you that I have received your paper entitled:

TALENT IDENTIFICATION DETERMINANTS FOR SPRINTING AND LONG-JUMP FOR 10 TO 15 YEAR-OLD BOYS FROM DISADVANTAGED COMMUNITIES

submitted to J. SPORTS MEDICINE PHYS.FITN. and registered with the number 2263.

I would ask you to kindly use this reference number for future correspondence.

The paper is now being examined by the referees and you will be notified of the decision of the Editorial Committee as soon as possible.

I thank you and your colleagues for your interest in Edizioni Minerva Medica journals and send you my very best regards.

Managing Editor
Prof. Alberto Oliaro