South African Journal for Research in Sport, Physical Education and Recreation Social Sciences
ISSN:0379-9069
www.sajrsper.com

EFFECT OF EXERCISE INTENSITY ON EXERCISE AND POST EXERCISE ENERGY EXPENDITURE IN MODERATELY OBESE WOMEN

Marius F. COETSEE
Department of Human Movement Science, University of Zululand, KwaDlangezwa, Republic of South Africa

ABSTRACT

Walking and/or jogging has become a popular activity especially for moderate obese women who aim to maintain acceptable body fat levels. The question whether it is more beneficial to walk/jog at a moderate pace for a longer duration or at a fast pace for a shorter duration is often asked. Research literature fails to answer this question conclusively. The aim of this study was to determine if exercise and post exercise energy expenditure are affected by the intensity of exercise during a set distance of 4km walking and/or jogging. Subjects for this study were 12 moderately obese females with mean fat percentage of 31.7±6.3% and mean age of 38.2±4.6 years. For the low intensity protocol (LI) continuous indirect calorimetry, using the Cortex Metamax portable system, was performed for a 30 minute pre-exercise period of sedentary sitting, for a 4km walk/jog on a motorised treadmill at 57% of maximum heart rate, as well as for 4 hours post exercise. The high intensity protocol (HI) consisted of continuous indirect calorimetry for a 30-minute pre-exercise period of sedentary sitting, for a 4km walk/jog on a motorised treadmill at the highest voluntary pace of the subject, as well as for 4 hours post exercise. A minimum period of one week separated the HI and LI evaluations. Oxygen consumption and substrate utilisation during and 4 hours following LI and HI were analysed. The main findings were: 1) oxygen consumption (ℓO_2) was significantly higher ($p<0.05$) during HI (54.5±9.8) than during LI (44.1±16.7); 2) post exercise oxygen consumption (ℓO_2) did not differ significantly ($p>0.05$) between HI (79.9±13.2) and LI (82.4±15.2); 3) total (exercise plus 4-hour recovery) oxygen consumption (ℓO_2) did not differ significantly ($p>0.05$) between HI (134.4±16.1) and LI (126.5±28.3); 4) post exercise fat utilisation (gm) was slightly lower after HI (18±18.7) than after LI (22.2±13.7), but the difference was not significant ($p>0.05$); 5) post exercise carbohydrate utilisation (gm) was slightly higher after HI (53.7±19.9) than after LI (46.5±21.0), but the difference was not significant ($p>0.05$); 6) total carbohydrate utilisation (gm) was significantly ($p<0.05$) higher with HI (100.7±33.7) than LI (73.8±30.2); and 7) total fat utilisation (gm) was lower with HI (26.1±17.1) than with LI (33.1±22.8), but it was not significant ($p>0.05$). This study did not find any significant advantage for mildly obese females to walk/jog for 4km at a very high intensity compared to a moderate intensity, in order to increase energy expenditure as well as enhance the oxidation of fat and thereby accelerate fat loss.

Key words: Recovery metabolism; Energy metabolism; Women; Walking.

INTRODUCTION

Walking and/or jogging has become a popular activity especially for women who aim to maintain acceptable body fat levels. The question whether it is more beneficial to walk/jog at a moderate pace for a longer duration than at a faster pace for a shorter duration, is often asked. The research literature remains unequivocal in this regard.

The relationship between oxygen uptake and running speed is linear; therefore, the total energy cost of running a given distance at a steady rate is about the same regardless of whether the pace is fast or slow (McArdle *et al.*, 1996). The same is true for walking at speeds of approximately 3 to 5 $km.hr^{-1}$, where after walking economy decreases and the relationship curves upward (McArdle *et al.*, 1996). It seems, therefore, that if the magnitude of energy expenditure is of importance, it is more beneficial to walk at a faster pace for a given distance. However, there are other factors that play a role in total energy expenditure resulting from a bout of exercise. If the magnitude of post exercise energy expenditure following exercise of low to moderate intensity differs significantly from that following high intensity exercise, it could play an important role in the maintenance of acceptable body fat levels. Research literature addresses this fact substantially but fails to reach an unopposed conclusion. Some researchers (Gore & Withers, 1990; Bahr & Sejersted 1991; Broeder *et al.*, 1991; Dawson *et al.*, 1996; Phelain *et al.*, 1997; Laforgia *et al.*, 1997) found a higher post exercise energy expenditure following more intensive exercise while others (Sedlock 1991; Thompson *et al.*, 1998) did not. It seems that the protocols employed by these researchers differed significantly and this can partly explain the controversial findings. Most studies concentrated on changing intensity but keeping duration constant. Total work done during exercise, and therefore energy expenditure, differed between the different protocols. Another factor that might explain the controversial findings, is the exercise duration that differed between different studies. Quinn *et al.* (1994) pointed out that duration of exercise could significantly affect the magnitude of post exercise oxygen consumption.

In addition to energy expenditure during and after exercise the contribution of carbohydrate and fat should be considered. Some researchers (Broeder *et al*., 1991) found a higher fat contribution to post exercise energy expenditure after higher intensity exercise when compared to lower intensity exercise, while others (Phelain *et al.*, 1997, Thompson *et al.*, 1998) did not. During exercise, fat contribution to energy expenditure is highest at approximately 57% of maximum heart rate (Coetsee & Teubes, 1993). As exercise intensity increases further, carbohydrate contribution increases and fat contribution decreases (McArdle *et al.*, 1996). This is due to the fact that a carbohydrate molecule contains many more oxygen atoms in its structure than a fat molecule, and therefore, requires less oxygen from the respiratory system. At higher intensities, when there is a relative shortage of respiratory derived oxygen at mitochondria level, carbohydrate will be the preferred fuel for the metabolic pathways.

The research described in this paper investigates the above issues as it applies to common exercise practice. The aim was to determine if exercise and post exercise energy expenditure were affected by the intensity of exercise during a set distance of 4km walking and/or jogging. The total workload was kept constant by standardising the distance covered. Only the intensity at which the standardised total amount of work was done (57% of heart rate maximum vs. voluntary fastest pace), differed. Necessarily the duration of exercise became shorter as the intensity increased.

These are common exercise modalities used by individuals wishing to lose fat. The results are therefore very relevant to a large group of women who utilise exercise to reduce body fat.

METHODS AND PROCEDURES

Subjects for this study were 12 moderately obese females with a fat percentage (mean ± standard deviation) of 31.7±6.3%, age of 38.2±4.6 years, mass of 71.9±12.8 kg and stature of 167.3±5.2 cm. All subjects were medically fit, free from any metabolic disorders, had no history of cardiovascular conditions and were not on any medication. Subjects all signed an informed consent form. Fat percentage was determined from measurements of the triceps, iliac crest and thigh skin folds, as per the method described by Jackson *et al*. (1980). Subjects were randomly assigned to perform either the low intensity protocol (LI) or the high intensity protocol (HI) first.

A standardised nutritional protocol was followed for three days prior to testing, which included a 12 hours fast, followed by a standardised light meal of cereal and one cup of coffee at 06h00, before reporting to the laboratory at 08h00. No exercise was allowed for 24 hours prior to testing. All possible factors that could affect the resting metabolic rate were avoided or standardised. The laboratory temperature was strictly controlled (mean for LI was 20.9±0.9°C and for HI 20.9±1.4°C) and humidity did not differ significantly (LI=74.7±5.7% and HI=73.1±4.6%). For the low intensity protocol (LI) continuous indirect calorimetry, using the Cortex Metamax portable system, was performed for a 30 minute pre-exercise period of sedentary sitting, for a 4km walk/jog on a motorised treadmill at 57% of maximum heart rate, as well as for 4 hours post exercise. The high intensity protocol (HI) consisted of continuous indirect calorimetry for a 30-minute pre-exercise period of sedentary sitting, for a 4km walk/jog on a motorised treadmill at the highest voluntary pace of the subject, as well as for 4 hours post exercise. A minimum period of one week separated the testing of the same subject. Data for all respiratory parameters, as well as heart rate, were recorded on-line. Rating of perceived exertion (RPE) using the Borg Scale (Borg, 1982) was recorded at 5 minute intervals during the 4km walk/jog. The 4 hours post-exercise period was spent in a secluded room, sitting and watching videos or reading. Subjects had free access to water but were not allowed any other nutrients. The following blood concentrations were measured using a Boehringer Reflotron and making use of an arterialized sample of blood from the finger: glucose 15 minutes before exercise, triglyceride 10 minutes before exercise, lactate 2 minutes after exercise, glucose 10 minutes after exercise and triglyceride 15 minutes after exercise. Energy consumption (kcal) and the contribution of carbohydrate and fat to energy consumption was calculated from oxygen consumption and respiratory quotient (RQ) according to the procedure described by McArdle *et al.*, (1996).

Statistical analyses were done using the dependent paired two-tailed t-test (Thomas & Nelson, 1996). Alpha was set at $p \leq 0.05$ for all analyses.

RESULTS

TABLE 1. **VARIABLES MEASURED DURING THE LOW INTENSITY (LI) AND HIGH INTENSITY (HI) EXERCISE PROTOCOLS (MEAN±STANDARD DEVIATION)**

Variable	**LI**	**HI**	**% Difference**
Resting metabolic rate (mlO_2/min)	271±39	276±37	+1.5
Exercise oxygen consumption (ℓO_2)	44.1±16.7	54.5±9.8	+23.4*
Post exercise oxygen consumption (ℓO_2)	82.4±15.2	79.9±13.2	-3.1
Total oxygen consumption (ℓO_2)	126.5±28.3	134.4±16.1	+6.8
Post exercise energy expenditure (kcal)	400.2±70.9	390.4±62.7	-2.4
Post exercise carbohydrate utilization (gm)	46.5±21.0	53.7±19.9	+15.6
Post exercise fat utilization (gm)	22.2±13.7	18±9.7	-18.8
Total carbohydrate utilization (gm)	73.8±30.2	100.7±33.7	+36.5*
Total fat utilization (gm)	33.1±22.8	26.1±17.1	-21.2
Exercise heart rate (bpm)	103.5±3.4	155.7±14.5	+50.3*
Post exercise heart rate (bpm)	66.2±6.1	71.3±5.7	+7.7
Exercise RPE	9.9±1.3	12.1±1.7	+22.7*
Blood lactate after exercise (mmol/l)	1.71±0.51	5.36±1.85	+213.5*

* = Statistically significant difference ($p<0.05$)

TABLE 2. **BLOOD TRIGLYCERIDE AND BLOOD GLUCOSE CONCENTRATIONS BEFORE AND AFTER LOW INTENSITY (LI) AND HIGH INTENSITY (HI) EXERCISE (MEAN±STANDARD DEVIATION)**

Variable	Before exercise	After exercise	% Difference
Blood triglyceride (mmol/l) for LI	0.98±0.27	1.14±0.42	16.3
Blood triglyceride (mmol/l) for HI	1.07±0.45	1.33±0.63	24.3*
Blood glucose (mmol/l) for LI	5.52±0.42	5.17±0.40	-6.3*
Blood glucose (mmol/l) for HI	6.02±0.82	6.14±0.84	2.0

* = Statistically significant difference ($p<0.05$)

In the present study exercise and post exercise oxygen consumption and substrate utilisation, during and 4 hours following a low and high intensity walk/jog of 4km, were compared. The results as shown in tables 1 and 2, (exercise heart rate, exercise RPE and blood lactate) clearly indicate that exercise intensity of HI was significantly ($p<0.05$) higher than for LI. Even though the distance of the walk/run was standardised at 4km, the oxygen consumption of LI and HI differed significantly ($p<0.05$). Post exercise oxygen consumption and total oxygen consumption, however, did not. Total carbohydrate utilisation differed significantly ($p<0.05$) due to the higher contribution of carbohydrate to energy consumption during HI. None of the other substrate values showed significant differences.

The main findings (mean ± standard deviation) were:

1) oxygen consumption (ℓO_2); was significantly higher ($p<0.05$) during high intensity exercise (54.5±8) than during low intensity exercise (44.1±16.7);

2) Post exercise oxygen consumption (ℓO_2); did not differ significantly ($p>0.05$) between high (79.9±13.2) and low (82.4±15.2) intensity exercise;

3) Total (exercise plus 4-hour recovery) oxygen consumption (ℓO_2); did not differ significantly ($p>0.05$) between high (134.4±16.1) and low (126.5±28.3) intensity exercise;

4) Post exercise fat utilisation (gm) was slightly lower after high intensity exercise *(18±18.7)* than after low intensity exercise *(22.2±13.7)*, but the difference was not significant ($p>0.05$);

5) Post exercise carbohydrate utilisation (gm) was slightly higher after high intensity exercise (53.7±19.9) than after low intensity exercise (46.5±21.0), but the difference was not significant ($p>0.05$);

6) Total carbohydrate utilisation (gm) was significantly ($p<0.05$) higher with high intensity exercise (100.7±33.7) than with low intensity exercise (73.8±30.2); and

7) Total fat utilisation (gm) was lower with high intensity exercise (26.1±17.1) than with low intensity exercise (33.1±22.8), but it was not significant ($p>0.05$).

DISCUSSION

This study does not support the findings of Phelain *et al*. (1997), Laforgia *et al*. (1997), Bahr and Sejersted (1991), Broeder *et al*. (1991), Gore and Withers, (1990) and Dawson *et al*. (1996) that higher intensity exercise induce a greater excess post exercise oxygen consumption. This discrepancy could partly be explained by the threshold phenomenon, described by Bahr and Sejersted (1991), who found that an exercise intensity above 40-50% of VO2max is required in order to trigger the metabolic processes responsible for prolonged excess post exercise O2 consumption. All the above researchers except Laforgia *et al*, (1997) compared an exercise intensity of 50% VO2max or lower with a higher intensity. However, both Thompson *et al*. (1998) and Sedlock (1991), who did not show a difference in excess post exercise oxygen consumption between low and high intensity exercise, used a low intensity of below 50% VO2max (33 vs. 66% and 40 vs. 60% respectively). The present study did not find a significant difference ($p>0.05$) in post exercise oxygen consumption following exercise of 57% of heart rate max versus 90% of heart rate max. Research further indicate that the duration of exercise may influence the magnitude of post exercise oxygen consumption (Sedlock 1991). A minimum of 1 hour seems to be required to effect prolonged excess post exercise oxygen consumption. The mean exercise time for low as well as high intensity exercise in the present study was below 1 hour (58.04 minutes and 35.04 minutes respectively).

The resting values for blood glucose and triglycerides were within normal range (see Table 2). HI resulted in a significant ($p<0.05$) increase in blood triglyceride level. This is consistent with what is expected, as lipids are the preferred substrate during moderate intensity exercise at a steady rate. LI resulted in a significant ($p<0.05$) increase in blood glucose level. Again this is consistent with the fact that, because of the relative shortage of cellular oxygen, glucose is preferred in the metabolism of energy for muscle contraction. The significant ($p<0.05$) higher total carbohydrate use of HI compared to LI supports this finding. Although 21% less total fat was utilised in HI than LI the difference was not significant ($p>0.05$).

CONCLUSION

This study did not find any significant advantage for moderate obese females to walk/jog at a very high intensity, relative to a moderate intensity, for a distance of 4km, in order to increase energy expenditure as well as enhance the oxidation of fat and thereby accelerate fat loss.

ACKNOWLEDGMENT

The Research Committee of the University of Zululand financially supported this research project.

REFERENCES

Bahr, R. & Sejersted, O.M. (1991). Effect of intensity of exercise on excess postexercise O_2 consumption. *Metabolism*, 40(8): 836-841.

Borg, G.A. (1982). Psychological basis of physical exertion. *Medicine Science in Sports and Exercise*, 14: *377*.

Broeder, C.E.; Brenner, M.; Hofman, Z.; Paijmans, U.; Thomas, E.L. & Wilmore, J.H. (1991). The metabolic consequences of low and moderate intensity exercise with or without feeding in lean and borderline obese males. *International Journal of Obesity*, 15(2): 95-104.

Coetsee, M.F. & Teubes, N.W. (1993). Effect of aerobic training on metabolism with special reference to obese individuals. In J. Parizkova & P. Douglas (Eds.), *Human growth, dietary intake, and other environmental factors (*78-82). Proceedings of 13th International Congress of Anthropological and Ethnological Sciences, Mexico City, 1993.

Dawson, B.; Straton, S. & Randal, N. (1996). Oxygen consumption during recovery from prolonged submaximal cycling below the anaerobic threshold. *Journal of Sports Medicine and Physical Fitness*, 36(2): 77-84.

Gore, C.J. & Withers, R.T. (1990). The effect of exercise intensity and duration on the oxygen deficit and excess post-exercise oxygen consumption. *European Journal of Applied Physiology*, 60(3): 169-174.

Jackson, A.S.; Pollock, M.L. & Ward, A. (1980). Generalized equations for predicting body density of women. *Medicine and Science in Sports and Exercise*, 12:175-182.

Laforgia, J.; Withers, R.T.; Shipp, N.I. & Gore, C.J. (1997). Comparison of energy expenditure elevations after submaximal and supramaximal running. *Journal of Applied Physiology*, 82(2): 661-666.

McArdle, W.D.; Katch, F.I. & Katch, V.L. (1996). *Exercise Physiology* (4th ed.). Baltimore, MD: Williams & Wilkins.

Phelain, J.F.; Reinke, E.; Harris, M.A. & Melby, C.L. (1997). Postexercise energy expenditure and substrate oxidation in young women resulting from exercise bouts of different intensity. *Journal of the American College of Nutrition*, 16(2): 140-146.

Quinn, T.J.; Vroman, N.B. & Kertzer, R. (1994). Postexercise oxygen consumption in trained females: Effect of exercise duration. *Medicine and Science of Sport and Exercise*, 26(7): 908-913.

Sedlock, D.A. (1991). Effect of exercise intensity on postexercise energy expenditure in women. *British Journal of Sports Medicine*, 25(1): 38-40.

Thomas, J.R. & Nelson, J.K. (1996). *Research methods in physical activity* (3rd ed.). Champaign, IL: Human Kinetics.

Thompson, D.L.; Townsend, K.M.; Boughey, R.; Patterson, K. & Bassett, D.R. (1998). Substrate use during and following moderate- and low-intensity exercise: Implications for weight control. *European Journal of Applied Physiology*, 78(1): 43-49.

Prof. Marius F. Coetsee, Dept. of Human Movement Science, University of Zululand, Private Bag X 1001, KwaDlangezwa 3886, Republic of South Africa. Tel: +27 (0)35 902-6648 (w), +27 (0)35 772-6639 (h), Fax: +27(0)35 93 916, E-mail: mcoetsee@pan.uzulu.ac.za

(Review editor: Dr. H.J. van Heerden)

BEPALING VAN TALENTIDENTIFISERINGSDETERMINANTE VIR KRUIPSLAGSWEMPRESTASIES BY 14 JARIGE SEUNS: 'N KINANTROPOMETRIESE PROFIEL

Ben COETZEE, Anita E. PIENAAR & Mercia COETZEE
Skool vir Biokinetika, Rekreasie en Sportwetenskap, Potchefstroomse Universiteit vir Christelike Hoër Onderwys, Potchefstroom, Republiek van Suid-Afrika

ABSTRACT

The aim of this study was to determine which kinanthropometric variables, with consideration of the growth and genetic stability of these determinants, are indicated by literature as possible talent-identification determinants for 50m and 100m crawl-stroke swimming performance in 14-year-old boys. The kinanthropometric variables that underlie swimming success of young boys were identified by means of an extensive literature survey. After analysing the relevant literature a kinanthropometric profile was compiled for this gender. Twenty-three kinanthropometric determinants were identified for 14-year-old boys: Long lower limb length, feet and thigh length, leg-length index, feet surface area, upper limb length, hand length, hand surface areas, long arm length in relation to body stature, brachial index, body stature, muscle mass percentage, lean body mass, body volume, wide shoulders in relation to hips, transverse chest breadth, biceps and head circumferences, sitting height, body mass, body mass stature index, as well as an ideal somatotype.

Key words: Talent; Talent identification; Crawl swimming; Kinanthropometry; Anathropometry; Heredity; Inheritance; Genetics; Growth; Development; Sexual maturation; Boys.

INLEIDING

Swem is een van die 10 sportsoorte in Suid-Afrika wat deur die National Sports Council in 1994 as 'n belangrike sportsoort geïdentifiseer is (National Sports Council, 1994). Die uitsonderlike prestasies van Penny Heyns en Mariaan Kriel by die 1996-Olimpiese Spele in Atlanta het weer eens getoon dat Suid-Afrika oor talentvolle swemmers beskik. Ten spyte van die goeie prestasies wat swemmers behaal, het 'n omvattende literatuurondersoek oor talentidentifisering in swem getoon dat talentidentifisering meestal op 'n onwetenskaplike wyse hanteer word (Hawley *et al.*, 1992; Jianyu, 1994). Tot onlangs toe is die identifisering van swemmers hoofsaaklik gebaseer op natuurlike seleksie, en dit is nog steeds in baie lande die geval. Indien talentidentifisering in swem egter op 'n meer wetenskaplike wyse in Suid-Afrika toegepas sou word, kan dit daartoe bydra dat talentvolle swemmers reeds op 'n vroeë ouderdom vir die mees geskikte swemitem geïdentifiseeer en ontwikkel word sodat beter internasionale prestasies dienooreenkomstig gelewer kan word.

PROBLEEMSTELLING

''n Omvattende literatuursoektog het aangetoon dat hoewel daar heelwat navorsingsliteratuur oor swem bestaan daar min studies is wat op jong deelnemers fokus (Coetzee, 2000). Ander tekortkominge wat uit die literatuur geblyk het, is dat die meerderheid literatuur of bloot beskrywend van aard is (Jianyu, 1994), of slegs op enkele komponente van swem fokus (Conley *et al*., 1991; Hawley *et al*., 1992).

Talentidentifisering wat op 'n wetenskaplike wyse uitgevoer word, vereis 'n spesifieke metodologie om doeltreffend te kan geskied, waaronder die bepaling van talentidentifiseringsdeterminante ook ressorteer. Volgens die literatuur dra die volgende determinante by tot swemtalent, naamlik die fisiologiese (Woodman, 1985; O'Shea, 1996), psigologiese (Furst & Hardman, 1988), motoriese (Maglischo, 1993) en kinantropometriese determinante (Mazza *et al*., 1994). Daar is ook ander verbandhoudende faktore wat tot wisselende sportprestasies kan lei, soos beskikbare geleenthede, voorbereidingservaringe, aanmoediging, ondersteuning, motivering, selfvertroue, deursettingsvermoë en gefokusde konsentrasie (Howe *et al*., 1997). Hierbenewens het Van Rossum (1997) vyf faktore uitgelig wat volgens hom net so belangrik in die behaling van sportprestasies is, naamlik: Psigiese fiksheid, natuurlike talent, fisieke fiksheid, motoriese vaardighede en kwantiteit van oefening. Weens die omvang van 'n multi-faktoriale ondersoek is daar vir die doel van die studie slegs gefokus op die kinantropometriese determinante wat swemsukses kan beïnvloed. Kinantropometrie behels onder andere 'n ondersoek na aspekte soos absolute liggaamsgrootte, somatotipering, relatiewe liggaamsgrootte of liggaamsverhouding, en liggaamsamestelling. Ackland en Mazza (1994) het aangedui dat kennis van kinantropometriese aspekte vir die wetenskaplike 'n aanduiding kan gee van die genetiese potensiaal van die kind, asook 'n aanduiding van die tipe sportsoort en die aard van 'n item binne 'n bepaalde sportsoort waarin die kind sal uitblink.

Die talentidentifiseringsprotokol wat met hierdie studie daargestel is, is van toepassing op 14-jarige seuns (puberteitsfase wat gekenmerk word deur groeiveranderinge), wat beteken dat die groeiproses en die effek daarvan op die waarde van talentbepalers ondersoek moet word (Jiang, 1993). Kinders ontwikkel verskillend en hul biologiese prosesse het verskillende ontwikkelingstempo's, wat nie noodwendig in ooreenstemming met chronologiese ouderdom is nie (Pienaar, 2000). Dit beteken dus dat vroeë ontwikkelaars kinantropometries verder ontwikkel sal wees as laat ontwikkelaars van dieselfde ouderdomsgroep en dus 'n voordeel met betrekking tot swemprestasie op hierdie ouderdom kan hê. Dit is dus noodsaaklik om 'n kind se skeletouderdom te bepaal, aangesien dit vir die wetenskaplike 'n aanduiding sal wees van hoeveel verandering daar nog na 14-jarige leeftyd te wagte kan wees, veral met betrekking tot kinantropometriese samestelling.

'n Aspek wat in samehang met die ondersoek na geskikte kinantropometriese determinante ondersoek is, is die oorerflikheidskoëffisiënt van kinantropometriese veranderlikes. Dit is algemeen bekend dat suksesvolle sportlui primêr gebore en nie ontwikkel word nie (Régnier *et al*., 1993). Dit beteken dat talentvolle sportlui oor bogemiddeld voortreflike motoriese en fisiologiese vermoëns beskik, en dat dit in 'n groot mate deur 'n persoon se genetiese samestelling bepaal word. Dit is dus belangrik dat dié faktor nooit in die talentidentifiseringsproses buite rekening gelaat sal word nie.

Die navorsingvraag wat gevolglik deur die ondersoek beantwoord wil word, is: Watter kinantropometriese veranderlikes, met inagneming van groei en genetiese stabiliteit van dié veranderlikes, kan deur die literatuur uitgewys word as moontlike talentidentifiseringsdeterminante van 50m- en 100m-kruipslagswemprestasies by 14-jarige seuns? Bevindings ten opsigte van hierdie vraag behoort die verwantskap wat daar tussen swemprestasie en die kinantropometriese samestelling van swemmers bestaan uit te wys. 'n Kinantropometriese profiel wat volgens hierdie metode saamgestel is, kan dit moontlik maak om talentvolle kruipslagswemmers te identifiseer wat hierdie aspek van hul samestelling betref.

METODE VAN ONDERSOEK

Hierdie studie het ten doel gehad om aan die hand van 'n uitgebreide literatuursoektog die kinantropometriese determinante vir kruipslag-kortafstandswem uit te lig en die belangrikheid daarvan as talentidentifiseringsdeterminante te oorweeg aan die hand van groei en genetiese stabiliteit van die veranderlikes. Literatuur is derhalwe in konteks gestel tot die doel van die studie en krities beoordeel ten einde sinvolle afleidings te kan maak. Rekenaarsoektogte wat gebruik is om die nodige literatuur op te spoor, is die volgende: *SportDiscus*, *Medical Line*, die PUK se Biblioteekkatalogus en Suid-Afrikaanse Tydskrifte (*SA Studies*). Deur gebruik te maak van hierdie soektogte is 157 bronne verkry, wat in die ondersoek gebruik is (Coetzee, 2000).

Die ondersoekgroep

Volgens Woodman (1985) is 12 tot 14 jaar die beste ouderdomme waartydens voorspellings oor prestasiepotensiaal gemaak kan word. Om hierdie redes is daar besluit om in hierdie ondersoek op seuns van 14 jaar te fokus, omdat dit as 'n gunstige ouderdom vir die aanvang van sportspesialisasie, en meer spesifiek van swem (Maglischo, 1993), beskou word. Gevolglik is literatuurbevindinge oor Interkollege-, Australiese Staatskampioenskap-, nasionale-, Olimpiese-, klub- en wêreldkampioenskapswemmers van die manlike geslag geraadpleeg. Die ouderdomme van die swemmers wat in die literatuur ontleed is, het tussen nege en 22,8 jaar gewissel. Suksesvolle man- kortafstandkruipslagswemmers se kinantropometriese samestelling is ook ontleed om daardeur determinante te identifiseer wat ook by seuns van belang mag wees. Om die invloed van groei en oorerflikheid op die geselekteerde kinantropometriese veranderlikes te bepaal, is data met betrekking tot kinders van alle ouderdomme tot en met volwassenheid vergelyk. In die ondersoek oor die invloed van oorerflikheid is data van veral tweelingstudies ontleed (Coetzee, 2000).

Prosedure van literatuurhantering

In die eerste stap van die studie is die prestasiekriteria van swem geïdentifiseer deur gebruik te maak van 'n taakanalise (Coetzee, 2000). Die waarskynlikste kinantropometriese determinante vir swemmers is hiervolgens bepaal. Volgens die riglyne van Bulgakova en Voroncov (1978) is gepoog om voorspellers te kies wat redelik "stabiel" is met betrekking tot groeiveranderinge en wat sterk deur genetiese faktore bepaal word. Longitudinale en kwasi-longitudinale studies se resultate is ontleed om die ontwikkelingsprofiel van elke kinantropometriese determinant te bepaal (Coetzee, 2000), hoewel hierdie tipe studies nie baie algemeen is nie. Literatuurbevindinge met betrekking tot vroeë en laat ontwikkelaars is ondersoek om daardeur die invloed van individuele verskille en variasies in groei op die talentidentifiseringsproses te bepaal (Beunen & Malina, 1988; Malina & Bouchard, 1991;

Lucacia, 1996). Ten laaste is die kinantropometriese determinante wat volgens hierdie analise moontlik voorspellingspotensiaal het vir 50- en 100m-kruipslagswemprestasie by 14-jarige seuns, in volgorde van belangrikheid gelys.

Kinantropometriese veranderlikes wat in die studie ondersoek is

Kinantropometriese samestelling omvat 'n groot aantal veranderlikes wat deur navorsers in breë kategorieë saamgevoeg word (Carter & Marfell-Jones, 1994). Die kinantropometriese veranderlikes wat in hierdie studie ondersoek is, is aan die hand van hierdie kategorieë ontleed. Dit is absolute liggaamsgrootte, somatotipering, relatiewe liggaamsgroottes en liggaamsamestelling (Drinkwater & Mazza, 1994; Mazza *et al*., 1994; Ross *et al*., 1994).

RESULTATE

Taakanalise

In die eerste stap van die taakanalise is die kruipslagswemslag geanaliseer. Kruipslag word uitgevoer met die abdomen wat na die bodem van die swembad gerig is en met die liggaam wat deur al die veranderende fases van die slag 'n gestroomlynde posisie inneem, wat daartoe lei dat weerstand verminder en momentum deur elke opeenvolgende armslag ontwikkel word. Die bolyf, heupe en bene bly in lyn met die wateroppervlak of net onder die wateroppervlak. Die waterlyn is tydens die uitvoering van dié swemslag ongeveer gelyk met die haarlyn van die kop. Die slag word gekenmerk deur breukdeel-van-sekonde-tydsberekening van die arms en 'n ritmiese oorskakeling van een fase van die slag na die volgende. Die bene help om die gestroomlynde posisie van die liggaam te handhaaf. Die liggaam rol gedurende die uitvoering van dié slag ongeveer 35-50° om sy lengte-as. Aan die einde van die rolaksie word die kop gedraai om asem te haal (Meyer *et al*., 1986).

Uit die taakanalise wat uitgevoer is om te bepaal watter onderliggende faktore noodsaaklik is vir swemprestasie het dit geblyk dat swemprestasie deur absolute liggaamsgrootteparameters sowel as relatiewe metings soos liggaamsamestelling beïnvloed word. Liggaamsegmentdimensies soos ledemaatlengtes, -breedtes en -omtrekke beïnvloed ook die slagtegniek en ontwikkeling van spierkrag, wat die twee slagmeganiese beginsels van die uitvoering van die swemslag is (Mazza *et al*., 1994). Uit die literatuur blyk dit duidelik dat slagafstand dié vaardigheidskomponent is wat 'n direkte en primêre invloed op die gemiddelde swemspoed (Vs) en gevolglike swemtyd van 'n swemmer oor 'n sekere afstand sal hê en nie slagfrekwensie nie (Hay & Guimaraes, 1983; Cappaert *et al*., 1995). Slagafstand ($\overline{S}$A) verwys na die afstand wat 'n swemmer per slagsiklus vorentoe beweeg, terwyl slagfrekwensie ($\overline{S}$F) na die aantal slae wat die swemmer oor 'n sekere afstand uitvoer, verwys.

Grimston en Hay (1986) het in hul navorsing ook bevind dat slagafstand sowel as slagfrekwensie van 'n aantal kinantropometriese veranderlikes afhanklik is. Uit die resultate van dié navorsers is dit duidelik dat 'n verhoogde aksilla-dwarsdeursneeoppervlakte, armlengte, hand-dwarsdeursneeoppervlakte, been frontale oppervlakte en voet-dwarsdeursneeoppervlakte almal tot 'n betekenisvolle verhoging in slagafstand sal lei. 'n Groter aksilla-dwarsdeursneeoppervlakte, arm- en beenlengte sal tot 'n betekenisvolle daling in slagfrekwensie lei. Norton *et al*. (1996) ondersteun die navorsingsbevindinge deurdat hulle langer ledemaatlengtes koppel aan 'n langer $\overline{S}$A, maar wys daarop dat die swemmer dan ook

die nodige spierkrag moet hê om die langer $\overline{S}A$ te ondersteun. Aangesien dié laasgenoemde kinantropometriese veranderlikes hoofsaaklik geneties bepaal word, wil dit voorkom asof die meerderheid swemmers wat die kinantropometriese kenmerke vertoon wat noodsaaklik vir swemprestasies is, so gebore word.

Goeie armslag- of swemtegniekkenmerke is belangrik vir swemprestasie, aldus navorsingsbevindinge (Chatard *et al*., 1991; Arellano *et al*., 1994). Hierdie navorsers het by die vergelyking van verskillende tipes swemmers (slae en afstande) definitiewe verskille ten opsigte van kinantropometriese afmetings en samestelling gevind. Uit navorsing oor stylkenmerke het daar ook 'n duidelike verband met kinantropometriese aspekte geblyk. So byvoorbeeld het Clarys *et al*. (1974) die verhouding tussen liggaamsvorm en totale weerstand in water nagevors en bevind dat die volgende faktore die grootste invloed op weerstand het:

- die Koëffisiënt van skraalheid van die swemmer, wat bepaal word deur die liggaamslengte van die swemmer te deel deur die derdemagswortel van die liggaamsvolume; en
- die Vierkantswortel van die middeldeursnee oppervlakte-verhouding

Dié resultate impliseer dat 'n groter verhouding aanleiding gee tot hoër weerstand wat die swemmer in die water sal ondervind en dat parameters soos liggaamslengte, liggaamsoppervlakte en dwarsdeursneeoppervlakte gevolglik belangrike determinante vir sukses in swem sal wees.

Voorts volg dit dat die energie-uitset van kruipslag beïnvloed kan word deur die swemmers se skraalliggaamsmassa en die effektiewe toepassing van krag gedurende die arm-trekaksie, soos wat dit deur die slagindeks (SI=Vs x $\overline{S}A$) weergegee word. Die SI en skraalliggaamsmassa is bepalend vir omtrent 81% (r=0.90) van die energiegebruik by 'n gegewe spoed, aldus Grimston en Hay (1986). Die energie-uitset van swem (Ks) per afstandseenheid teen 'n gegewe spoed (v) varieer van swemmer tot swemmer en is onder andere ook afhanklik van liggaamsgrootte. Liggaamslengte, liggaamsmassa en liggaamsoppervlakte verhoog die Ks (Chatard *et al*., 1990), waar dryfbaarheid dit laat afneem (Costill *et al*., 1985; Chatard *et al*., 1990). Chatard *et al*. (1990) het verder ook getoon dat armlengte Ks direk beïnvloed, deurdat Ks afgeneem het in direkte verhouding tot die toename in armlengte. 'n Verdere studie van Chatard *et al*. (1991) het getoon dat swemmers met lang arms 12% minder energie gebruik het as swemmers met kort arms (77cm vergeleke met 72cm). In die studie van Chatard *et al*. (1991) het liggaamslengte en -oppervlakte, wat hoog korreleer met liggaamsmassa (r=0.81 en 0.92 onderskeidelik; $p<0.01$) slegs 12% en 25% van Ks-variasie verteenwoordig. Verdere bevindinge toon ook dat suksesvolle swemmers die laagste Ks getoon het (Chatard *et al*., 1991).

Stapgewyse regressies het getoon dat liggaamslengte die enkele beste voorspeller van Ks was, met die insluiting van hidrostatiese hefkragte het die akkuraatheid van die regressie verhoog tot r=0.53. Hidrostatiese hefkragte verwys na die kragte wat met 'n opwaartse druk geassosieer word, wat vanweë 'n watervloeisnelheidsverskil ontstaan (Colwin, 1992). Dit wil dus voorkom asof Ks afhanklik is van tegniese uitvoeringsvermoë, kinantropometriese veranderlikes (liggaamslengte, liggaamsmassa, liggaamsoppervlakte, armlengte), swemtegniek en swemsnelheid.

Vervolgens word 'n kort samevatting van die literatuurbevindinge wat handel oor die kinantropometriese samestelling van man- en seun-kortafstandkruipslagswemmers weergegee.

Absolute liggaamsgrootteresultate se verband met kruipslagswem

Manlike kruipslagswemmers (KS) toon langer liggaamslengtes en ledemaatlengtes (onderste ledemaat- en dylengtes), vergeleke met swemmers van ander *swemslae* (Drinkwater & Mazza, 1994; Mazza *et al*., 1994). Dit, tesame met 'n groter gemiddelde kopomtrek en transverse borsdeursnee, gee aan hulle 'n voordeel met betrekking tot kruipslagswem vanweë hul groter bou. Dit geld veral vir kortafstand-kruipslagswemmers (KA-KS) (Mazza *et al*., 1994).

KA-KS vergeleke met swemmers van ander *swemafstande* toon groter absolute liggaamsgrootteveranderlikes (liggaamslengtes, liggaamsmassa, gebuigde-armomtrekke, biakromiale deursneë, hand- en voetlengtes, sittende hoogte en armspanne) (Drinkwater & Mazza, 1994; Mazza *et al*., 1994; Norton *et al*., 1996). Dit is waarskynlik te wyte aan die feit dat verskillende afstande verskillende kraggenererings- en energievereistes het. Kortafstandswemmers (KA) het oor die algemeen groter boonste ledemate en breër skouers (Jiang, 1993; Mazza *et al*., 1994) en is sodoende kinantropometries meer geskik gebou om hoë kraggenerering te bewerkstellig.

Die vergelyking van *suksesvolle* en *minder suksesvolle kruipslagswemmers* het aangetoon dat suksesvolle KA-KS betekenisvol ouer en langer is (Jiang, 1993; Drinkwater & Mazza, 1994; Mazza *et al*., 1994), met groter onderste- en boonsteledemaatlengtes, iliocristale- en humerusdeursneë (Mazza *et al*., 1994) as minder suksesvolle swemmers.

Resultate wat met betrekking tot ouderdomsgroepswemmers (ouderdom = nege tot 13 jaar) ondersoek is, het aangetoon dat daar 'n betekenisvolle korrelasiekoëffisiënt van -0.3445 tussen kruipslagprestasieverhoudings (die swemmer se tyd oor 100m kruipslag/die Staatrekord vir die betrokke item) en staande liggaamslengte bestaan (Blanksby *et al*., 1986). 'n Langer liggaamslengte word hiervolgens met 'n kleiner prestasieverhouding geassosieer, wat vinniger swemtye reflekteer. Navorsing het verder aangetoon dat suksesvolle KA-ouderdomsgroepswemmers klein bi-iliocristale deursneë, maar groter handpalm- en voetoppervlaktes vergeleke met minder suksesvolle swemmers toon (Lucacia, 1996).

Somatotiperingskenmerke se verband met kruipslagswem

Volgens die meerderheid navorsing wat in dié verband bestudeer is, val *suksesvolle manswemmers* se somatotipering in 'n ektomorfiese-mesomorfgradering van 2-5-3 (Carter, 1984; Carter & Marfell-Jones, 1994) en in sommige gevalle ook in die gebalanseerde-mesomorfie-kategorie van 3-5-3 (Carter, 1984; Gualdi-Russo & Graziani, 1993). Uit die voorafgaande resultate kan dus gesien word dat suksesvolle manswemmers oor 'n lang, lenige liggaamsbou beskik, met 'n gespierde voorkoms. Uit die aard van die kruipslagaksie (soos op p.12 bespreek) is dit duidelik waarom swemmers met dié liggaamsbou die grootste kans sal staan om sukses in die item te behaal. Dit geld veral vir kortafstand-kruipslagitems waar swemmers oor 'n hoë spierkomponent (mesomorfiese komponent) moet beskik om hulle in staat te stel om baie krag teen die water uit te oefen. 'n Lang liggaamslengte (ektomorfiese komponent) sal die swemmers weer 'n voordeel bied ten opsigte daarvan dat krag oor 'n langer tydperk en afstand uitgevoer kan word.

Wat betref 'n vergelyking van manlike swemmers in verskillende *swemslae* het navorsing getoon dat gemiddelde somatotiperingswaardes nie betekenisvol ten opsigte van verskillende swemslae verskil nie. Daar is egter nie-betekenisvolle verskille wat genoem kan word, naamlik dat KS die grootste gemiddelde ektomorfiekomponent getoon het, terwyl hulle die groep was met die kleinste gemiddelde meso- en endomorfiese tellings (Carter & Marfell-Jones, 1994). KA-KS het die tweede laagste endomorfietellings getoon, terwyl die gemiddelde mesomorfie- en ektomorfietellings van die KA die tweede grootste in dié vergelyking tussen swemmers van verskillende *swemafstande* was (Carter & Marfell-Jones, 1994).

Studies waar *suksesvolle* en *minder suksesvolle kruipslagswemmers* met mekaar vergelyk is wat hul somatotipe betref, het getoon dat daar geen betekenisvolle verskille ten opsigte van die somatotipering van dié twee groepe swemmers voorkom nie (Carter & Marfell-Jones, 1994). 'n Vergelyking tussen klub- en suksesvolle manswemmers het egter aan die lig gebring dat klubswemmers 'n kleiner mesomorfiese sowel as ektomorfiese telling behaal het (Gualdi-Russo & Graziani, 1993; Siders *et al*., 1993) terwyl die endomorfiese telling ietwat hoër was as dié van die Olimpiese en wêreldkampioenskap-swemmers (Liu *et al*., 1989; Gualdi-Russo & Graziani, 1993).

Uit die literatuur van suksesvolle jong swemmers (gemiddelde ouderdom van 14.1 jaar), blyk dit dat hulle oor 'n kleiner spierkomponent (mesomorfie) en groter vetkomponent (endomorfie) en ektomorfiewaarde as manswemmers (gemiddelde ouderdom van 21.3 jaar) beskik (Bloomfield *et al*., 1994). Dit verklaar ook hoekom die mans langer slagafstande tydens die kruipslagaksie sal kan uitvoer vanweë hul hoër spiermassa en groter kraggenereringskapasiteit.

Met ouderdomstoename verhoog seunswemmers se spier- en liggaamslengte-komponent, terwyl die vetkomponent verminder, almal faktore wat voordelig is vir 50m- en 100m-kruipslagprestasie. Hierdie tendens word bevestig deur navorsing wat op junior Australiese Staatskampioenskapswemmers gedoen is en getoon het dat seuns 'n effense afname in spier- en vetmassa en 'n toename in liniariteit en lengte vanaf die ouderdom van 12.2 tot 14.1 jaar verkry (Bloomfield *et al*., 1994). Dit is duidelik dat verskille ten opsigte van die somatotiperingswaardes met betrekking tot endomorfie- en ektomorfiewaardes met toename in ouderdom al hoe groter word, terwyl die mesomorfiekomponent tydens hierdie tydperk redelik konstant bly.

Liggaamsverhouding of relatiewe liggaamsgrootte se verband met kruipslagswem

Die literatuur oor relatiewe liggaamsgrootte het aangetoon dat mans KA-KS betekenisvol kleiner in die meeste relatiewe liggaamsgroottewaardes is as hulle met swemmers van ander swemslae vergelyk word (Ross *et al*., 1994).

In Ross *et al*. (1994) se studie is voorts bevind dat KA-KS oor korter voorams as langafstandswemmers beskik. Die KA-groep was weer groter ten opsigte van handlengtes en humerusbreedtes as hulle met betrekking tot die verskillende *swemafstande* vergelyk is.

Literatuurbevindinge oor manswemmers toon dat daar geen duidelike verskille ten opsigte van verskillende relatiewe liggaamsgroottes in 'n vergelyking tussen *suksesvolle* en *minder*

suksesvolle kruipslagswemmers bestaan nie, behalwe vir kleiner velvoue by suksesvolle KA-swemmers (Ross *et al*., 1994). Hierdie resultate bevestig weer eens dat 'n kleiner vetmassa voordeliger vir swemprestasie is, aangesien die swemmer minder "onaktiewe" liggaamsmassa het om oor 'n afstand te verplaas. Navorsing het wel getoon dat suksesvolle kruipslagswemmers lang armlengtes in verhouding tot liggaaamslengte het (Lucacia, 1996; Norton *et al*., 1996).

Liggaamsamestelling se verband met kruipslagswem

Die resultate van die literatuurondersoek oor liggaamsamestelling toon dat manlike kruipslagswemmers oor die kleinste gemiddelde persentasie spierweefselmassa en spiermassa-skeletmassa-verhouding van al die *swemslae* beskik (Drinkwater & Mazza, 1994).

In 'n vergelyking tussen swemmers van verskillende *swemafstande* het manlike KA die grootste spierpersentasie en kleinste velvoue vergeleke met LA getoon (Drinkwater & Mazza, 1994).

Navorsing met betrekking tot verskille wat daar bestaan tussen *suksesvolle* en *minder suksesvolle kortafstand-manskruipslagswemmers* (19.8 jaar) het aangetoon dat suksesvolle kruipslagswemmers 'n laer vetmassa (-persentasie) toon as minder suksesvolle kruipslagswemmers (Siders *et al*., 1993) en verder in al die ander liggaam-samestellingsveranderlikes hoër waardes behaal het (Klika & Thorland, 1994). Die suksesvolle groep se slagfrekwensie was ook laer en hul slagafstand groter as dié van die minder suksesvolle groep, wat verband hou met die hoër spiermassa waaroor die suksesvolle groep beskik. Die liggaamsvolume, skraalliggaamsmassa en gespierdheid van die suksesvolle kruipslagswemmers het betekenisvol met die 91.4m-swemspoed gekorreleer (Klika & Thorland, 1994). Dit is dus duidelik dat dit voordelig vir 'n volwasse kruipslagswemmer is om hoë waardes op die drie komponente te behaal, aangesien dit tot verhogings in kortafstandswemprestasie kan bydra.

Data van jonger junior swemmers (10.3 jaar) wat in Klika en Thorland (1994) se studie verkry is, het egter getoon dat die minder suksesvolle swemmers in hierdie geval 'n groter gemiddelde armlengte en liggaamsdigtheid en kleiner vetpersentasie as die suksesvolle swemmers behaal het, terwyl die res van die waardes ooreengestem het met verskille wat by twee mansgroepe verkry is. Die suksesvolle groep se slagfrekwensie was egter hoër en hul slagafstand langer as dié van die minder suksesvolle groep. Liggaamsdigtheid het betekenisvol negatief met swemspoed oor 91.4m gekorreleer, wat beteken dat 'n laer waarde voordeliger vir swemprestasies oor dié afstand is. Vetmassa het 'n positiewe betekenisvolle korrelasie met swemsnelheid getoon. Uit hierdie liggaamsamestelling van junior seuns wil dit voorkom of jong junior swemmers meer op hul dryfbaarheidsvermoë en slagfrekwensie staatmaak om hoë snelhede oor kort afstande te genereer, waar die volwasse mans weer meer op hul krag en slagafstand staatmaak om dieselfde effek te verkry.

Die studies het ook aangetoon dat mans hoër waardes met betrekking tot alle liggaamssamestellingveranderlikes toon, behalwe wat vetpersentasie betref (Bloomfield *et al*., 1983; Klika & Thorland, 1994). Dit is dus voor die hand liggend dat mans beter (ten opsigte van swemtye behaal) in kortafstand-swemaktiwiteite as seuns sal presteer.

'n Kinantropometriese profiel vir die kortafstand-kruipslag is uit hierdie afsonderlikes ontledings saamgestel en word vervolgens aangebied.

Ideale kinantropometriese samestelling van 'n seunkortafstand-kruipslagswemmer met oorweging van groei en oorerflikheid

Die ideale seunskortafstand-kruipslagswemmer behoort samevattend uit die literatuur kinantropometries soos volg daar uit te sien: Hy moet lank wees (ongeveer 1.70m) (Drinkwater & Mazza, 1994; Mazza *et al*., 1994; Norten *et al*., 1996) met 'n klein bi-iliokristale deursnee (Lucacia, 1996), en met groot handpalm- en voetoppervlaktes (Lucacia, 1996). Daarbenewens sal jong swemmers met 'n hoë bragiale en beenlengte-indeks hierdeur bevoordeel word (Bloomfield & Sigerseth, 1965). Hy moet verder oor lang ledemaatlengtes in verhouding tot sy liggaamslengte (armlengte nagenoeg 46.4% van liggaamslengte) beskik (Lucacia, 1996; Norton *et al*., 1996) en moet 'n klein liggaamsdigtheid (1.060kg) toon (Klika & Thorland, 1994). Verder moet hy op 14-jarige ouderdom oor 'n somatotiperingsgradering van nagenoeg 2.3-4.3-3.7 beskik (ektomorfiese mesomorf) (Bloomfield *et al*., 1994), met 'n lae tot matige endomorfiese en matige ektomorfiese en mesomorfiese waarde, wat ook met 'n redelike klein vetmassa (vetpersentasie van nagenoeg 6.4%) (Bloomfield *et al*., 1983; Klika & Thorland, 1994) en 'n matige spierpersentasie (Klika & Thorland, 1994) in verband staan. Die ideale seunswemmer behoort ook wat betref sy liggaamsbou (morfologie) groter as minder ideale seunswemmers te wees (Lucacia, 1996).

Sekere van die kinantropometriese determinante sal meer as ander deur groei geraak word omdat dit gedurende die puberteitsjare (14 jaar en ouer) steeds ontwikkeling ondergaan. Dit het noodwendig implikasies vir talentidentifisering omdat dit die determinant se voorspellingspotensiaal beïnvloed. Vervolgens word die bevindinge wat met hierdie literatuurondersoek, rakende die invloed van **groei** op die kinantropometriese profiel wat vir seunswemmers daaargestel is, uitgelig:

- Die ideale seunskortafstand-kruipslagswemmer vertoon reeds op die ouderdom van 14 jaar kenmerke van die manskortafstand-kruipslagswemmer. Suksesvolle manswemmers en seunswemmers vertoon lang ledemaatlengtes in verhouding tot liggaamslengte, sowel as hoë bragiale en beenlengte-indekse. Dit beteken dus dat die ideale jong swemmer met betrekking tot sy ondersteledemaat-, arm-, voorarm-, hand-, voet- en dylengtes hoër waardes as minder ideale kortafstand-kruipslagswemmers sal toon (Mazza *et al*., 1994). Die aanname geld ook ten opsigte van liggaamslengte (Grimston & Hay, 1986; Lavoie & Montpetit, 1986) en –massa (Blanksby *et al*., 1986).
- Liggaamslengte en boonste ledemaatlengtes (bragiale indeks) kan nog relatief baie verander na die ouderdom van 14 jaar (Preece & Baines, 1978; Malina & Bouchard, 1991). Aangesien die maksimum toename in liggaamslengte gemiddeld eers voorkom wanneer die maksimum groeiperiode van die humerus en radius plaasvind (op ongeveer 14-jarige ouderdom) (Malina & Bouchard, 1991), beteken dit dat die onderste ledemate se groeifase vroeër geskied as die groeifase van die boonste ledemate. Dit impliseer dat die seun met betrekking tot die onderste ledemate (beenlengte-indeks) op 14-jarige leeftyd min verdere groei sal ondergaan.
- Aangesien die voete in die onderste ledemate eerste 'n toename in finale lengte toon, en die hande in die boonste ledemate (Cameron *et al*., 1982), beteken dit dat voetlengte en

voetoppervlakte na die ouderdom van 14 jaar redelik stabiel sal wees, terwyl handlengte en handoppervlakte nog geringe groeiveranderinge kan ondergaan.

- Romplengte (sittende hoogte) bereik eers teen puberteit finale lengte (Eveleth, 1978), wat beteken dat sittende hoogte nog redelik baie na 14-jarige ouderdom sal verander.
- Tesame met die piekversnelling in romplengte kom piektoenames in skouer- (biakromiale deursnee) en heupbreedtes (bi-iliocristale deursnee) voor (Tanner *et al*., 1976). Hierdie twee veranderlikes sal dus ook na die ouderdom van 14 jaar nog veranderinge toon.
- Die verhouding tussen die skouers en heupe sal ook verdere veranderinge ondergaan, aangesien seuns gedurende dié tydperk as gevolg van groei breër skouers (biakromiale deursnee) in verhouding tot hul heupe (bi-iliocristale deursnee) ondergaan (Malina & Bouchard, 1991). Dieselfde tendens geld vir kopomtrek (Malina & Bouchard, 1991).
- Liggaamsmassa se maksimale groei vind eers na maksimale lengtegroei plaas (Tanner *et al*., 1976), wat beteken dat seuns se liggaamsmassa na die ouderdom van 14 jaar heelwat kan toeneem.
- Met maksimale massatoename vertoon ledemaat- en rompomtrekke gelyktydig soortgelyke groeipatrone (Malina & Bouchard, 1991). Die armomtrek (bisepsomtrek), transverse borsdeursnee en kopomtrek neem ongeveer in hierdie tyd maksimaal toe (Wilmore & Costill, 1994).
- Aangesien spierhipertrofie eers tydens puberteit by seuns 'n drastiese toename toon (Wilmore & Costill, 1994), beteken dit ook dat skraalliggaamsmassa, liggaamsvolume, liggaamsdigtheid en spiermassa nog baie veranderinge na die leeftyd van 14 jaar sal ondergaan. Hierdie veranderinge gaan gepaard met 'n afname (2-3%) in die gemiddelde vetpersentasie (Saris *et al*., 1985). Spierontwikkeling, 'n vetpersentasieafname en lengtetoename sal dus noodwendig daartoe lei dat somatotiperingswaardes ook verdere verandering sal ondergaan.
- Na die ouderdom van 13 jaar ontwikkel seuns oor die algemeen vanaf 'n endomorfiese mesomorf-kategorie na 'n gebalanseerde mesomorf-kategorie (Carter & Heath, 1990; Malina & Bouchard, 1991). In mid-adolessensie (ongeveer 19-jarige ouderdom) vind daar weer 'n verskuiwing na die ektomorfiese kategorie plaas (Malina & Bouchard, 1991), waama 'n verdere spiermassaverhoging weer tot 'n terugbeweging na die mesomorfkategorie lei (Bloomfield *et al*., 1994). Aangesien die somatotipering van 'n ideale kortafstandswemmer min of meer in die ektomorfiese mesomorf-kategorie val, beteken dit ook dat seuns gedurende puberteit nader aan die ideale somatotipering vir swemprestasie beweeg.

Die groeipatrone wat hier bespreek is, geld hoofsaaklik vir die gemiddelde ontwikkelaar. Die vroeë ontwikkelaar sal in die meeste gevalle makliker op ‘n jong ouderdom vir talentidentifiseringsdoeleindes geïdentifiseer kan word vanweë die feit dat die meeste van sy kinantropometriese veranderlikes op 14-jarige ouderdom reeds meer volwasse eienskappe sal vertoon. In teenstelling hiermee sal die laat ontwikkelaar met betrekking tot sy kinantropometriese samestelling nog heelwat veranderinge na die ouderdom van 14 jaar ondergaan, wat kan veroorsaak dat hierdie groep potensieel talentvolle swemmers makliker oor die hoof gesien kan word. Hierdie problematiek onderstreep weer eens die belangrikheid van die vasstelling van 'n potensiële seunswemmer se skeletouderdom op die ouderdom van 14 jaar.

Samevattend kan gestel word dat seuns teen die ouderdom van 14 jaar 'n liggaamsbou toon met min kenmerke van die volwasse liggaamsbou wat verlang word vir kruipslagswemprestasie. Dit bemoeilik talentidentifisering van seunswemmers op hierdie ouderdom aansienlik. Groei is egter nie die enigste faktor wat die stabiliteit van kinantropometriese determinante bepaal nie. **Genetiese stabiliteit**, of anders gestel, die **oorerflikheidskoëffisient** van 'n betrokke kinantropometriese determinant is 'n verdere belangrike faktor wat vir voorspellingsdoeleindes in ag geneem moet word.

Navorsingsbevindinge van Lucacia (1996) het getoon dat die genetiese samestelling van 'n persoon in 'n groot mate ook die mate, tydsbereking en regulering van die groeiproses bepaal. Die voorafgaande bespreking oor groei by seuns toon dat daar groeitendense is wat kenmerkend van die algemene populasie is. Navorsing het byvoorbeeld getoon dat na die ouderdom van 14 jaar die onderste ledemaatlengte, voetlengte, voetoppervlakte, handlengte en handoppervlakte) redelik stabiel met betrekking tot groei sal bly. Aangesien segment-(beenlengte-indeks) en beenlengtes (r=0.82 vir voetlengte) in 'n groot mate geneties bepaal word (Bouchard & Lortie, 1984; Bouchard *et al*., 1997), beteken dit dat die determinante relatief stabiel is en as talentidentifiseringsdeterminante belangrik geag kan word.

In teenstelling hiermee sal liggaamsmassa, romplengte (sittende hoogte), ledemaatomtrekke, boonste ledemaatlengtes (bragiale indeks), beendeursneë en –omtrekke (kopomtrek), spiermassa, liggaamsvolume, skraalliggaamsmassa, liggaamsdigtheid, vetpersentasie en somatotipering, gewig-lengte-indeks en in 'n mindere mate liggaamslengte met betrekking tot groei na die ouderdom van 14 jaar nog baie verandering ondergaan. Liggaamslengte (r=0.85) (Bouchard & Lortie, 1984) en boonste ledemaatlengtes (r=0.84 vir totale armlengte, r=0.71 vir voorarmlengte) (Bouchard & Lortie, 1984; Bouchard *et al*., 1997), wat ook sittende hoogte insluit, word in 'n groot mate geneties bepaal, terwyl skeletafmetings (kopomtrek) (Bouchard soos aangehaal deur Bouchard *et al*., 1997), skeletraamwerkgrootte en sommige beendeursneë (r=0.62 vir biakromiale deursnee, r=0.60 vir bi-iliocristale deursnee en r=0.60 vir humerusdeursnee) (Bouchard & Lortie, 1984; Bouchard *et al*., 1997) in 'n kleiner mate geneties bepaal word. Laasgenoemde determinante word egter steeds na die ouderdom van 14 jaar deur groei beïnvloed en sal dus om hierdie rede in 'n mindere mate as talentidentifiseringsdeterminmante op hierdie ouderdom geskik wees.

Somatotipering (r=0.50 vir endomorfie, r=0.42 vir mesomorfie en r=0.35 vir ektomorfie) (Bouchard & Lortie, 1984) en transverse borsdeursnee (r=0.34 tot 0.52) (Bouchard & Lortie, 1984; Bouchard *et al*., 1997) word in 'n mindere mate deur die oorerflikheidsfaktor bepaal. Sommige navorsers (Parnell, soos aangehaal deur Norton *et al*., 1996) verskil nog oor die effek van oorerflikheid op somatotipering (r=0.75), aangesien dié kinantropometriese determinant bepaal word deur beide liggaamslengte en spiermassa, wat op hul beurt beide in 'n groot mate geneties bepaal word. Dit wil egter lyk of vetpersentasie (r=0.55 of 25%) in 'n mindere mate deur oorerflikheid beïnvloed word (Bouchard & Lortie, 1984; McArdle *et al*., 1996). Laasgenoemde determinante behoort dus met groter omsigtigheid in die talentidentifiseringsproses gebruik te word.

GEVOLGTREKKING

Die volgende 23 kinantropometriese determinante is uit die bogenoemde analise geselekteer as belangrik vir talentidentifisering-doeleindes by seuns van 14 jaar en is in volgorde van belang gerangskik:

1. Lang onderste ledemaatlengtes;
2. Lang voet- en
3. dylengtes;
4. 'n Hoë beenlengte-indeks en
5. groot voetoppervlakte;
6. Lang boonste ledemate;
7. Handlengte en
8. handoppervlakte;
9. 'n Lang armlengte in verhouding tot liggaamslengte asook
10. 'n hoë bragiale indeks;
11. 'n Lang liggaamslengte.
12. 'n Redelik hoë spierpersentasie (spiermassa),
13. skraalliggaamsmassa en
14. liggaamsvolume.
15. 'n Redelik groot bisepsomtrek;
16. Breë skouers (biakromiale deursnee) in verhouding tot die heupe (bi-iliocristale deursnee).
17. 'n Groot transverse borsdeursnee.
18. 'n Groot kopomtrek.
19. 'n Lang sittende hoogte.
20. 'n Redelike hoë liggaamsmassa met
21. 'n hoë gewig-lengte-indeks;
22. 'n Lae vetpersentasie;
23. 'n Somatotiperingsgradering van nagenoeg 2.3-4.3-3.7.

Aangesien die onderste ledemate, wat voet- en dylengtes insluit, die mees stabiele determinante ten opsigte van groei en oorerflikheid na die ouderdom van 14 jaar is, blyk dit dat dié kinantropometriese determinante die geskikste voorspellers behoort te wees vir die identifisering van talentvolle kortafstand-seunskruipslagswemmers.

Hierdie literatuurontleding het duidelik getoon dat seuns steeds na die ouderdom van 14 jaar veranderinge met betrekking tot hul kinantropometriese samestelling sal ondergaan. Die lys van determinante wat vir talentidentifiseringsdoeleindes geselekteer is, moet dan ook in die lig hiervan beoordeel word. Dié lys van determinante sal wat priotiteitsvolgorde betref, waarskynlik heelwat verander met verdere toename in ouderdom. Daar wil dan ook uit die resultate aanbeveel word dat talentidentifisering op ‘n later ouderdom as 14 jaar moet geskied. 'n Eerste poging om kruipslagswemtalent by seuns aan die hand van kinantropometriese veranderlikes te identifiseer, sal waarskynlik beter resultate op 'n effens ouer ouderdom lewer.

SAMEVATTING

Die werkswyse wat in hierdie studie gevolg is, het dit vir die navorser moontlik gemaak om 23 kinantropometriese veranderlikes te identifiseer waaruit 'n profiel van 'n suksesvolle 14-jarige seunswemmer wat aan kortafstand-kruipslagswemitems deelneem, saamgestel kan word. Aangesien groei en genetiese stabiliteit deeglik ontleed is met betrekking tot die kinantropometriese profiel wat saamgestel is, kan die gevolgtrekking gemaak word dat die determinante wat geselekteer is, wel voorspellingspotensiaal het.

Dit kon egter nie met hierdie studie bepaal word of hierdie geselekteerde kinantropometriese veranderlikes wel diskriminerende waarde in die talentidentifiseringsproses sal hê nie. 'n Logiese volgende stap sal dus wees om empiries vas te stel watter van die veranderlikes die grootste diskriminerende waarde op 14 jaar by seuns sal toon. Daarna sal die meriete van die geselekteerde kinantropometriese veranderlikes eers as volwaardige talentvoorspellers in die praktyk bepaal kan word. Hierdie stap behoort ook in samehang met ander talentbepalende faktore gedoen te word weens die multi-faktoriale aard van talentvoorspelling.

Die ouderdom van 21.8 jaar is deur die literatuur aangetoon as die ouderdom waarby manlike kortafstandkruipslagswemmers topprestasie lewer (Mazza *et al*., 1994). Heelwat veranderinge moet nog plaasvind by die seun van 14 jaar om die tipiese kinantropometriese profiel van die manlike suksesvol (elite) swemmer te verkry. Gevolglik is dit belangrik om veral tussen die ouderdomme van 14- tot 16 jaar opvolgnavorsing te doen om daardeur die dinamiese aard van die kinantropometriese samestelling, veral wat betref die groeipatroon daarvan, te ontleed.

SUMMARY

Determining of talent identification determinants for crawl swimming performance of 14 years old boys: A kinanthropometric profile

Until recently the identification of talented sports participants have been based on natural selection methods and talent identification was carried out by coaches using their own intuition and competitors' performances in comparison with other competitors of the same age group. These methods are limited and not in accordance with scientists' findings that the identification of talented competitors should be determined by scientific and norm based selection methods. A sport where talent identification in South Africa is presently performed in an unscientific manner is swimming. A comprehensive study of available literature indicated that there is sufficient literature about successful, grown swimmers, but little research has been focussed on young swimmers. Research on this subject is very important because of the fact that talent identification of young swimmers can enhance the prospect of reaching maximum potential and direct them into the specific event/s for which they are physically and physiologically qualified.

It is against this background that the necessity for a good, scientifically based protocol for the talent identification of young swimmers is established. Such a protocol must enclose all relevant motor-, physiological-, kinanthropometric-, stroking characteristics- and psychological performance determinants that are of importance in the pursue of swimming success. Such a study would however be too comprehensive for the purpose of an article and therefore it was decided that this study would only focus on the kinanthropometric

determinants of 50- and 100m- short distance crawl swimming. According to research literature the final talent identification phase should be conducted on boys 14 years of age and older. It is for this reason that a decision was made to focus on 14-year-old boys. The stability of these kinantropometric determinants in regard to growth and heredity (genetic composition) must be established.

The aim of this study was thus to determine which kinanthropometric variables, with consideration of growth- and genetic stability of these determinants, are pointed out by literature as possible talent identification determinants of 50- and 100m crawl stroke swimming performance of 14-year-old boys.

The kinanthropometric variables that underlie the swimming success by young children were identified through a survey of available literature. A kinanthropometric profile was compiled for the gender through a thorough research of literature. The effect of growth on the kinanthropometric variables after the age of 14 years was also researched in the literature. The process of determining the stability of identified kinanthropometric variables was further carried out by researching the heritability of the different, identified kinanthropometric variables.

Results indicated that it is possible to determine which kinanthropometric variables, with consideration of growth- and genetic stability of these determinants, are pointed out by literature as possible talent identification determinants of 50- and 100m crawl stroke swimming performance of 14-year-old boys. Twenty-three kinanthropometric determinants of 50- and 100m swimming success were identified for 14-year-old-boys. The most important kinanthropometric determinants were long lower limbs, feet- and thigh lengths, a high leg-length-index and a big feet surface-area. Over and above that, successful young boy swimmers are also characterize by long upper limb lengths, hand lengths and big handsurface-areas. A long arm length in relation with body stature as well as a high brachial index, muscle mass percentage, lean body mass, body volume, wide shoulders in relation to hips, transverse chest breadth, biceps and head circumferences and sitting height can also distinguish successful young swimmers from less successful swimmers. It has also been shown that a long body stature gives a swimmer advantage when it comes to short distance swimming performances.

These results make it possible for coaches and sport scientists to use the kinanthropometric determinants identified and to categorise their young swimmers in talented and less talented swimmers. Unfortunately more comprehensive and multi-factorial studies need to be conducted to identify all relevant short distance crawl performance determinants.

VERWYSINGS

ACKLAND, T.R. & MAZZA, J.C. (1994). Introduction. In J.E.L Carter; T.R. Ackland; J.C. Mazza & W.D. Ross, (Eds.). *Kinanthropometry in aquatic sports* (viii-x). Champaign, IL: Human Kinetics.

ARELLANO, R.; BROWN, P.; CAPPAERT, J. & NELSON, R.C. (1994). Analysis of 50-, 100- and 200-m freestyle swimmers at the 1992 Olympic Games. *Journal of Applied Biomechanics*, 10(2): 189-199.

BEUNEN, G. & MALINA, R.M. (1988). Growth and physical performance relative to the timing of the adolescent spurt. In K.B. Pandolf (Ed.). *Exercise and Sport Sciences Reviews*, 16: 503-540.

BLANKSBY, B.A.; BLOOMFIELD, J.; PONCHARD, M. & ACKLAND, T.R. (1986). The relationship between anatomical characteristics and swimming performance in state age-group championship competitors. *Journal of Swimming Research*, 2(2): 30-36.

BLOOMFIELD, J. & SIGERSETH, P.O. (1965). Anatomical and physiological differences between sprint and middle distance swimmers and university level. *Journal of Sports Medicine and Physical Fitness*, 5(2): 76-81.

BLOOMFIELD, J.; ACKLAND, T.R & ELLIOTT, B.C. (1994). *Applied anatomy and biomechanics in sport.* Melbourne: Blackwell Scientific Publications.

BLOOMFIELD, J.; BLANKSBY, B.A. & ACKLAND, T. (1983). Anatomical profiles of Australian junior swimmers. *The Australian Journal of Sport Sciences*, 3(2): 14-20.

BLOOMFIELD, J.; BLANKSBY, B.A. & ACKLAND, T.R. (1994). Morphological and physiological growth of competitive swimmers and non-competitors through adolescence. In B.A. Blanksby; J. Bloomfield; T.R. Ackland; B.C. Elliott & A.R. Morton (Eds.). *Athletics, growth and development in children* (91-109). Langhorne (Australia): Harwood Academic Publishers.

BOUCHARD, C. & LORTIE, G. (1984). Heredity and endurance performance. *Sports Medicine*, 1(1): 38-64.

BOUCHARD, C.; MALINA, R.M. & PERUSSE, L. (1997). *Genetics of fitness and physical performance*. Champaign, IL: Human Kinetics.

BROOKS, G.A. & FAHEY, T.D. (1985). *Exercise physiology: Human bioenergetics and its applications*. New York, NJ: McMillan.

BULGAKOVA, N.S. & VORONCOV, A.R. (1978). How to predict talent in swimmers using longitudinal studies. *Teoriza y Practika*, 7: 37-40.

CAMERON, N.; TANNER, J.M. & WHITEHOUSE, R.H. (1982). A longitudinal analysis of growth of limb segments in adolescence. *Annals of Human Biology*, 9: 211-220.

CAPPAERT, M.J.; PEASE, D.L. & TROUP, J.P. (1995). Three dimensional analysis of the men 100m freestyle during the 1992 Olympic Games. *Journal of Applied Biomechanics*, 11(1): 103-112.

CARTER, J.E.L. & HEATH, B.H. (1990). *Somatotyping - development and applications*. Cambridge, MA: Cambridge University Press.

CARTER, J.E.L. & MARFELL-JONES, M.J. (1994). Somatotypes. In J.E.L. Carter; T.R. Ackland; J.C. Mazza & W.D. Ross (Eds.). *Kinanthropometry in aquatic sports* (55-82). Champaign, IL: Human Kinetics.

CARTER, J.E.L. (1984). Somatotypes of Olympic athletes from 1948 to 1976. In J.E.L. Carter (Ed.). Physical structure of Olympic athletes, part II. *Kinanthropometry of Olympic athletes* (80-109). Basel: S. Karger.

CHATARD, J.C.; LAVOIE, J.M. & LACOUR, J.R. (1990). Analysis of determinants of swimming economy in front crawl. *European Journal of Applied Physiology and Occupational Physiology*, 61(1-2): 88-92.

CHATARD, J.C.; LAVOIE, J.M. & LACOUR, J.R. (1991). Energy cost of front-crawl swimming in women. *European Journal of Applied Physiology and Occupational Physiology*, 63(1): 12-16.

CLARYS, J.P.; JISKOOT, J.; RIJKEN, H. & BROUWER, P.J. (1974). Total resistance in water and its relation to body form. In R.C. Nelson & C.A. Morehouse (Eds.). *Biomechanics IV* (187-196). Baltimore, MD: University Park Press.

COETZEE, B. (2000). Bepaling van talentidentifiseringsdeterminante vir kruipslagswemprestasies by kinders: 'n Kinantropometriese model. Ongepubliseerde M.Sc.-tesis. Potchefstroom: PU vir CHO.

COLWIN, C.M. (1992). *Swimming into the 21st century.* Champaign, IL: Human Kinetics.

CONLEY, D.S.; CURETON, K.J.; DENGEL, D.R. & WEYAND, P.G. (1991). Validation of the 12-min swim as a field test of peak aerobic power in young men. *Medicine and Science in Sports and Exercise*, 23(6): 766-773.

COSTILL, D.L.; KOVALESKI, J.; PORTER, D.; FIELDING, R. & KIND, D. (1985). Energy expenditure during front crawl swimming: Predicting success in middle distance events. *International Journal of Sports Medicine*, 6: 266-270.

DRINKWATER, D.T. & MAZZA, J.C. (1994). Body composition. In J.E.L. Carter; T.R. Ackland; J.C. Mazza & W.D. Ross (Eds.). *Kinanthropometry in aquatic sports* (102-137). Champaign, IL: Human Kinetics.

EVELETH, P.B. (1978). Difference between populations in body shape of children and adolescents. *American Journal of Physical Antropology*, 49: 373-382.

FURST, D.M. & HARDMAN, J.S. (1988). The iceberg profile and young competitive swimmers. *Perceptual and Motor Skills*, 67: 478.

GRIMSTON, S.K. & HAY, J.G. (1986). Relationship among anthropometric and stroking characteristics of college swimmers. *Medicine and Science in Sports and Exercise*, 18(1): 60-68.

GUALDI-RUSSO, E. & GRAZIANI, I. (1993). Anthropometric somatotype of Italian sport participants. *Journal of Sports Medicine and Physical Fitness*, 33(3): 282-291.

HAWLEY, J.A.; WILLIAMS, M.M.; VICKOVIC, M.M. & HANDCOCK, P.J. (1992). Muscle power predicts freestyle swimming performance. *British Journal of Sports Medicine*, 26(3): 151-155.

HAY, J.G. & GUIMARAES, A.C.S. (1983). A quantitative look at swimming biomechanics. *Swimming Technique*, 20(2): 11-12, 14-21.

HOWE, J.A.; DAVIDSON, J.W. & SLOBODA, J.A. (1997). *Innate talents: reality of myth?* Cambridge: Cambridge University Press.

JIANG, J. (1993). How to select potential Olympic swimmers. *American Swimming Magazine*, Feb/Mar.: 14-18.

JIANYU, W. (1994). A feel for the water. *Swimming Technique*: 30(4): 16-17**,** Feb/Apr.

KLIKA, R.J. & THORLAND, W.G. (1994). Physiological determinants of sprint swimming performance in children and young adults. *Pediatric Exercise Science*, 6: 59-68.

LAVOIE, J.M. & MONTPETIT, R.R. (1986). Applied physiology of swimming. *Sports Medicine*, 3: 165-189.

LIU, N.Y.; PLOWMAN, S.A. & WELLS, C.L. (1989). Somatotypes of premenarcheal athletes and non-athletes. *Human Biology*, 61:227-247.

LUCACIA, L. (1996). *Talent identification in swimming*. New Westminister: Lidia Lucaciu.

MAGLISCHO, E.W. (1993). *Swimming even faster*. Mountain View, CA: Mayfield.

MALINA, R.M. & BOUCHARD C. (1991). *Growth, maturation, and physical activity*. Champaign, IL: Human Kinetics.

MAZZA, J.C.; ACKLAND, T.R.; BACH, T.M. & COSOLITO, P. (1994). Absolute body size. In J.E.L. Carter; T.R. Ackland; J.C. Mazza & W.D. Ross (Eds.). *Kinanthropometry in aquatic sports* (15-54). Champaign, IL: Human Kinetics.

MCARDLE, W.D.; KATCH, F.I. & KATCH, V.L. (1996). *Exercise physiology* (4th ed.). Baltimore, MD: Williams & Wilkins.

MEYER, C. DU P.; CAMPBELL, B. & VAN JAARSVELD, S. (1986). *Swimming manual for teacher and physical education students*. Potchefstroom: Institute for Leisure Studies (PU for CHE).

NATIONAL SPORTS COUNCIL (1994). *NSC strategic viewpoint on South African Sport: Vision for Sport.* Johannesburg: South African National Sports Congress.

NORTON, K.I.; OLDS, T.S.; OLIVE, S.C. & CRAIG, N.P. (1996). Anthropometry and sports performance. In K.L. Norton & T.S. Olds (Eds.). *Anthropometrica: A textbook of body measurements for sports and health courses* (287-364). Marrickville, NSW: Southwood Press.

O'SHEA, P. (1996). *Quantum strength and power training*. Corvallis, OR: Patrick's Books.

PIENAAR, A.E. (2000). *Perseptueel-Motoriese leer: Teorie en praktyk*. Potchefstroom: PU vir CHO.

PREECE, M.A. & BAINES, M.J. (1978). A new family of mathematical models describing the human growth curve. *Annals of Human Biology*, 5: 1-24.

RÉGNIER, G.; SALMELA, J. & RUSSEL, S.J. (1993). Talent detenction and development in sport. In R.N. Singer; M. Murphey & L.K. Tennant (Eds.). *Handbook of research on sport psychology* (290-313). New York, NJ: MacMillan.

ROSS, W.D.; LEAHY, R.M.; MAZZA, J.C. & DRINKWATER, D.T. (1994). Relative body size. In J.E.L. Carter; T.R. Ackland; J.C. Mazza & W.D. Ross (Eds.). *Kinanthropometry in aquatic sports* (83-101). Champaign, IL: Human Kinetics.

SARIS, W.H.M.; NOORDELOOS, A.M.; RINGNALDA, B.E.M.; VAN'THOF, M.A. & BINKHORST, R.A. (1985). Reference values for aerobic power of healthy 4 to 18 year old Dutch children: Preliminary results. In R.A. Binkhorst; H.C.G. Kemper & W.H.M. Saris (Eds.). *Children and exercise* (151-160). 11th Congress on Pediatric Work Physiology, 1983, Papendal, The Netherlands. Champaign, IL: Human Kinetics.

SIDERS, W.A.; LUKASKI, H.C. & BOLONCHUK, W.W. (1993). Relationships among swimming performance, body composition and somatotype in competitive collegiate swimmers. *Journal of Sports Medicine and Physical Fitness*, 33(2): 161-171.

TANNER, J.M.; WHITEHOUSE, R.H.; MARUBINI, E. & RESELE, F. (1976). The adolescent growth spurt of boys and girls of the Harpenden Growth Study. *Annals of Human Biology*, 3: 109-126.

VAN ROSSUM, J. (1997). *The voice of experts: The role of innate athletic abilities according to coaches and athletes*. Amsterdam: Vrije Universiteit.

WILMORE, J.H. & COSTILL, D.L. (1994). *Physiology of sport and exercise.* Champaign, IL: Human Kinetics.

WOODMAN, L. (1985). Talent identification - Is competition enough? *Sports Coach*, 9(1): 49-57.

S.A. Journal for Research in Sport, Physical Education and Recreation, 2001, 23(1):27-36.
S.A. Tydskrif vir Navorsing in Sport, Liggaamlike Opvoedkunde en Ontspanning, 2001, 23(1):27-36.
ISSN: 0379-9069

PHYSICAL ACTIVITY LEVELS AND HEALTH PROFILES OF ADULT WOMEN LIVING IN INFORMAL SETTLEMENTS

Ezera L. TSHABANGU & Yoga COOPOO
Department of Sport Science, University of Durban-Westville, Durban, Republic of South Africa

ABSTRACT

This study investigated the physical activity levels and health profiles of adult women living in the Mmasechaba informal settlement in Gauteng. Apart from the questionnaire, anthropometric measurements were recorded and body mass index and waist-to-hip ratios were calculated. The results indicated that the incidence of lower back pain (74.1%) was the highest hypokinetic disease pathology demonstrated and a number of biomechanical factors are implicated. The daily physical activity levels of these women were fairly high (180 minutes). These activity levels include 30 minutes of vigorous activity consisting of chopping wood, carrying and lifting water. The other 150 minutes per day was spent on mild to moderate activity consisting of cleaning the house, walking to work and doing other chores around the house. In addition, about two hours a day was spent on passive recreational activities such as socialising and watching television. The study strongly recommends that educational programmes must be put in place to increase the awareness of health and dietary problems that exist among these communities.

Key words: Informal settlement; Physical activity; Health; Hypokinetic diseases.

INTRODUCTION

Urbanisation in South Africa has resulted in many Black people moving from the rural areas to cities. This is a universal problem known to many developing countries. Hence, the rapid increase in the number of 'shack dwellings or informal settlements' which is a relatively new development in South Africa. A shack dwelling can be described as a roughly built shed or hut, usually with scrap wood, corrugated iron, and or any scrap building material.

Some of the recent work in urban research regarding informal settlements in South Africa was done in Durban. Cross (1996) did a study on the size and distribution of the shack population, and the working of urban informal land markets. It was indicated that in the Durban Metropolitan area, informal settlement dwellers account for a quarter of the 2.3 million population. This finding was also recorded in the 1990 national census data for informal settlements.

People who live in informal settlements lack sporting facilities, however, cultural norms further interfere with women and exercise. Certain Black societies believe that exercise is only for men and that if women exercise, they will not be able to bear children. This finding is supported by Brehm and Iannotta (1998), who argue that women were instructed to avoid physical activity for fear of uterine displacement, spinal shock, hardened abdominal muscles, and an inappropriate diversion of the 'vital energy' critical for the reproductive function.

Physical activity, however, is important for the prevention and management of hypokinetic diseases such as hypertension, lower back pain, coronary artery disease and diabetes mellitus.

The purpose of this study was to determine the physical activity levels and health patterns of adult women living in informal settlements and to establish if there was a relationship between the physical activity patterns and health profiles in this population.

Studies on populations in informal settlements are not well documented, and yield little information on the role that physical activity has on the inhabitants' lifestyle and health.

Internationally, the Hillary Commission (1997) funds most of the sports trusts in New Zealand which promote fitness activities and assist in getting people active in their communities. Special emphasis was placed on older people, women and disabled persons. In 1997 the Commission worked with health agencies to provide advice and service about sport and physical activity, and encouraged doctors to prescribe exercise to their patients (Hillary Commission, 1997). In a survey conducted by the commission in 1996, people were asked about the physical activities they had done in the past year (1995). Forty five per cent of the women indicated that short walks were part of their daily activity, 43% indicated that long walks were part of their activity and 22% exercised at home (Hillary Commission, 1997). The statistics of the New Zealand population indicate that their physical activity patterns are higher than in most countries. The incidence of women exercising is also significantly higher. A similar study, if undertaken in most developing countries in Africa, could highlight the physical activity of the population, and set up programmes to improve health.

In South Africa the combination of urbanisation and informal settlements poses a greater risk to Black women and men.

Seedat (1982) conducted a random house to house survey in the Durban area, with respect to the prevalence of primary hypertension according to the WHO criteria. The finding for age-corrected prevalence of hypertension in the different ethnic groups in Durban was 25% for Zulus (Blacks), 17.2% for Whites and 14.2% for Indians. The conclusions of the study indicated that 58% of the Indian population had undiagnosed or inadequately treated hypertension. The high incidence of IHD (ischaemic heart disease) among Indians and Whites of South Africa and the low incidence among Blacks, suggests that there might be different thresholds for the susceptibility of disease in various ethnic groups, beyond which the risk factor begins to operate. In a recent investigation by Schuman (1999) on the coronary risk factor profiles of black executives at Eskom, found that these subjects exhibited a higher than normal risk of developing coronary heart disease.

Steyn *et al*. (1991) did a cross sectional study of risk factors for IHD in a random sample of 986 Black people aged 15 to 64 years, living in the Cape Peninsula. Areas that were covered included Khayelitsha, New and Old Crossroads, Nyanga, Langa and Guguletu. The type of dwelling included houses and shacks. Participants in the study completed a risk factor and dietary questionnaire. The questionnaire covered aspects of urbanisation, socio-economic items, smoking habits and physical activity patterns. Anthropometric and blood pressure measurements were recorded.

The results indicated that more females than males were overweight or obese, with a mean BMI (body mass index) of 27.8 for females and 23.4 for males. Of those who worked, 42.6% of males and 27.3% of females were involved in minimum physical activity at work; 37.8% of males and 34.5% of females participated in no exercise outside working hours. The overall risk profile identified in the study showed that the Black urban male population of the Cape Peninsula already had considerable IHD risk. About 30.8% of males aged 25 years and above had at least one risk factor. In the oldest age group (55-64 years), among both men and women, more than half the participants had at least one IHD risk factor (Steyn *et al*., 1991). Among males, the bulk of the risk was due to the smoking of cigarettes, while among females, the biggest contribution to the profile was made by hypertension. Steyn *et al*. (1991) concluded the that epidemic of IHD and CVD (cardiovascular disease) as seen in White, Asian and Coloured South Africans, could still be prevented in the Black population, but preventative measures have to be rapidly instituted.

A study by Moodley *et al*. (1997) researched the prevalence of ischemic heart disease (IHD) risk factors in an urban workforce in the Eastern Cape. The results of this study indicated that urban men were at high risk for IHD. Further, if intervention programmes were not introduced at the workplace, IHD would reach epidemic proportions in this sample.

Most of the studies (Steyn *et al*., 1991; Moodley *et al*., 1997; Seedat, 1989) on the disease profiles for different racial groups in South Africa indicate that Blacks were at lower risks compared to the other racial groups. The researchers, however, argues that these profiles have been altered over the years. More Black people are moving into highly industrialised areas and jobs that are highly demanding. Lifestyle changes are affecting the Black population today more than in the past ten years. Thus the emergence of many of the hypokinetic diseases because of poor lifestyle habits will come to the fore in this population. This was supported by Seedat (1989), who indicated that 25% of the urban Blacks had hypertension as compared to 10% of rural Blacks.

METHODS

Two hundred and twenty six women volunteered and consented to participate in this study from the Mmasechaba informal settlement on the East Rand, Gauteng. A health and lifestyle questionnaire was administered to a randomly selected cohort to obtain information concerning health profiles, dietary habits, physical activity levels and recreational patterns.

Standardised methods were used to determine height, weight and girth measurements. The waist-to-hip ratio was determined according to the method described by Van Itallie (1988). The body mass index (BMI) was computed from the Bray and Gray (1988) method. Inferential and descriptive statistics was analysed using a computer statistical package (Statistical Analysis System).

RESULTS AND DISCUSSION

The total number of women that participated in this study was 226, however, 21 of them were pregnant and their results were excluded for analysis. The main reason for not analysing their results was that there are no reference norms to compare these women with. The results were

discussed under the following headings: namely, demographic profiles, anthropometric profiles, physical activity levels, health profiles, dietary patterns and social patterns.

Demographic profiles

The demographic profiles that were discussed were age, marital status and the number of children the women have. The age groups were divided into five categories. The 18-29 years age group accounted for a greater percentage (60%) of participants. The distribution of the age groups is depicted in Figure 1.

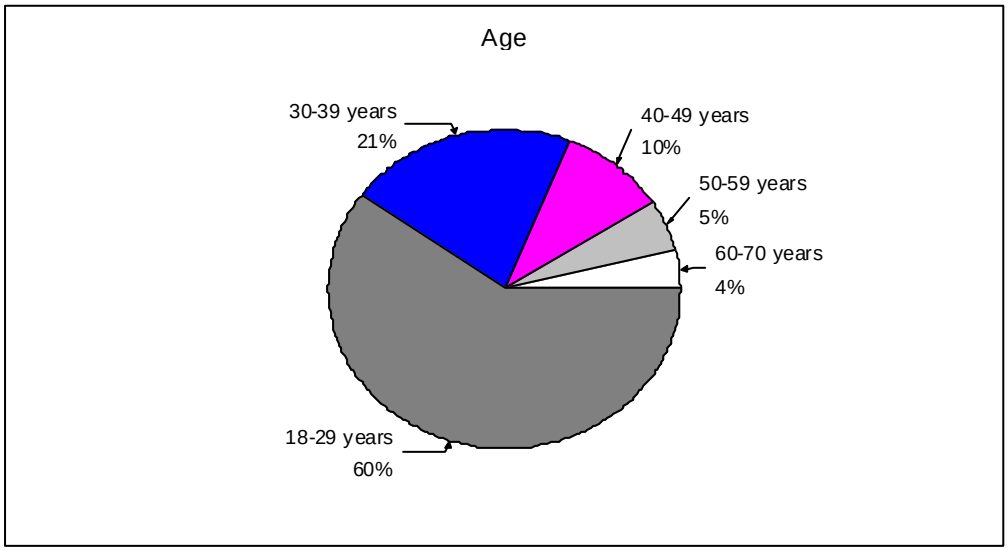


FIGURE 1. **AGE DISTRIBUTION OF THE SAMPLE STUDIED**

The question on the number of children the women have was included in the questionnaire because of its major effect on the activity patterns of women. Women with children spent most of their time rearing their children, which left little time for physical activity.

Anthropometric profiles

The anthropometric profiles included the calculation of the Body Mass Index and the waist-to-hip ratio to determine the risk profile of these women and their susceptibility to diseases. As indicated by Lambert (1988), BMI values of 26-34 indicate moderate obesity, while BMI values of 35 and over indicate severe obesity. The BMI values are depicted in Table 1.

TABLE 1. **BMI VALUES OF THE WOMEN**

BMI values	%	Classification
<25	39	Normal
26-34	46.3	Moderate obesity
>35	14.7	Severe obesity

The girth measurements of the waist and the hip were used to calculate this ratio. A high waist-to-hip ratio indicates an increased abdominal adipose distribution, whereas a low waist-to-hip ratio indicates an increased femoral adipose distribution. The percentages of adipose distribution of the sample studied are indicated in Table 2.

TABLE 2. **PERCENTAGES OF WAIST TO HIP RATIO OF THE SAMPLE**

Ratio	**%**
>0.85	16.2
<0.84	83.8

These ratios indicated that 16.2% of the women were at risk compared to 83.8% who had a ratio of less than 0.84. As indicated by the BMI values, the percentage of women who were at high risk was less than 17%, which may be lowered if these women receive nutritional intervention and proper education on the positive benefits of exercise and physical activity in their lives. Abdominal and femoral adipose distribution were visible features in the older women. These women believed that being fat was normal for a Black female.

The correlation coefficient was also calculated to determine the relationship between BMI, waist-to-hip ratio and weight. The relationship was calculated at the 5% level of significance. The results indicated a relationship of 0.9 between BMI and weight, 0.15 between BMI and the waist-to-hip ratio. The relationship between weight and the waist-to-hip ratio was 0.13. The statistics indicated that BMI had a strong correlation with weight, as can be expected.

Physical activity levels

Chopping wood may impact positively on the subjects, as they must have a good arm and grip strength to be able to use an axe effectively. Also, being alert and having good co-ordination is required when chopping wood because of the dangers that are involved if these factors are ignored.

The strength levels of the women in the study are further confirmed as they carry many litres of water on their heads. The fact that water would have to be lifted in order to be placed on their heads or in wheelbarrows, indicates their strength index. Further, 20 litres of water is equal to 20 kilograms in weight. Thus a fair amount of strength training is occurring on a daily basis. However, incorrect technique could limit the exercise, because of premature back pain. Cress (1994) argues that certain activities involve high intensity levels e.g. chopping wood, whereas making a bed requires certain levels of arm and grip strength.

Eaton *et al*. (1989) believes that women during the stone-age were gatherers of food, which appears to apply to a minor extent in this population. The present study shows that much of the women's time was spent maintaining households, preparing food, sewing clothing, visiting nearby townships or engaging in a variety of leisure activities such as dancing. These activities indicate that the women's physical work in this society has been well characterised by the daily chores they perform e.g. collecting food, carrying heavy loads of water or firewood (often while carrying a child), walking long distances and dancing vigorously,

sometimes for hours (Eaton *et al*., 1989). The physical activity patterns of women in the Mmasechaba informal settlement, who participated in this study, could be rated as higher than most urban female populations.

The physical activity patterns included lifting, collecting wood, fetching water, household chores and cooking. The physical activity patterns of these women indicated that on average, a typical informal settler engaged in the following activities on a daily basis:

- Cleans the house for approximately 100 minutes per day
- Carries water for approximately 10 to 15 minutes per day
- Chops wood for approximately 10 to 15 minutes per day
- Lifts heavy objects (± 20kgs) for at least 4 to 10 times per day
- Walks to work for approximately 60 minutes per day, and
- Watches television for ± 3 hours per day (11.3% of the subjects)

This population under study may be rated as being quite physically active on a daily basis.

Health profiles

The health profiles surveyed included smoking, alcohol consumption, hypokinetic diseases, sleeping patterns and personal health care. The results indicated that 22.4% of the women in this study were smokers, while 2% used snuff. Smoking is also a risk factor for IHD. Of the 22.4% of smokers, 8.3% indicated that they smoked two cigarettes a day, while 6.3% smoked five cigarettes, and 7.8% smoked more than six cigarettes a day. Of the 205 women, 68 (33.2%), indicated that their partners did smoke, compared to 22.4% of the women who were smokers.

The prevalence of alcohol consumption among this population was 14.1%, while 85.4% were teetotallers and 0.5% took traditional beer once in a while. Their alcohol consumption habits were compared to those of their spouses, with results indicating that 36.1% of the spouses consumed alcohol as compared to 14.1% of the women.

Socio-economic status and level of education may be major factors that contribute to the prevalence of smoking and drinking in this community. These women were always at home, sometimes with their spouses. They did not have stable jobs to keep them busy, and, often met in groups to consume alcohol and smoke, to help while away the time. It is reasonable to assume that if there was a recreation programme provided for these people within their living areas, perhaps the level of alcohol and smoking would be reduced. This would reduce health related problems resulting from cigarette smoking and alcohol abuse. Some form of educational programme should be set up to improve the primary health care of these individuals. With the introduction of some form of primary health care programme, there would be a reduction in health care cost, for the state.

In this study, lower back pain was the most prevalent among the subjects (74,%) (Table 3). There are a number of factors that may contribute to this problem, which appear to be related to:

- Incorrect posture
- Incorrect methods of doing household chores e.g. lifting mechanics
- Carrying 20-25 litres of water on the head while carrying a baby on the back, and
- Sleeping on an uneven bed/surface (floor)

This is similar to results presented by Jamal (1989), who indicated the following as the risk factors for lower back pain:

- incorrect posture
- incorrect bending and lifting habits
- obesity
- lack of exercise
- lack of proper rest
- tension and stress related backache
- colds, flu and other illnesses

Jamal (1989) further states that most back pain is due to wear and tear, causing degenerative changes in the discs and joints of the spine. It was indicated that trouble arose from the area of the spine subjected to the heaviest mechanical stresses because of bad postural habits or incorrect lifting and bending of legs e.g. poor mechanics in lifting objects. Chopping wood may be another factor that contributes to the high level of lower back pain in these women. Correct body mechanics in the execution of daily chores may reduce the incidence of lower back pain. Most of these women chop wood daily. However, they do so with straight legs, thus creating extra strain of the lower-back and precipitating lower back pain. The positive effect of the household chores and the chopping of wood daily increases the physical activity levels of these women, which may retard or reduce the effects of hypokinetic diseases.

In the disease profile of these subjects it is clear that asthma, diabetes, tuberculosis showed a low incidence (less than 2%), while hypertension is recorded at 17,% (Table 3). A possible reason for the low incidence of diabetes (2%) and hypertension (17.%) could be that most of the subjects (60%) were between the ages of 18 and 29 years. The activity patterns of this group are still quite high, and may serve as a preventative factor. As these women age, their physical activity patterns decrease, so there would be an increase in degenerative diseases.

TABLE 3. **DISTRIBUTION OF HYPOKINETIC DISEASES AND OTHER PATHOLOGIES**

PATHOLOGY	NUMBER OF SUBJECTS	%
Diabetes	3	1.5
Hypertension	35	17
Lower back pain	152	74
Asthma	4	2
Tuberculosis	3	1.5
No pathology	8	4

Dietary habits

The staple diet of the women was large quantities of bread, pap, meat and tripe. These are typical dietary components of a township meal. This type of diet was followed by about 80% of these women. Tripe was seen as cheap 'meat' containing proteins and fats. However, these families were ignorant of the fat content of tripe. Morogo was favoured as a vegetable and like tripe, it was very easy to acquire and is cheap. Morogo was used as a substitute for spinach. Potatoes and cabbage were other vegetables preferred by these women, with soft maize porridge eaten for breakfast. Most (50.7%) of the women in the study indicated that they had three meals a day. 33% had two meals a day, 10.5% had more than four meals a day, while 5.0% indicated that they sometimes survived with one meal a day. 0.5% sometimes survived without any meals.

Their diet is high in fat. The cooking methods included using large quantities of oil for frying eggs, meat or chicken livers. Samp and rice was also cooked with oil and 81.5% of respondents indicated that they re-used their oil. Used cooking oil develops greater levels of hydrocarbons, especially if re-used often. This impacts negatively on cardiovascular health. It could be argued that these women could reduce their obesity levels by modifying their diet and eating less fat in their diets.

An education programme could be implemented, in which these women may be taught how to wisely prepare meals in the most economical manner, which is also nutritionally sound and healthy. The women should be educated to go back to their roots and continue to prepare vegetable dishes with a minimum of meat as their forefathers did. The risk of hypokinetic diseases was far lower for their grandparents than in the current generation.

Social patterns

The major social aspect in most of the Black communities constitutes the 'stokvel'. Members of a stokvel get together on a monthly basis. Each month different individuals host it at their home and each member pays a certain amount as a contribution. The host gets the total amount paid by all the stokvel members. This is a form of active recreational activity as it involves dancing. It is also a form of income for the host. However, in the study population, not all persons could be involved in stokvel activities, as many are unemployed and do not have the economic backing to participate. Many may attend, however, with no financial gain. For most of these settlers, their income is so low that it hardly allows for day to day survival. Without any governmental intervention, they would not be able to afford a house or improve their living conditions substantially. This in the long term, impacts negatively on their psychological and physiological well-being, education standards and health status.

The other form of socialising in these communities is standing at the fence and sharing views and ideas with the neighbours. This form of socialising has proved to be a stress reliever, as by sharing their problems with other people, the women's health and mental well-being improves. Sharing alcohol and cigarettes appears to be another popular method of socialising in this community. Clearly, a recreational centre should be built which may encourage other positive methods of socialisation, such as the formation of youth clubs and women's groups.

CONCLUSIONS

The results of this study confirm that women living in informal settlements have high daily levels of physical activity. Most of them carry water, chop wood, clean the house and walk to work on a daily basis. Thus, the average informal settler is involved in approximately 30 minutes of vigorous activity (chopping wood, carrying water) and is engaged in 150 minutes of mild to moderate activity (cleaning the house, walking to work). It was estimated that an average woman at the Mmasechaba informal settlement expended approximately $\pm$1350 kcal of energy daily (McArdle *et al*., 1991).

The hypokinetic disease profile of the women indicated that lower back pain in particular should be looked at by health professionals at the local clinic. The most suitable way to achieve this goal would be to educate them on correct lifting mechanics, sleeping patterns, and the balancing of the weight of water on their heads with babies on their backs. Educational programmes on health and lifestyle changes have been recommended by various researchers to inform communities about diseases and changes in lifestyle (Mayet, 1982; Seedat, 1982; Rossouw *et al*., 1983; Sewdarsen, 1987). Sixty one percent of this population ranged from moderately to severely obese, which would at some time in their lives impact negatively on their health. This is a major risk factor for hypokinetic diseases, including diabetes, heart disease and hypertension. Already, there was 17% incidence of hypertension in this population. The waist-to-hip ratio further confirms this risk, with 16.2% of the subjects having visible abdominal and femoral adipose tissue distribution, mainly visible in the older women. The 74% incidence of lower back pain in this population is epidemic.

It was further concluded that these women were at the crossroads with respect to health and activity. Generally, their activity levels were higher than most South Africans. However, their eating habits, the stress of living, and poor body mechanics placed them at extreme risk for developing health problems which were not related to activity patterns.

RECOMMENDATIONS

It is recommended that education and support programmes should be conducted by nurses in the local clinics to assist in creating awareness on certain hypokinetic diseases and lifestyle changes. The employing of biokineticists at such clinics may assist in this education programme. All Departments of Human Movement and Sport Science at tertiary institutions should 'adopt' an informal settlement within their precinct as one of their outreach projects. The recently established Working Group on the Standardising of the Measurement of Physical Exercise in South Africa should conduct more research projects on the informal settlers to ascertain their physical activity levels.

REFERENCES

BRAY, G.A & GRAY, D.S. (1988). Obesity. Part 1 – Pathogems. *Western Journal Medicine,* 149: 429-441.

BREHM, B.A. & IANNOTTA, J.G. (1998). Women and physical activity: Active lifestyles enhance health and well-being. *Journal of Health Education,* 29(2): 89-92.

CRESS, M.E. (1994). Exercise and older women. In R. Agostini (Ed.). *Medical and orthopaedic issues of active and athletic women* (68-74). Philadelphia, PA: Hanley and Belfus.

CROSS, C. (1996). Informal settlers in the Durban metropolitan area. In T. Bailey (Ed.). *Regional Research Facilitation Function: Review* (68-74). Congella: Human Sciences Research Council.

EATON, S.B.; SHOSTAK, M. & KONNER, M. (1989). *The Stone-Age health programme: Diet and exercise as nature intended*. London: Angus & Robertson.

HILLARY COMMISSION (1997). Getting more people active. [http://www.hillary.org.nz/what/ww2.html]. Retrieved, 15 September 1998.

JAMAL, A. (1989). Approach to back care. In M.A. Seedat (Ed.). 'Health care today': Vth Annual Symposium for Health Workers (55-69), April, Durban.

LAMBERT, E.V. (1988). Current issues in the aetiology and treatment of obesity: Diet versus exercise. *South African Journal for Research in Sport, Physical Education and Recreation*, 11(1): 93-110.

MAYET, F.G.H. (1982). Disease patterns in Indian South Africans. *South African Medical Journal*, 61: 968-972.

MCARDLE, W.D; KATCH, F. & KATCH, V.L. (1991). Exercise physiology: Energy, nutrition and human performance. Philadelphia, PA: Lea and Febiger.

MOODLEY, J.; STEYN, K.; EHRLICH, R.I.; JORDAAN, E.; MARAIS, A.D & BURGESS, C. (1997). Lipid and ischemic heart disease in an urbanising South African workforce. *South African Medical Journal*, 87(11): 1615-1620.

ROSSOUW, J.E.; DU PLESSIS, J.P.; BENADE, A.J.S.; JORDAAN, P.C.J.; KOTZE, J.P.; JOOSTE, P.L. & FERREIRA, J.J. (1983). Coronary risk factor screening in three rural communities: The CORIS baseline study. *South African Medical Journal*, 64: 430-436.

SCHUMAN, L. (1999). The incidence of selected cardiac risk factors among physically active and inactive senior black managers in Eskom. Unpublished Masters thesis. Potchefstroom: Potchefstroom University for Christian Higher Education.

SEEDAT, M.A. (Ed.) (1989). Screening in the community for hypertension and diabetes. Proceedings of the "Health Care Today" Vth Annual Symposium for Health Workers (14-22), April, Durban.

SEEDAT, Y.K. (1982). Hypertension and ischemic heart disease in Indian people living in South Africa and India. *South African Medical Journal*, 61: 965-967.

SEWDARSEN, M.; VYTHILINGUM, S.; JIALAL, I.; MOODLEY, T. & MITHA, A.S. (1987). Risk factors in young Indian males with myocardial infarction. *South African Medical Journal*, 71: 261-262.

STEYN, K.; JOOSTE, P.L.; BOURNE, L.; FOURIE, J.; BADENHORST, C.J.; BOURNE, D.E.; LANGENHOVEN, M.L.; LOMBARD, C.J.; TRUTER, H.; KATZENELLENBOGEN, J.; MARAIS, M. & OELOFSE, A. (1991). Risk factors for coronary heart disease in the black population of the Cape Peninsula: The BRISK study. *South African Medical Journal*, 79: 480-484.

VAN ITALLIE, T.B. (1988). Topographic of body fat: Relationships to risk of cardiovascular and other diseases. In T.G. Lohman; A.F. Roche & R. Martorell (Eds.). Anthropometric standardization reference manual (143-149). Champaign, IL: Human Kinetics.

YEAGER, K.K. & MACERA, C. (1994). Women activity and health profiles and healthy people 2000. In R. Agostini (Ed.) Medical and orthopaedic issues of active and athletic women (29-33). Philadelphia, PA: Hanley and Belfus.

Prof. Y. Coopoo, Department of Sport Science, University of Durban-Westville, Private Bag X54001, Durban 4000, Republic of South Africa. Tel: +27 (0)31 204 4904 (w), Fax: +27 (0)31 204 4903, E-mail: ycoopoo@pixie.udw.ac.za

(Review editor: Prof. M.F. Coetsee)

AN INVESTIGATION INTO ESSENTIAL ASPECTS OF POSTURE IN PRIMARY SCHOOL BOYS AND MALE SENIOR EXECUTIVES

Maureen LOOTS, Johannes M. LOOTS & Ben J.M. STEYN
Department of Biokinetics, Sport- and Leisure Studies, University of Pretoria, Pretoria, Republic of South Africa

ABSTRACT

The purpose of this study was to investigate the incidence and extent of postural defects in a group of 43 middle aged senior executives from two large companies, and 58 primary school boys from rural areas. The first group had a sedentary lifestyle while the second was selected to attend an annual sports training workshop at the Sports Institute of the University of Pretoria. Postures of the subjects were analysed by means of photographic images using the pro forma of Barlow (1956, 1990). The majority of the executives had malposture with 2.3%, 23.3%, 58.1% and 16.3% and 6.3% of the subjects being categorised with slight postural defects, severe postural defects, very severe postural defects and gross deformity, respectively. The values of the primary school boys for the same categories were 3.4%, 20.7%, 48.3% and 27.6%. None of the subjects studied was categorised as being without any postural defects. The results support others in this field (Cochrane, 1924; Dart, 1947; Kiernander, 1956; Lawson-Wood & Lawson-Wood, 1977; Barlow, 1990) who observed that malposture is common in both children and adults. The most common postural defect found in both groups were kyphosis (100% in adults and 89.7% in primary school boys) and lordosis (70% in adults and 93.1% in primary school boys). Barlow (1956; 1990) in a study on various groups, found that students in Physical Education had worse postures than other students. In the present study 75.9% of the primary school boys had either very severe postural defects or gross deformity against a value of 62.4% in the male senior executives, supporting the findings of Barlow (1956; 1990) to some extent.

Keywords: Posture; Slight-; Severe-; Very severe postural defects; Male senior executives and primary school boys.

INTRODUCTION

Malposture is pandemic in modern society (Sherrington, 1946; Dart, 1947; Lawson-Wood & Lawson-Wood, 1977; Rolf, 1977). Dart (1947) and Barlow (1955) both emphasised the fact that faulty posture was a prevalent condition of the human body affecting, for example, between 70% and 95% of children up to the age of 18 years (Barlow, 1990). In 1924 Cochrane (1924) drew attention to Swain's declaration that he saw no more than 20 well-postured individuals among 3000 patients at a sanatorium, and at a training camp for youths and men he found that 75% were physically inefficient. This is in contrast with the findings of Fenton (1973), who found that 9% of children in his study were over-curved when standing, 17% leant forward or backward when standing and at least 5% had a noticeable lateral curvature of the spine. The extent of this problem in children and adults in this country is not known at present. Lack of body awareness, modern sedentary lifestyle, stress, poor use

are to be blamed for this unfortunate state of affairs (Dart, 1947; Rolf, 1977; Feldenkrais, 1985; Alexander, 1987; 1996).

A common misconception is that regular participation in physical activity and sport leads to good posture. This was pointed out by Alexander in 1910 (Alexander, 1996), and was supported by Feldenkrais (1985) and studies done by Barlow (1956; 1990). Alexander (1996), Barlow (1956; 1990), Dart (1946; 1947; 1950), Feldenkrais (1985), Janda and Schmidt (1980), Jull and Janda (1987), Lowen (1994), Richardson (1992) and Rolf (1977) were of the opinion that malposture has as its root imbalances in different aspects of the human makeup. These imbalances may be found in the musculature (Alexander, 1932; 1996; Janda & Schmidt, 1980; Feldenkrais, 1985; Jull & Janda, 1987; Richardson, 1992), the psyche (Jones, 1979; Feldenkrais, 1985; Painter, 1986; Lowen, 1994; Alexander, 1996) and the fascia (Rolf, 1977). Be it as it may, imbalances are reflected in how the body is aligned, carried, used and in its muscular tension (Jones, 1979; Barlow, 1990).

The purpose of this study was threefold: Firstly to look into the incidence and extent of malposture in South African subjects, and secondly to investigate posture in subjects which are exposed to stressful lifestyles, and therefore in a group in which postural problems are most likely to be found (Barlow, 1959). Thirdly, the posture in young primary school boys was also investigated. The reason for the inclusion of the latter group into the study was to look into the incidence of malposture in young individuals, and to determine the potentially beneficial effects of exercise on posture in subjects who regularly participated in physical exercise.

METHOD

Subjects

The subjects of the first part of the study consisted of 43 white male senior executives from two large companies in the Pretoria area. The ages of the subjects ranged from 31 to 61 years, with a mean age of 44.5 years. The subjects were included in the study because of their excessively sedentary lifestyles.

The subject population of the second part of the study consisted of 58 white male primary school boys who participated actively in sport. The subjects were selected on the basis of their sport performances by their schools to attend an annual Vleissentraal Sport Junior coaching clinic at the Sport Institute of the University of Pretoria in one of the following codes: Tennis, gymnastics, athletics (track and field) and swimming. None had had back surgery or other major health problems. Their ages varied between eight and 12 years with the mean age of 11.3 years. All subjects agreed to participate in the study and signed an informed consent form.

Postural analysis

All data was obtained by the use of photographs. The equipment consisted of a Pentax camera mounted on a tripod. In order to minimize image distortion a Takumar zoom lens, set at a focal length of 85 millimetres, was used. Images were recorded on black and white film.

A plumb-line was brought on permanently against the wall and followed through on the floor

with a 2cm wide strip. The subjects were instructed to stand comfortably in front of the plumb-line with the floor-line between the feet, and with the arms hanging at the sides. The subject was photographed from the front, the back and each side at a distance of 4.5 metres. The subjects were instructed to assume a typical stance, the one they usually stood comfortably in, with arms hanging at their sides. The posture had to be the habitual standing posture with no aim towards the ideal. The subjects were then photographed laterally from both sides, and also from the front and from the back. A total number of 404 photographs were intensively evaluated and scrutinized by a panel of experts which had extensive training and experience in the field of postural defects. The principle of consensus among the experts themselves was used to get to an objective evaluation of the postural defects.

The analysis of the photographic prints was done, based on the pro forma suggested by Barlow (1956; 1990), which is a useful guide in assessing a given subject's postural defects and the associated muscular tension. Details of this pro forma will be found in Tables 3 and 5. This pro forma enables one not only to analyse the subject's posture, but also the relationship and position of the various body parts in relation to each other and the tension in the body musculature needed for the maintenance of this posture. Defects were scored in different body segments on a basis of one, two or three marks according to the severity of the defect, with 1 denoting a slight-, 2 a moderate- and 3 a severe postural defect using examples from Barlow (1990) and Robinow *et al*. (1943) as guidelines. At the end all the scores were added in order to get to the total score. The lower the total score the nearer to the attainment of *poise* (Dart, 1947; Barlow, 1956; 1990). According to the use of their bodies, the quality of the subject's total body posture was assessed according to the categories shown in Table 1. A total score ranging between 0-3 indicated excellent posture or use of the different body structures in relation to each other (Alexander, 1932). It also indicated what Dart (1947) referred to as *poise*, which is a state of balance in a well functioning body. Scores of 4 and higher indicated the presence postural defects with scores of 15 and higher indicating gross postural deformity (Barlow, 1956).

TABLE 1. **CLASSIFICATION AND SCORING OF BODY USE AND DEFECTS**

USE	**TOTAL SCORE**
Excellent use / *poised*	0-3
Slight postural defects	4-5
Severe postural defects	6-9
Very severe postural defects	10-14
Gross deformity	15 and over

RESULTS

Postural defects and their incidence in male senior executives

Of the group of 43 male subjects none had excellent use (*poise)*, only one subject was classified as having slight defects (score 5), while more than half of the group had severe and very severe defects according to their total scores. The mean total score was 11.8 of which the lowest was 5 and the highest 21. The mean score of almost 12, placed the subjects studied in the category of very serious defects (Table 2).

TABLE 2. **INCIDENCE AND SEVERITY OF POSTURAL DEFECTS IN MALE SENIOR EXECUTIVES**

POSTURAL DEFECTS	NUMBERS	PERCENTAGE
Excellent use/*poised*	0	0
Slight postural defects	1	2.3
Severe postural defects	10	23.3
Very severe postural defects	25	58.1
Gross deformity	7	16.3

Occurrence and mean score of postural defects in the various body segments

Postural defects in the various body segments, their mean score, as well as their occurrence in the sample are listed in Table 3. Mean scores were calculated according to the formula:

$$\text{Mean score} = \frac{\text{Total score}}{\text{Number of subjects with defects}}$$

This score is therefore an indication of the severity of the postural defect in a segment. Mean scores were low, ranging from 1.0 to 1.4, while postural faults occurred in all body segments. The highest incidence of postural defects was observed in the back, shoulders and the neck, with kyphosis a problem present in all the subjects studied.

TABLE 3. **OCCURRENCE AND MEAN SCORE OF POSTURAL DEFECTS IN DIFFERENT BODY SEGMENTS**

REGION	FAULTS	% OF CASES	MEAN SCORE
Head	Poked	14	1.2
	Retracted	79	1.1
	Tilted backwards	51	1
Shoulders	Raised	77	1.4
	Rotated	9	1.3
	Pulled together	33	1.1
	Dropped	14	1.2
Pelvis	Tilted forwards	42	1.3
Spine	Kyphosis	100	1.3
	Lordosis	70	1.8
	Scoliosis	72	1.4
	Thorax displacement	47	1.2
Stance	Forward inclination	81	1.4
	Hyperextended knees	86	1.1
	Internal rotation of knees	12	1
	Asymmetry	58	1.2
Tension	General	9	1.3
	Local	84	1.1

None of the subjects appeared to have a comfortable, balanced stance. A tight, "holding on" type of stance was the general posture. Typical examples of standing postures in the sample is shown in Figure 1.

In Figure 1a and 1b examples of the postural outcomes of scoliosis is shown. In the subject shown in Figure 1b, torsional rotation in response to spinal scoliosis is particularly evident. In Figure 1c the upright posture is maintained by means of excessive muscle tension. The subject in Figure 1d leans far forward, putting unnecessary strain on his lower calf muscles.

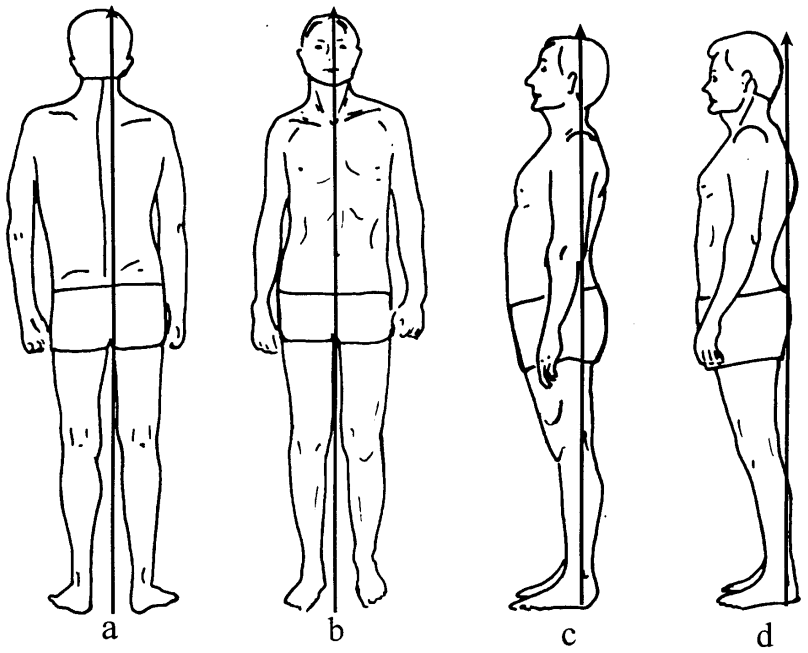


FIGURE 1. **EXAMPLES OF SOME OF THE POSTURES ASSUMED BY SUBJECTS**

Figure 2 shows different ways of carrying the upper quarter in 6 subjects - in all the examples head and neck position are maintained by means of excessive muscle tension, a feature which is evident in the tight shoulder and neck muscles, and which contributed to the high incidence of localized tension (Table 3).

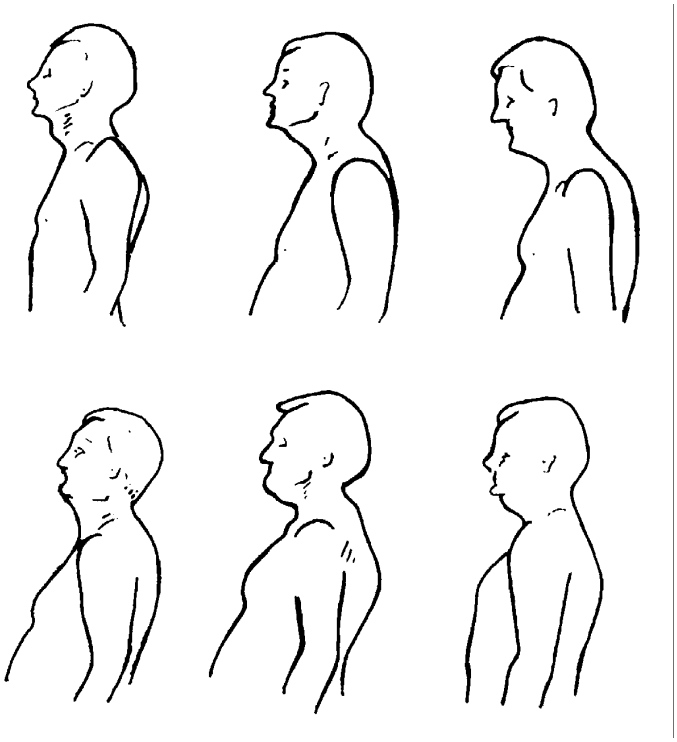


FIGURE 2. **HEAD AND NECK POSITION IN SIX SUBJECTS, SHOWING THE VARIABILITY IN WHICH HEAD CARRIAGE IS BEING DEALT WITH IN DIFFERENT INDIVIDUALS**

Posture and postural defects in primary school boys

In Table 4 the incidence of the various postural defects is shown. None of the subjects had excellent use and only two had slight postural defects (3.4%). Severe postural defects were found in about a fifth of the subjects (20.7%), while nearly half of the subjects had a total score which put them in the very severe postural defect category. Gross deformity was found in 27.6% of the subjects.

TABLE 4. **OCCURRENCE AND INTENSITY OF POSTURAL DEFECTS IN PRIMARY SCHOOL BOYS**

USE	NUMBERS	PERCENTAGE
Excellent use / *poised*	0	0
Slight postural defects	2	3.4
Severe postural defects	12	20.7
Very severe postural defects	28	48.3
Gross deformity	16	27.6

Postural faults in the various regions of the body are shown in Table 5. The greatest number of faults was found in the spine and pelvis, kyphosis being present in 89.7%, lordosis in 93.1% and a forward tilting pelvis in 95% of all subjects. Forward inclination was found in 86.2% of the individuals.

Asymmetry in body segments while standing was found in an unusually high percentage of the subjects (84.5%), which indicates a large incidence of muscle-imbalance, especially when associated with a nearly 40% occurrence of scoliosis. General tension was observed in 55% of the subjects while local tension was a common occurrence (88%), which was mainly present in the upper quarter.

TABLE 5. **OCCURRENCE AND MEAN SCORE OF POSTURAL DEFECTS IN DIFFERENT BODY SEGMENTS**

REGION	FAULTS	% OF CASES	MEAN SCORE
Head	Poked	31	1.2
	Retracted	32.8	1.1
	Tilted backwards	52	1
Shoulders	Raised	74.1	1.6
	Rotated	51.7	1
	Pulled together	15.5	1.2
	Dropped	17	1
Pelvis	Tilted forwards	95	1.3
Spine	Kyphosis	89.7	1.4
	Lordosis	93.1	1.6
	Scoliosis	39.7	1
	Thorax displacement	60.3	1.1
Stance	Forward inclination	86.2	1.3
	Hyperextended knees	24.1	1
	Internal rotation of knees	31	1.1
	Asymmetry	84.5	1
Tension	General	55.2	1.3
	Local	87.9	1.4

DISCUSSION

Posture in male senior executives

The purpose of the first part of the study was to investigate the postural consequences of modern Western lifestyle characterized by a sedentary lifestyle (National Institutes for Health, 1997), lack of body awareness, stress and poor use of body mechanics (Dart, 1947; Barlow, 1959; 1990; Rolf, 1977; Feldenkrais, 1985; Alexander, 1987; 1996). The results of this part of the study support the other workers who were of the opinion that malposture is pandemic (Sherrington, 1946; Dart, 1947; Lawson-Wood & Lawson-Wood, 1977). Apart from the high percentage of subjects with severe and more than severe postural defects (97.7% Table 2) analysis of Table 3 indicates an alarming tendency in that more than one postural defect per body segment was a common occurrence. Examples of this are the high incidence of head

retraction (79%) with 51% of the heads tilted backward. Kyphosis was found in all of the subjects. This was associated with a 70%, 72% and 47% incidence in lordosis, scoliosis and thoracic displacement, respectively. Scoliosis starts to develop at the age of 6 years, and progresses with advancing age (Farkas, 1941). The high incidence (72%) of scoliosis in the subjects of the present study is about twice as high as the estimated incidence (about 30%) in school children (Dickson, 1983), thus supporting Farkas' (1941) findings.

Local muscular tension was observed in 84% of the subjects, mainly present in body areas where muscle imbalance would be expected (Jull & Janda, 1987). This tension in different areas of the body can be seen in all of the subjects in Figures 1 and 2. Prominent here are tension in the neck, shoulder area and upper back (expressed for example in the 79% occurrence of retracted necks and a 100% incidence of kyphosis). With the exception of 1 subject, none of the subjects in the present study were able to maintain body alignment without undue muscular tension. Barlow (1959: 345) was of the opinion that this constitutes an additional stress:

> Muscular hypertension, then, is the residual tension and postural deformity which remains after stress activity, or after any other activity for that matter, since any activity which leaves residual muscular tension is to that extent a stress activity.

Comparison of the postural faults in the subjects of the present study with those made by Barlow (1956; 1990) on drama and physical education students (Figure 3) presents a bleak picture. The incidence of individuals with very severe postural defects and gross deformity are higher than that found in Barlow's (1956; 1990) subjects.

The findings of this study indicate that middle-aged, mainly sedentary males generally have poor postures. In the light of the foregoing research, it can be assumed that the faulty postures are due to misuse of the bodies (Alexander, 1932; Feldenkrais, 1985; Rolf, 1977), and an inability to deal with physical and emotional stress. The subjects would not be able to perform certain movements adequately or easily, and there is also a possibility that minor pains of the moment might develop into pathologies in the future (Barlow, 1959; Goldthwait, *et al.,* 1952).

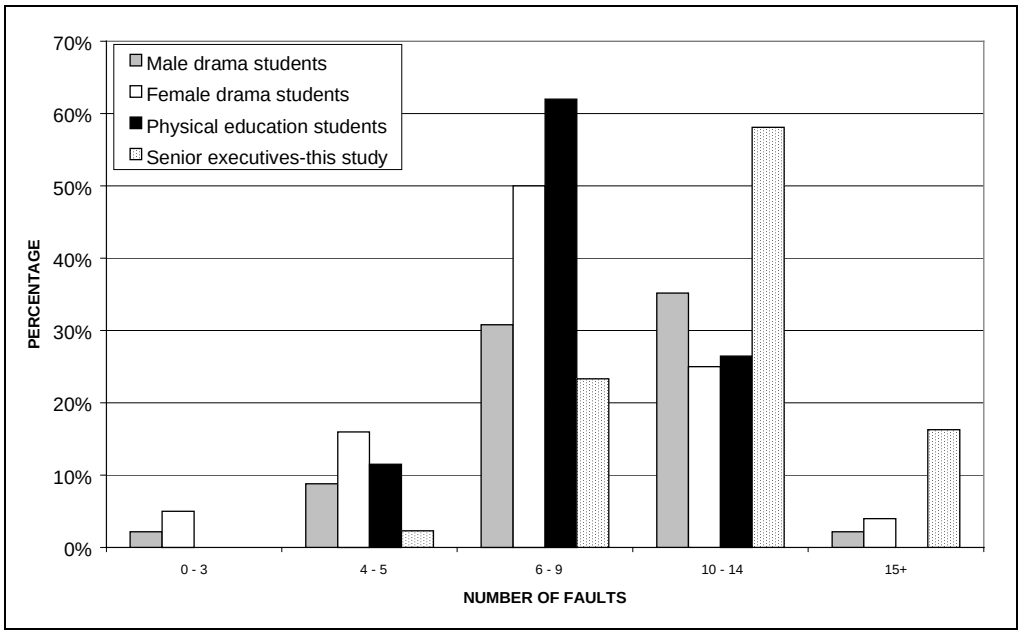


FIGURE 3. **COMPARISON BETWEEN THE NUMBER OF POSTURAL FAULTS IN STUDIES BY BARLOW (1956; 1990) ON TWO GROUPS OF DRAMA STUDENTS, PHYSICAL EDUCATION STUDENTS AND THE SUBJECTS OF THE PRESENT STUDY**

Postural defects in school children

The White House report of 1932 painted a bleak picture about postural defects in American school children (Kiernander, 1956). Postural defects were found in 92% of the children studied, with 44% of these having extremely severe postural defects. By the age of 11, 70% of all children will already show obvious muscular and postural defects. Usually these defects appear as passing inefficiencies and difficulties in learning, becoming accentuated in emotional situations. During adolescence the childhood faults become fully fledged defects and by the age of 18, 65% of the population will have severe defects and 15% will have very severe defects (Barlow, 1990). The subjects in this study all had postural defects with very severe postural defects (48.3%) and gross deformity (27.6%), adding up to a total percentage of 75.9 of the boys studied, indicating a higher incidence and severity of postural problems amongst school children of this study.

The postural defects found in the subjects (primary school boys) of the present study agree with those reported by others (Asher, 1975; Barlow, 1990; Dickson, 1983; Fenton, 1973; Rolf, 1977), in that kyphosis (and its associated rounded shoulders), lordosis and scoliosis are common postural problems, in addition to other postural defects also being present and noticeable. In the present study 49 of the subjects (84.5%) had abducted and "winged" scapulae, while the remaining nine (15.5%), had shoulders that were pulled together.

Kyphosis in a minor degree appears to be a common occurrence in infancy, childhood and

adolescence and "is reminiscent of the days before our ancestors assumed their upright posture" (Asher, 1975:26). Asmussen and Klausen (1962) supported this by stating that thoracic kyphosis is a feature common to all mammals. The incidence of increased kyphosis increases between the ages of 11 and 16 and diminishes thereafter (Asher, 1975). In the primary school boys of the present study kyphosis was prevalent (89.7% of all subjects, Table 5).

Kendall and McCreary (1983) identified four abnormal posture types, namely: Lordotic, kypholordotic, sway back and flat back. The first two of these are, according to Kendall and McCreary (1983), associated with an anteriorly tilted pelvis and hyperextended knees. In the present study 5.1% of the subjects were lordotic and 85% kypholordotic. Of these all had forward tilted pelvises, but only 24% had hyperextended knees. None of the subjects in the present study had flat or sway backs.

Scoliosis, however, is rarely seen under eight years of age, and not often thereafter. If a single lateral curve, usually to the left, is observed which disappears on flexion of the spine or when lying down, the condition is of postural origin (Asher, 1975). Dickson (1983), however, found scoliosis in 14.48% of a sample of 5303 school children studied. With more accurate evaluation this figure may be a high as 30% (Burwell *et al*., 1982), which is more in agreement with the results (39.7%) of the present study. An interesting explanation for this problem by Dickson *et al*. (1984) is that idiophatic scoliosis (biplanar spinal asymmetry) is the reverse of Scheuermann's disease.

Round shoulders was a term used by Asher (1975) to describe a whole range of postures in children namely: forward shoulders, poking head, poking neck, kyphosis and mobile scapula. She found that in most primary school children the tip of the acromion process appeared to be pointing forward, and in the older group round shoulders was a serious postural defect and which was used as a position of rest. She advocated discovering where the main fault lay and making the child appreciate the importance of recognizing the fault, as this particular posture was frequently part of the body image, and a new body image needed to be established (Asher, 1975). Body image is a term used for the visual, mental and memory images that a person has of his body. It influences the way the body is habitually used, as well as forming the background to his perceptions and it is embedded in his habitual resting state while influencing his posture, movement and communication (Barlow, 1990).

The primary school boys (subjects) in the present study all competed in some sport or other physical activity, and therefore could, to some extent, be considered to determine the effects of regular participation in physical activity/sport on posture. Postural defects of the subjects in the present study were, therefore, compared to those in the study undertaken by Barlow (1956; 1990).

In collaboration with Tanner (1978), from the Institute of Child Health, Barlow (1956; 1990) conducted studies on physical education students. This study was done at some of the leading physical education colleges in the United Kingdom. When the postural faults of the students in Barlow's (1956; 1990) study and the subjects of the present study were compared (Figure 4), a definite pattern emerged, in that the largest percentage of subjects in both the present and the study by Barlow (1956; 1990) fell in the categories of severe and very severe postural defects. Notably and disturbing is the fact that in the group of physical education students in

the Barlow (1956; 1990) study, the majority showed severe (62.0%), or very severe (26.5%) postural defects. In the present study on primary school boys values in these categories were 20.7% and 48.3%, respectively, with gross deformities found in an appreciable number of subjects (27.6%). The values of the male senior executives in the present study were 23.3% severe, 58.1% very severe while 16.3% had gross deformity. None of the subjects in the present study had *poise*, with only a very small percentage having slight postural defects (3.4%).

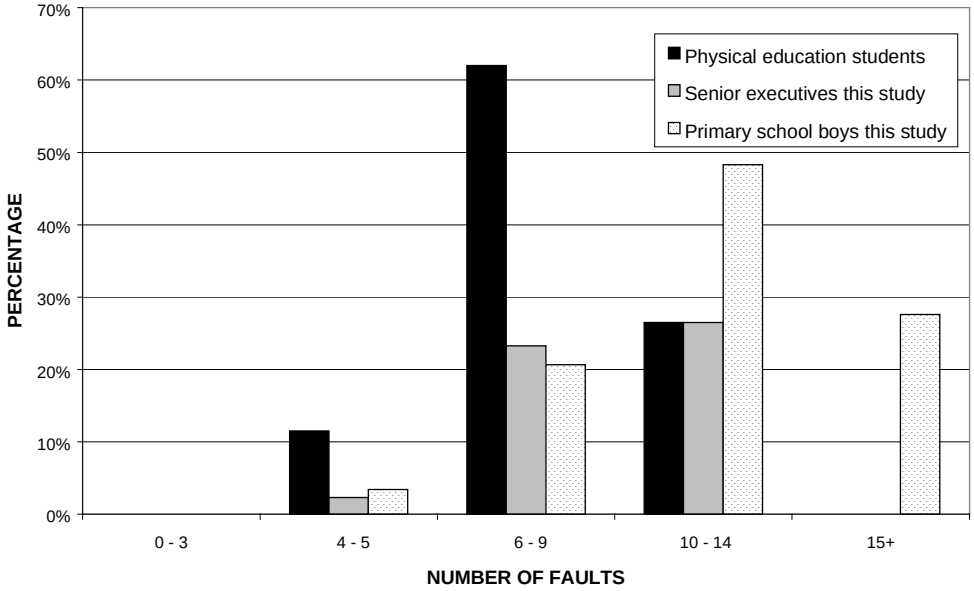


FIGURE 4. **A COMPARISON BETWEEN THE POSTURAL DEFECTS IN PHYSICAL EDUCATION STUDENTS IN THE BARLOW (1956; 1990) STUDY, SENIOR EXECUTIVES AND PRIMARY SCHOOL BOYS OF THE PRESENT STUDY**

In the United Kingdom high physical standards were required on entry into a tertiary training institution which drew on some of the best athletes and games players in the country. The large number of postural faults in physically active and fit individuals of this and the study by Barlow (1956; 1990) do **not** support the idea that: "… plenty of fresh air and exercise will ensure a reasonably good USE" (Barlow, 1990: 187). In this sense the word *use* is not used here in the limited sense of the use of any specific body part, as, for instance, the use of an arm or a leg, but in a much wider and comprehensive sense applying to the working of the body in general (Alexander, 1932).

CONCLUSION

The present study may serve as an indication of the extent in which posture is affected by age. The occurrence and intensity of postural defects of the primary school boys were compared with that of the male senior executives (Figure 4). Both groups in the study had poor posture,

with more boys falling in the category of gross postural defects than the male executives (Figure 4, Tables 2 & 4). This is not surprising in view of the observations made by Barlow (1956; 1990) and Woodhull *et al*. (1985), that those involved in sport and dance have poorer postures and body alignment than their sedentary counterparts. The explanation of this phenomenon is probably to be found in a point of view of Alexander made as early as 1910 (Alexander, 1996) in that one of the important outcomes of exercise should be the achievement of a balanced state. This critical important balanced state eludes us in our current highly technological driven physical and exercise culture and it seems that we cannot even achieve the most fundamental and basic starting point of all movement, namely good posture.

REFERENCES

ALEXANDER, F.M. (1932). *The use of the self.* London: Methuen.

ALEXANDER, F.M. (1987). *Constructive conscious control of the individual* (reissue of the 1951 ed.). London: Victor Gollancz.

ALEXANDER, F.M. (1996). *Man's supreme inheritance* (5th ed.). London: Mouritz.

ASHER, C. (1975). *Postural variations in childhood.* London: Butterworths.

ASMUSSEN, E. & KLAUSEN, K. (1962). Form and function of the human spine. *Clinical Orthopaedics,* 25: 55-63.

BARLOW, W. (1955). Psychosomatic problems in postural re-education. *The Lancet,* ii: 659-664.

BARLOW, W. (1956). Postural deformity. *Proceedings of the Royal Society of Medicine,* 49: 670-674.

BARLOW, W. (1959). Anxiety and muscle-tension pain. *The British Journal of Clinical Practice,* 63(5): 339-350.

BARLOW, W. (1990). *The Alexander principle.* London: Victor Gollancz.

BURWELL, R.G.; JAMES, N.J.; JOHNSON, F. & WEBB, J.K. (1982). The rib hump score: A guide to referral and prognosis? *The Journal of Bone and Joint Surgery,* 64-B: 248.

COCHRANE, W.A. (1924). The importance of physique and correct posture in relation to the art of medicine. *British Medical Journal,* 1: 310-313.

DART, R.A. (1946). The postural aspect of malocclusion. *The Official Journal of the Dental Association of South Africa,* 1(1): 1-21.

DART, R.A. (1947). The attainment of poise. *South African Medical Journal,* 21: 74-91.

DART, R.A. (1950). Voluntary musculature in the human body. The double spiral arrangement. *The British Journal of Physical Medicine,* 13(12): 265-268.

DICKSON, R.A. (1983). Scoliosis in the community. *British Medical Journal,* 286: 615-618.

DICKSON, R.A.; LAWTON, J.O.; ARCHER, I.A. & BUTT, W.P. (1984). The pathogenesis of idiopathic scoliosis. *The Journal of Bone and Joint Surgery,* 66-B: 8-15.

FARKAS, A. (1941). Physiological scoliosis. *The Journal of Bone and Joint Surgery,* 23(3): 607-627.

FELDENKRAIS, M. (1985). *The potent self. A guide to spontaneity.* San Francisco, CA: Harper & Row.

FENTON, J.V. (1973). *Practical movement control.* Boston, PA: Plays.

GOLDTHWAIT, J.E.; BROWN, L.T.; SWAIN, L.T. & KUHNS, J.G. (1952). *Essentials of body mechanics in health and disease* (5th ed.). Philadelphia, PA: J.B. Lippincott.

JANDA, V. & SCHMIDT, H.J.A. (1980). Muscles as a pathogenic factor in back pain. *Proceedings of the fourth conference of the International Federation of Orthopaedic Manipulative Therapists (*1-23), Christchurch, New Zealand.

JONES, F.P. (1979). *Body awareness in action. A study of the Alexander technique.* New York, NJ: Schocken Books.

JULL, G.A. & JANDA, V. (1987). Muscles and motor control in low back pain: Assessment and management. In L.T. Twomey & J.R. Taylor (Eds.), *Physical Therapy of the Low Back* (253-278). New York, NJ: Churchill Livingstone.

KENDALL, F.P. & McCREARY, E.C. (1983). *Muscles testing and function* (3rd ed.). Baltimore, MD: Williams & Wilkins.

KIERNANDER, B. (1956). Discussion on postural re-education - a critical examination of methods. *Proceedings of the Royal Society of Medicine,* 49: 667-670.

LAWSON-WOOD, D. & LAWSON-WOOD, J. (1977). *Progressive vitality and dynamic posture.* Hengiscote (Bradfort, North Devon): Health Science Press.

LOWEN, A. (1994). *Bioenergetics.* New York, NJ: Penguin Arkana.

NATIONAL INSTITUTES OF HEALTH (1997). NIH consensus statement. In A.S. Leon (Ed.), *Physical Activity and Cardiovascular Health. A National Consensus* (3-13). Champaign, IL: Human Kinetics.

PAINTER, J.W. (1986). *Deep bodywork and personal development.* Mill Valey, CA: Bodymind Books.

RICHARDSON, C.A. (1992). Muscle imbalance: Principles of treatment and assessment. *Proceedings of the New Zealand Society of Physiotherapists Challenges Conference (*127-138), Christchurch, New Zealand.

ROBINOW, M.; LEONARD, V.L. & ANDERSON, M. (1943). A new approach to the quantitative analysis of children's posture. *The Journal of Paediatrics,* 22: 655-663.

ROLF, I.P. (1977). *Rolfing: The integration of human structures.* New York, NJ: Harper & Row.

SHERRINGTON, C.S. (1946). *The endeavour of Jean Fernel.* Cambridge: Cambridge University Press.

TANNER, J.M. (1978). *Fetus into man: Physical growth from conception to maturity.* Cambridge, MA: Harvard University Press.

WOODHULL, A.M.; MALTRUD, K. & MELLO, B.L. (1985). Alignment of the human body in standing. *European Journal of Applied Physiology,* 54: 109-115.

Dr. Ben J.M. Steyn, Department of Biokinetics, Sport- and Leisure Studies, University of Pretoria, Pretoria 0001, Republic of South Africa. Tel: +27 (0)12 362-1574, Fax: +27 (0)12 362-0463, E-Mail: Steyn@lcdv.up.ac.za

(Review editor: Dr. L. Dreyer)

LESSONS FROM THE OLYMPICS: PARTICIPANTS' PERCEPTIONS OF THE 2000 GAMES

Justus R. POTGIETER

Department of Sport Science, Stellenbosch University, Stellenbosch, Republic of South Africa

ABSTRACT

The purpose of this study was to investigate the experiences of South African athletes at the Olympic Games and to identify the possible factors that could have affected their performances. A sample of 44 participants at the 2000 Olympic Games completed a post-Olympic questionnaire. Although most athletes believed that they were adequately prepared, a large proportion (58%) did not meet their pre-Olympic expectations. A variety of factors such as team selection, the media, village life, distractions, and coaching behaviours were identified as possible factors that influenced performance. Suggestions based on these data are proposed for future Olympic teams.

Key words: Olympic Games; Sport psychology; Elite competition.

INTRODUCTION

> *What was really positive was waking up every morning and seeing the flame burning at the stadium.*
> (Athlete comment)

The Olympic Games are in many ways different from other international competitions and therefore present unique demands, stresses and distractions. The general Olympic environment in itself may have had a significant effect on the performance of some participants. Some athletes thrive in this environment while others fail to live up to pre-Olympic expectations (Gould, *et al*. 1999b).

A study by Orlick and Partington (1988) identified factors that affected Olympic performances negatively. These included changing things that worked successfully in the past, late team selection and distractions at the Games. These authors were of the opinion that the athletes themselves were an important source of information regarding the mental dimensions of Olympic participation.

PROBLEM

The purpose of the current study is to investigate factors that from the athletes' perspective may have effected their performance. The long-term goal is to use these findings to ensure that optimal conditions are created for future Olympic participants. These are not only limited to mental readiness, but could also include other aspects such as organisational, administrative and political issues that have the potential to disrupt peak performance.

METHOD

Sample

After obtaining permission from the National Olympic Committee of South Africa (NOCSA) 113 questionnaires were mailed to athletes who attended the 2000 Games in Sydney. The football team was not included because they did not stay at the Olympic Village and competed almost exclusively at venues outside Sydney. They also returned home relatively early, immediately after their last match.

A stamped and addressed envelope was included for respondents to return their completed questionnaires. The response of the athletes was disappointing. Only 24 completed questionnaires were returned. A possible reason for this poor response was that questionnaires did not reach all the athletes. Quite a few are based overseas and others have moved base since the Games. Personal inquiries also revealed that some athletes did not have the desire to do anything after the Games, least of all completing a questionnaire. This aspect of lethargy and feelings of depression will be dealt with at a later stage.

A second round of questionnaires was mailed to the athletes. This second appeal yielded 20 additional questionnaires giving a total of 44 completed questionnaires for analysis. This represents 39% of the South African team that participated in the Games.

The questionnaire

The contents of the questionnaire was based on similar Olympic surveys carried out by Orlick and Partington (1988), Partington and Orlick (1991), Meyers (1997) and Gould, *et al*. (1999a, 1999b). The first section deals with the athletes' perception of whether they have met their pre-Olympic expectations. The second section investigates coaching behaviours. This is followed by items pertaining to environmental factors that could have affected performance. The next sections deals with post-Olympic perceptions and emotions. The specific issues covered in the questionnaire will be discussed in the presentation of results that follows.

RESULTS

Adequacy of pre-Olympic preparation

The vast majority (80%) of athletes believed that they were adequately physically prepared for the Games. However, members of the baseball team were of the opinion that they were short of recent match experience when arriving in Sydney. Only three athletes were of the opinion that they were not adequately physically prepared. Six athletes were uncertain about the adequacy of their physical preparation. As regards technical and psychological preparation the athletes were less confident. A total of 77% of the sample believed that they were technically adequately prepared and 66% were of the opinion that they were adequately psychologically prepared.

> *The best thing I did before the Games was that I visited the sport psychologist. It helped me mentally to relax.*

Quite a few (34%) athletes were uncertain about the adequacy of their psychological preparation and two athletes stated that they were not adequately psychologically prepared.

Things that I did not expect to hit my feet out from underneath me, that bowled me over.

I was prepared before the Games, but in hindsight I needed more preparation.

Success of performances

A large proportion of the sample (58%) stated that they did not meet their pre-Olympic expectations. Approximately a third (33%) of the sample were satisfied that they met their expectations. Only three athletes reported that they exceeded their expectations.

The role of coaches and managers

Respondents were requested to mention the best things that their coaches and managers did to help them perform well at the Games. They were also asked to comment on things that coaches and managers did that hurt their performances.

The athletes expressed appreciation for coaches and managers who looked after their needs such as organising transport, training sessions, etc. They also appreciated the efforts of coaches and managers to shield them from unnecessary hassles and stresses. They also commended coaches and managers who kept them informed.

Positive behaviours

The coach did a good job scheduling training sessions and keeping us informed about travelling and other arrangements.

The manager sorted out all missions to keep us free from hassles and pressures.

The coach tried to take all unnecessary worry away.

The manager kept politics and administrative problems away from me.

My manager created a training environment in which I could achieve my best.

Our competitions last ten days, therefore the coach had an important task in keeping me mentally focused.

Negative behaviours

He made decisions without consulting the athletes.

There was a lack of communication between the coach and team members.

Some athletes perceived the freedom allowed by the coaches and managers as positive.

Positive behaviours

They gave us the freedom to deal with the games in our own way.

Another good thing was that he allowed time alone (to think and relax).

Allowed me to stay away from the opening ceremony and village.

Negative behaviours

Not giving me space to relax alone and do my own thing.

Positive support from the coach was also mentioned. A seasoned international competitor wrote:

I was grateful to have my coach at the Games. He helped me with confidence and technical advice. But positive support was the most important thing.

The athletes commended the professional demeanour of the coach, staying calm, and maintaining confidence under pressure.

Positive behaviours

He kept things professional.

He remained positive although the morale was pretty low.

He was professional, calm and in control. He wasn't overwhelmed.

The coach remained calm and relaxed and therefore did not cause additional stress for us.

Negative behaviours

The coach seemed to lack confidence.

He did not take enough control.

There were some complaints about negativism and favouritism.

I was not afforded the opportunity to enjoy myself as my manager was the most negative thing on the tour.

There were two sets of rules for different people.

One athlete complained about a lack of loyalty and support from the coaches and managers.

Most of the time they were praising athletes from other countries that we had competed against before and had defeated. That kind of put a damper on my spirit.

Selection procedures

Seven (16%) athletes stated that selection procedures affected their performance extremely negatively. A further 15 (34%) were of the opinion that selection procedures affected their performances moderately negatively.

A few athletes were unhappy with the fact that the men's hockey team had not been included in the South African team.

The universal problem of late selection of teams was mentioned frequently.

> *The uncertainty caused by the late announcement of the team was a mental drain.*
>
> *Team selection should have been done sooner. This would have given everyone peace of mind when preparing for the Olympics.*
>
> *The team was selected too late. Uncertainty about participation affected my preparation negatively.*
>
> *I only knew by the Durban camp that I was selected. I found it extremely stressful and emotionally draining.*
>
> *The selection was left too late. I know that I was a border-line case for selection. The amount of pressure and anxiety that I suffered the whole year was excruciating.*

There were also negative perceptions about selection criteria and procedures.

> *They changed the criteria. One never knew where one stood.*
>
> *I was never made to feel part of the team and that my selection was on merit.*

Other extraneous factors

Respondents were requested to report their perceptions of various factors on a 5-point scale ranging from "extremely negative" through "no impact" to "extremely positive".

Travel arrangements

In general, the respondents did not experience travelling to and at the Games as negative. However, some of the athletes were of the opinion that they travelled too much in the year prior to the Games.

> *I had to travel to competitions in order to qualify. This drained me mentally and financially.*
>
> *I should have stayed in South Africa to train and not have travelled so much.*

Village life

The average response on the 5-point scale was 3.4. Village life in general (4), eating arrangements (4.1) and accommodation (3.8) were generally perceived positively.

> *Living amongst the best athletes in the world and coming to realise that they are also just human was in a sense very uplifting and very motivating.*
>
> *The whole vibe and hype in the Village helped me want to achieve, fuelled my eagerness to succeed.*
>
> *It was good that we were located close to the dining hall.*

There was some dissatisfaction with the accommodation. However, this was the exception rather than the rule.

> *The accommodations were too close together. One could hear people talking late into the night.*
>
> *I really enjoyed the Village, but I lost too much sleep because the rooms were too noisy with little soundproofing.*
>
> *The heat in the afternoons in the rooms was a bit too much. I could not have an afternoon rest, which was sometimes needed.*
>
> *The smoking was awful.*

Distractions

The average perception of the effect of distractions during the Games was that it did not have an impact (2.8 on the 5-point scale) on their performance.

> *I was well aware of what to expect about the distractions in the Village.*
>
> *Although we were forewarned, distractions still got the better of certain members of the team.*
>
> *Having been at the Commonwealth Games helped me to deal with distractions.*
>
> *We had the freedom to avoid distractions (e.g. functions, etc.) which was good.*
>
> *It is not good to stay in the Village for such a long time before competing. One loses focus.*
>
> *Being away from the Village for the first two weeks was a good move.*
>
> *The athletes had to attend too many functions (e.g. sponsors). This led to a loss of focus.*
>
> *Trying to secure tickets for family for the final caused extra stress that perhaps should be shouldered by someone else.*

The media

The overall response to the possible effect of the media on performance was that it did not have a significant impact on performance. However, five athletes (11%) were of the opinion that the media affected them extremely negatively. A further nine (20%) of the sample experienced the effect of the media moderately negatively. Six (13%) experienced the media moderately positively, while four (9%) of the sample rated the effect of the media as "extremely positive."

> *Not only do you have to deal with your poor performance, but also the negative criticism I got from individuals going straight to the papers without talking with me first. They had no idea what went wrong.*

> *The media only think of medals and fail to see the bigger picture. To have athletes in 29 finals is a massive improvement from Atlanta.*

> *The media seemed to think that we had to fit in with them and not the other way around.*

Members of the baseball team experienced the media negatively due to the issue of the men's hockey team not being included in the Sydney team. The following statement represents the feelings of some of the baseball players:

> *The media gave us no chance. The "hockey vs baseball" debate made us feel that we were not good enough to be at the Games. The media should have supported us.*

Administrative support

In general the respondents were of the opinion that the administrative support staff did not have any impact on their performances. A group of 14 athletes (32%) experienced the effect of the administrative staff positively.

> *I found the administrative staff very supportive of my decisions and needs.*

> *I found the individuals who I dealt with exceptionally helpful.*

However, 11 (25%) of the sample perceived the effect of the administrative staff negatively.

> *Some staff members were not as helpful as others.*

> *I found the general lack of punctuality of administrators and athletes alike very irritating. It leads to lack of discipline.*

Medical support

There was general satisfaction with and appreciation for the medical staff at the Games. The average rating on the 5-point scale was 4.4. A total of 25 athletes (56%) gave the medical staff an "extremely positive" rating.

> *They worked very hard and gave a lot without receiving much thank you and appreciation.*

> *The medical staff helped beyond their call of duty and became good friends over and above their official functions.*

> *The medical team should be enlarged. They were overbooked and not available when I needed them.*

Team-mates

A total of nine (20%) of the sample of athletes were of the opinion that team-mates did not have any impact on their performance. Twenty-nine (61%) perceived the effect of their team-mates positively. Only four (9%) of the sample rated the effect of team-mates negatively.

I really enjoyed the team spirit.

There was a great atmosphere among the track and field athletes. During the tournament and the preparation process there were no problems. Only now afterwards the realization that some players are spreading negative rumours about things is very painful. But at the time, that was not really detected.

Team-mates were very supportive. This created a positive environment.

Family

The effect of family members on performance was generally rated highly positively (average rating of 4.6 on the 5-point scale).

My family and friends were my biggest support. I couldn't have done it without them.

My folks were there and helped make my Olympics more enjoyable. They supported me, no matter what.

Very supportive. They told me they were happy to see me in the team and would like me whether or not I got a medal.

My father and husband helped create a warm, familiar environment.

Only one athlete experienced the effect of his/her family on performance negatively.

Others' expectations

Thirteen athletes (30%) reported that the expectations of others did not have any impact on their performance. Nine athletes (20%) were of the opinion that the expectations of others had a negative effect on their achievements.

NOCSA put high expectations (medal count) on us instead of letting everyone perform to their best without pressure.

The expectations and disappointments on behalf of the South Africans were very hard to accept.

Fifty percent of the sample perceived the effect of the expectations of others as positive.

Post-Olympic perceptions

Feelings of depression

The majority (77%) of the sample reported subjective feelings of post-Olympic depression. Twelve (27%) respondents reported feelings of "extreme" depression after the Games. A total of 11 (25%) athletes experienced "quite a bit" of post-Olympic depression. A further 12 (27%) reported subjective feelings of "moderate" depression. Only nine athletes (20%) reported that they did not experience any depression.

There was no significant relationship between these scores of incidence/degree of depression and the athletes' perceptions of their pre-Olympic psychological readiness (r=0.173; p=0.262) and their evaluation of whether they met their pre-Olympic expectations (r=0.197; p=0.199).

> *I still wonder about certain things, but with time things will become easier to digest. I will still take a while to get over the whole experience.*

Two athletes mentioned the need for post-Olympic counselling.

> *It would have been quite nice to have had some counselling after the Olympics.*

> *How do we deal with life after the Olympics? Some guidance is needed.*

Second chances

Respondents were asked to comment on matters that they would have done differently if they were given a second chance to attend the Games. A response mentioned, that is worth considering, is that members of various sporting codes should build a stronger relationship with the entire team. Mention was also made of a need for better psychological preparation.

> *I would like to have been more mentally prepared for an event like this.*

> *There should be a more thorough debriefing (technically and psychologically) after each event to refocus and set new goals.*

> *I would like a stronger team spirit.*

> *I would spend less time in the Village before my race.*

> *The travelling prior to the Olympics exhausted me. Next time I would plan better.*

Some athletes were of the opinion that they should have expressed their unhappiness with certain matters earlier.

> *I would have spoken my mind earlier.*

Post-Olympic criticism

Respondents were generally of the opinion that the post-Olympic criticism was harsh and unfair. The following are examples of the many responses to this question:

> *Some of it was very unfair. Mr. Ramsamy and NOCSA, however, were very supportive and appreciated our performance.*

> *The media and NOCSA tend to overstate the athletes' abilities, which is part of the building interest, but the public does not understand it.*

> *It was very hurtful, but one has to take it from where it comes from. I was proud to represent my team-mates at the Olympics, but not my country. I feel that South Africans failed their athletes.*

We performed better than ever before, so it would be crazy to listen to uninformed opinions.

The criticism is based on a misinformed public, a poor understanding of the Olympics by our press, and generally a poor Olympic culture in the country.

I was shocked that a country can just turn on you. We did our best to perform at the level that we can. It was very disheartening.

People need to see the number of finals reached in Sydney compared to Atlanta in order to see an improvement from then.

There were also team members who acknowledged the public criticism as realistic and justified.

The criticism was deserved, as we did not do well because we were not prepared to face the professional teams.

For the sports talent and sports fanatical public we should definitely be producing more medals.

Some of it was valid, but South Africans don't know what it takes for an athlete to perform well at the Games.

Some of it is fair, but we cannot compare to other countries as far as available resources.

The reaction of the press was much more positive than it was in Atlanta. They had learnt a lot over the years and were more supportive of us.

Other comments and suggestions

Respondents were requested to make suggestions or comment on any other matters of interest. Mention was made of monetary sacrifices and the need for financial support for athletes in general.

We suffered enormous monetary loss. Because we had to pay for all medical costs we played through pain before the games.

More money needs to be put into schools of excellence. We need a super squad system supported by NOCSA and the government.

It is not possible to work to survive and put in the effort that is needed to win Gold.

I received good support from NOCSA for my final year of preparation. Ideally, the support needs to begin earlier, not just in the final build up to the Olympics.

Frequent mention was made of extending the preparation period of athletes for international events such as the Olympic Games.

Don't ignore us the three years between Games. Now is the time to lay a foundation for Athens.

A programme of at least four years should be introduced for athletes who qualify for the Olympics.

More emphasis should be placed on mental states before, during and after the Games. Individual sessions with athletes are needed.

A need for team building was frequently mentioned.

There needs to be more team-building exercises so that the whole team gets to know one another. The smaller sports do tend to stick together while the team sports and larger groups keep separate.

We need to act more as a team and not have people treated differently and exclusively.

More should have been done to create a team spirit. The team seemed disjointed, not intentionally or as a result of tensions, but rather due to a lack of interaction.

The team could have gotten together to support other sports and team-mates.

The team spirit needs to be better.

Better team synergy was needed.

One athlete suggested that the participants should have some input when appointing managers and coaches.

DISCUSSION AND RECOMMENDATIONS

Adequacy of pre-Olympic preparation

NOCSA did its best to ensure that this was the best-prepared Olympic team to ever leave the shores of South Africa. However, there is always room for improvement because many athletes felt that they were not optimally prepared in all dimensions (physical, technical and psychological). NOCSA should continue to give athletes the financial and other support to empower them to prepare over an extended time period for the Games.

The role of coaches, managers and support staff

In the midst of the everyday hassles and crises management, the critical role of coaches, managers and administrative staff is possibly negated. These individuals should not underestimate the crucial role they play in providing a positive environment for athletes to perform optimally. This places great demands on them. They need to have a positive, helping attitude towards the athletes and be prepared for the Olympic experience.

Athletes seem to have high, and in some cases, unrealistic expectations of their coaches and support staff. They expect a professional attitude, confidence, commitment, technical and administrative competence, placing the needs of the athlete first, trust and fairness, good communication and interpersonal skills, loyalty and confidence-building support. Although this places great demands on staff, such expectations are natural. Only coaches and staff who meet these criteria should be appointed in these positions. On the other hand, athletes should also acknowledge their dependence on the administrative support staff, cooperate with them, and show appreciation for their efforts. It is not the responsibility of the administrative staff only to maintain a positive environment.

Selection procedures

Late selection of teams is a universal problem. The responses of athletes who participated in this study highlighted this problem. Although there are usually valid practical reasons for this phenomenon, every possible precaution should be taken to alleviate this problem. The appointment of support staff should similarly be concluded as soon as practically possible.

Other extraneous factors

The athletes did not report significant problems with travel arrangement and life in the Olympic village. In contrast with other studies (Orlick & Partington, 1988) the South African team did not have major problems with distractions at the Sydney Olympic Games. This could possibly be attributed to the quality of the general organisation at the Games and perhaps to a lesser degree to the fact that attention was given to this aspect at the pre-Olympic preparation camps. In addition, coaches and managers visited the Olympic site shortly before the commencement of the Games. The familiarity with many of the conditions surrounding the Games enabled them to better prepare their athletes as to what they should expect at the Games. This practice should be continued when preparing future teams.

Athletes should be made aware of how their behaviour could affect their team-mates. A commitment to be sensitive to the needs of other athletes should be instilled in all team members. This includes matters such as positive interpersonal relations, allowing other athletes quiet time for resting and sleeping, supporting and encouraging team-mates, and other behaviours such as punctuality and inconsiderate behaviour such as smoking.

The media

The responses of the athletes in this survey showed that the media could play a positive as well as destructive role. Attempts should be made to maintain a good relationship between athletes and the media. The ideal would be for the media to refrain from creating unrealistic expectations among their readers and to promote and support the various sport codes and their athletes.

Medical support

The athletes involved in this survey were generally very satisfied with the quality of medical support. Because this is an important factor in the life of athletes NOCSA should continue to appoint competent professionals with a “feel” for elite sport to assist athletes in their preparation for and performance at the Games.

Team-mates

Many of the respondents in this survey were of the opinion that the spirit of the SA team could have been better. Serious attention should be given to this aspect when preparing future teams.

Family

For many athletes the support of their families was very important. Attempts should be made to assist family and friends of athletes to fulfil this supportive role without becoming an additional source of distraction. These include obtaining tickets for events and passes to visit the athletes.

Others' expectations

The expectations of others can have a negative as well as positive effect on performance. It is recommended that an overemphasis on medals should be avoided.

Post-Olympic matters

Athletes should be prepared to handle the possible media criticism they will have to endure after the Games.

The feelings of depression that was reported by a large percentage of the athletes can possibly be attributed to feelings of emptiness and lack of purpose after many years of preparation and eager anticipation, which came to a climactic end at the Games. Athletes should be prepared for possible post-Olympic negative emotions. Some post-Olympic counselling should be offered.

CONCLUSION

A professional approach is imperative to compete successfully at the Olympic Games. In order to enhance the professional development of athletes the necessary resources should be put at their disposal. This includes adequate financial, technical, scientific, medical, and psychological assistance.

REFERENCES

GOULD, D.; GREENLEAF, C.; DIEFFENBACH, K.; LAUER, L.; CHUNG, Y.; PETERSON, K. & MCCANN, S. (1999a). *Positive and negative factors influencing U.S. Olympic athletes and coaches: Nagano Games assessment.* Unpublished USOC report.

GOULD, D.; GUINAN D.; GREENLEAF, C.; MEDBERTY, R. & PETERSON K. (1999b). Factors affecting Olympic performance: Perceptions of athletes and coaches from more and less successful team. *The Sport Psychologist,* 13*:* 371-394.

MEYERS, A.W. (1997). Sport psychology service to the United States Olympic Festival: An experiential account. *The Sport Psychologist,* 11*:* 454-468.

ORLICK, T. & PARTINGTON, J. (1988). Mental links to excellence. *The Sport Psychologist,* 2: 105-130.

PARTINGTON, J. & ORLICK, T. (1991). An analysis of Olympic sport psychology consultants' best-ever consulting experiences. *The Sport Psychologist,* 5: 183-193.

Prof. Justus R Potgieter, Department of Sport Science, Stellenbosch University, Private Bag X1, Matieland, Stellenbosch 7602, Republic of South Africa. Tel: +27 (0)21 808 4915, Fax: +27 (0)21 808 4817, E-mail: jrp@maties.sun.ac.za

(Review editor: Mr. H. de Vos)

THE JOB SECURITY OF COACHES

Paul C. SINGH
Department of Sport and Movement Studies, Rand Afrikaans University, Johannesburg, Republic of South Africa

ABSTRACT

The proliferation of international sport competitions has drawn considerable attention to coaching. However, it appears that when a team loses, the first solution seems to be to fire the coach. This study thus aims to investigate the job security of professional coaches in South Africa. It attempts to identify the problems experienced by coaches, the solutions they propose and to make managers of sport and future coaches aware of the stability or instability, security or insecurity involved in coaching. Postal questionnaires and telephonic interviews were used to gather data from 25 professional coaches from five major sport codes. Frequencies, percentages and averages were computed. The majority of coaches felt insecure about their jobs. The most common reason for their dismissal was dissatisfaction experienced by players and management with the inability of coaches to make their team win.

Key words: Coaching; Job security; Stability; Dismissal.

INTRODUCTION

Professional coaching today is an exciting, highly valued and lucrative occupation, but only for those who are dedicated and enjoy it. Professional coaches have the most prestige, whatever their sport. They also have the least job security. For a head coach, losing games can mean losing a job (Mariani, 1995). Weingarten (1980) strongly regards sport coaching not only as a dignified profession, but a most complicated and demanding one. It is a profession in which science and art are moulded together to produce a specialist of high quality. According to Ritzers (1977) in Massengale (1985), coaching has special status, power and prestige. It enjoys the mystique of a profession with special rights, privileges and obligations. It has public acceptance and displays a distinctive occupational culture. Coaching also embodies authority, a norm of altruism, a body of knowledge, technical skills and a norm of professional autonomy (Weingarten, 1980; Massengale, 1985; Gummerson, 1992).

One of the first concerns that anyone has upon entering a new profession is job security, or tenure of employment. But it would appear that flexibility and mobility have become bywords for workers in the 1990's. Ever since the big corporate layoffs, downsizing and rightsizing began in the last decade, it has been said that job security is a thing of the past. The perception is that all workers have to get used to changing jobs more frequently (Booth, 1999; Landry, 1999). Kenny (in Leonard, 2000:29-30) maintains that "Even in a thriving economy, mergers and acquisitions, changes in business directions and staff realignments cause organizations to lay off employees. But few workers expect it to happen to them." According to Nigro (1997), enhancing job security is fundamental to career management and it connotes adding character to the resume by broadening areas of specialization.

Beach (1970) in Paterson (1990) identified four categories of job dissatisfaction, namely: nature of the work; job insecurity; interpersonal relations; upward mobility and status. While these four factors account for the major reasons for job dissatisfaction in general human resource management, they could also apply to the sport industry, particularly since professionals such as coaches are paid employees. Job security is closely related to the opportunity for upward mobility and status and thus is a significant determinant of job satisfaction. Herzberg's theory of job satisfaction also explains that "motivators" such as "recognition" and "advancement" are essential for job satisfaction (Paterson, 1990).

Pospisil (1998) maintains that retaining talent is a major issue for companies today, but contrary to popular opinion, increased workloads and decreased job security are less important to employees than opportunities for skill development, management competence, and rewards. Schmidt (1999) also expressed concern over job security and states that in recent years in the United States, workers are more anxious about losing their jobs than they have been in the past.

In discussing reasons why people leave a job, De Marco and Lister (1987) identified the following as the main reasons that account for most departures for organizations with pathologically high turnover (over 50%): a just-passing-through mentality; a feeling of disposability; and a sense that loyalty would be ludicrous. The insidious effect here is that turnover engenders turnover. People leave quickly, so there is no use spending money on training. Since the organization has invested nothing in the individual, the individual thinks nothing of moving on (De Marco & Lister, 1987).

The fore-mentioned principles of job security are particularly relevant to the sport industry in South Africa. South Africa is a fairly young democracy, and as it has become part of the global sport economy it needs to become internationally competitive. The recognition and acceptance of the importance of sport coaching in the past was largely based on the notion of developing healthy participants. Today, the emphasis is on the economic benefits that success in major international events generate. However, without the provision of competent coaches, any athlete's potential will never be fulfilled (Gummerson, 1992).

Unlike Australia, Britain, America, and some of the 'eastern bloc' countries where their economies are strong and large sums of money are spent on sport, South Africa does not have the financial resources to lavish on sport alone. There are several other priorities. Hence, it would be vital to ensure that whatever funds are spent on sport, on coaches and coaching programmes in particular, are spent judiciously. This would mean that coaches should feel secure and satisfied in their profession or it would lead to vast losses in terms of finances and expertise.

Security in coaching lies in three broad areas. Firstly, coaches must rely mostly on their own ability, regardless of the number of assistants on the staff. Secondly, the head coach must have complete faith in the players on the team, faith that the athletes will perform in the excitement of competition the way they have been taught in practice. Thirdly, the coach must have faith in the assistant coaches, in that they are dedicated enough and possess sufficient knowledge to do an outstanding job of teaching skills and attitudes necessary for excellence in an athlete (Gummerson, 1992).

Every coach should be aware that coaching is a volatile profession involving many pressures. It places demands on a coach's time, energy, family life and physical well being. Many coaches do not last long in their jobs (Templin & Washburn, 1980). Further, coaching is a perilous occupation. In the 1998 soccer World Cup finals in France, Saudi Arabia, after a 0-1 loss to Denmark and a 0-4 loss to France, dismissed Brazilian coach Carlos Alberto Parreira, the man who assisted Mario Zagallo in Brazil's triumph at the 1994 World Cup finals in the United States. The Saudi Arabian federation officials argued that Parreira failed to build on the achievements attained by the team at the 1994 finals. Parreira earned a monthly salary of R1.4 million and had signed a one-year contract at the end of the Confederation Cup in Riyadh the previous December. However, his employers perceived Saudi Arabia's two defeats as failure and they dismissed the Brazilian (*Natal Mercury*, 11 July 1998).

Tunisia's Henry Kasperazak was also not fortunate. When the 1996 Africa Cup of Nations runners-up were defeated 0-2 by England, followed by a 0-1 loss to Columbia, he was also dismissed. Parreira stated that building a winning team takes time and hard work. Being the coach of a national team is one of the most arduous undertakings in sport. Even though a coach may help his team win the World Cup, fans and the media will still complain that the type of soccer was not artistic, imaginative, or attacking enough. Excessively high expectations can have painful and unpleasant effects on a coach (*Sunday Times*, 18 October 1998).

A similar trend appears to have infiltrated South African sport, as witnessed by a high turnover of coaches recently. Soccer fans and administrators have expressed vociferous concerns about Bafana Bafana's poor performance in international competitions, and wanted coach Trott Moloto fired. It seems that the Natal Sharks rugby coach, Hugh Reece-Edwards was also dismissed after the team suffered six defeats in six home-games, although he had a one year coaching contract. His service to his province for 18 years, 14 of which were as a player and four as assistant coach to Ian McIntosh, and his experience, seemed to matter little (*Sunday Times*, 13 February 2000).

The Springbok rugby team has also seen a high turnover of coaches in the recent past (four coaches over the last 4-year period). After Kitch Christie was relieved of duty due to ill health, Markgraaff was dismissed for racist slurs which he admitted making (*Mail & Guardian*, 3 August 1997). Carel du Plessis was the surprise replacement as the new Springbok coach, ahead of the deputy coach Nick Mallett. Du Plessis had relatively little coaching experience, and was not a provincial level coach, usually one of the criteria for selection (*Mail & Guardian*, 26 February 1997). However, he too was dismissed before his contract expired, apparently because of poor performances of the team. The condemnation of a Springbok coach has never been more universal than in Nick Mallett's case in the recent past, because of a spate of defeats. In fact, a formidably powerful "Mallett must go" movement developed. The South African Rugby Football Union (SARFU), in spite of the assurance that Mallett's position would be secure until the end of his contract in 2001 (*Sunday Times*, 9 July 2000), dismissed him with an out-of-court settlement of R1.25 million over fifteen months (*Sunday Times*, 1 October 2000). In a similar fashion, both du Plessis and Markgraaff were also appointed to take charge of the Springbok team at the 1999 World Cup, but were dismissed prior to it.

Workers' perceptions of job insecurity are said to affect a number of economic variables. Manski & Straub (in Anonymous, 1999) studied the issue in the United States and found that expectations of job loss tend to decline as age increased, but so do expectations that a subsequent job search would be successful. They further found that perceptions of job insecurity tended to decline as educational attainment increased .

Lackey (1977) conducted a study to find out the causes and frequency of coaching dismissals and resignations in Nebraska. He sampled 320 principals of public high schools. Forty five percent indicated that they had been administrators in schools where an athletic coach had been dismissed, and 71% witnessed resignations. A striking finding was that coaching ability was ranked as only the sixth main reason for dismissal. The three most significant reasons provided for resignations were career changes (42%), personal factors (27%) and job pressures (24%).

Research on job security in South Africa is fragmentary and anecdotal. There are no academic papers on job security in sport or in sport coaching. There is a need for relevant information to inform future coaches about what their expected roles are and if there is stability/security in the coaching profession. This is important for their professional self-determination. Information is also needed to assist curriculum developers to design relevant and up-to-date courses that prepare coaches with the requisite skills and knowledge. Since South Africa's re-entry into the international sporting arena, and the sudden interest and growth in sport, there is a dire shortage of qualified coaches in all sports, necessitating the training of coaches who will be required at communities, schools, colleges, technikons, universities, and professional clubs.

PURPOSE

The purpose of this study was to investigate the job security of professional coaches in South Africa. It attempted to identify the problems experienced by coaches, the solutions they propose and to make managers of sport and future coaches aware of the stability or instability, security or insecurity involved in coaching in general. As this was the first investigation of this type, it was not intended to report on sports individually, notwithstanding the fact that there would be variations in responses from individual sports types. The critical questions to which answers were sought were as follows:

1. Are coaches dismissed frequently because of stress, pressures from administrators, public expectations and media pressure?
2. Should a coach who has been a credit to a team for years be dismissed when s/he has a losing season?
3. Is it fair to dismiss a coach from coaching when that person has been evaluated as an excellent instructor?
4. Should the coach be accountable to individuals with little/no training in the mechanics or the psychology of coaching?

METHODS AND PROCEDURES

The instrument used in the primary data gathering was designed by the researcher as an interview schedule appropriate for use as a mailed questionnaire, for face-to-face interviews, and telephonic interviews. It was designed specifically to provide data about job security and

job satisfaction in sport coaching. The components that were considered were coaching contracts, dismissals, anxiety and stress, media influences, expectations from coaches, availability of assistants, decision making, and accountability. A pilot study was undertaken to check the validity of the questionnaire. Where it was not possible to conduct personal interviews, either because of distance or time constraints, the questionnaire was mailed. A covering letter explained the purpose of the investigation and assured the respondents of confidentiality and anonymity. This was done to remove any scepticism that respondents may have and to encourage them to co-operate. Where the respondents could not be physically available, telephonic interviews were conducted.

For the purposes of this study, a professional coach was regarded as a coach who had an academic and/or professional qualification in coaching, and one who was paid for his services. A stratified random sample of 12.5% was drawn from the approximately 200 professional coaches of all disciplines in South Africa who were listed on the database of the National Department of Sport and Recreation in Pretoria. This gave a valid sample of 25, consisting of males and females. To be representative of all disciplines, the total population was divided into codes and five coaches were randomly selected from each of the following five major sports utilizing professional coaches: soccer, rugby, cricket, hockey and gymnastics. The data was analyzed by computing frequencies, percentages, cumulative frequencies and averages.

RESULTS AND DISCUSSION

TABLE 1. **EXPERIENCE IN PROFESSIONAL COACHING**

Number of years	Percentage
0–4	8
5–9	16
10–14	16
15-20	60

The respondents were all South Africans. According to table 1, a total of 60% of the respondents had between 15-20 years of experience in coaching, whilst 16% each had between 10-14 years and 5-9 years of experience respectively. Only 8% had relatively little experience of four years and less. Such high levels of specific experience in coaching would be indicative of a high standard and quality of coaching in South African sport.

A total of 84% of the respondents either had a diploma (32%), degree (40%), or post-graduate qualification (12%), while only 16% had a matriculation. This finding supports the contention of Riordan (1979) in Weingarten (1980) that coaches in the U.S.S.R. were "the most authoritative figures in Soviet Sport". In 1977, 60% of all coaches had at least a 4-year course in higher education, while the rest had a coaching diploma. Without such qualification, he claimed that it was impossible to obtain a coaching position on either a full- or part-time basis. It also confirms the findings of Mariani (1995:4), who states that "professional coaching jobs – the most difficult to get - do not require a bachelor's, but the degree is preferred". In the current study, 80% had attained their current employment through experience. This supports the findings of Mariani (1995:4), who stated that "although education matters in preparing for

a coaching career, experience counts for more". The educational qualifications, considered together with the high levels of experience amongst the coaches augur well for coaching to assume a highly professional image and level of functioning. This finding was further supported by their specialized coaching qualifications. A total of 80% of the respondents had the equivalent of a level 3 (40%) and a level 5 (40%) qualification. A small proportion of 12% had level 2 certification and 8% level 1. These levels had been standardised for all sports by the then National Sports Council's Protea Mmuso coach education programme since 1996.

An overwhelming 80% of the respondents had contractual obligations with their employers, with 20% reporting no such contracts of employment. In theory, this would suggest that professional coaches in South Africa, unlike their international colleagues, do enjoy tenure of employment through contractual obligations with their employers. Further, 80% of the respondents indicated that they were consulted in the drawing up of their contracts. Despite the high level of consultation reported, it should nevertheless be a matter of concern that 20% of the coaches had reportedly not been consulted. South Africa has a very progressive Labour Relations Bill which could have implications should these individuals not be treated fairly in the absence of a contract.

All of the respondents (100%) indicated that they did not belong to any professional coaches association. This was due to the absence of such an organization in the country at the time. This is noteworthy as South Africa has just emerged from four decades of international sports isolation. The absence of such an association could affect the development of professional coaching at the higher levels of performance. It would also suggest that for the advancement of the coaching profession in the country, there is a need for coaches to facilitate the formation of such a body.

With regard to job security, 24% of the sampled coaches felt secure in their jobs, whereas an overwhelming 76% were insecure. Further, 55% expressed anxiety about their jobs. Viewed against the knowledge that 80% had previously reported that they had employment contracts and 84% had appropriate qualifications, this raises serious concerns. A logical explanation for such insecurity and anxiety would be the unrealistic demands of coaching and the emphasis on winning and success. Coaches on the average indicated that "you are only as good as your last win". Hence, despite the fact that the majority of respondents had contracts and appropriate qualifications, feelings of job security were very low. This has to be appreciated by all that have an interest in sport, because by its very nature, the outcome of competitions is very unpredictable. Certainly the criteria for success in coaching has to include more than winning. The results also show that tenure of employment is not the only factor determining job security for professional coaches. This confirms the finding of Pospisil (1998) that opportunities for skill development, management competence, and rewards are more important considerations than increased workloads and decreased job security.

Twenty percent of these coaches were previously dismissed from employment, with some of the following being offered as the main reasons for their dismissal: poor attitude of coach; poor team performance; political reasons; and dissatisfaction of players and administrators with the coach's ability to make the team win. The implication here is that coaches experienced role problems which can generally be solved by an open, consistent approach to interpersonal behaviour. Perhaps a sharper focus is required on the matter of role conflict

arising from the management of coaching support personnel, and on the variety of role interpretations imposed by individuals and groups in top-level sport.

All respondents (100%) reported that the management personnel of sport organizations had very high expectations of the coaches to ensure that their team wins. This confirms that in South Africa the primary criteria for coaching effectiveness is winning. Chelladurai (1986) explains that sport's concern with the pursuit of excellence implies that the **outcome** of winning is the criterion of effectiveness whereas in other occupations the **process** is also included. The unfortunate part of this concept of control through outcome is that the coach is held responsible for a team's failure, but the athletes get most of the credit for victories. For these reasons, the community is not likely to confer on coaching a status or authority comparable to other established professions like medicine or teaching.

TABLE 2. **FACTORS THAT AFFECTED COACHES**

Factors	Percentage	
	Yes	No
Stress (High: 60%; Medium: 40%)	100	0
Media pressure	64	36
Assistant coach necessary	60	40
Management influence on team selection	100	0
Unfairness of dismissal due to losing a game	100	0

Sixty percent of the respondents indicated that stress levels in coaching were very high, and the remaining 40% felt that it was medium. Sixty four percent of coaches indicated that they felt pressured by the media, and that this affected their coaching performance. This suggests that the media had a profound influence on the levels of stress and anxiety experienced by coaches. This could be attributed to the fact that the media brings them under public scrutiny and thus exerts pressure on them to deliver success. This could be further exacerbated by the fact that 40% of these coaches did not have assistant coaches, who may have reduced the demands placed totally on them by the media, administrators, public and players. This could be borne out by the report of the 60% of the respondents who had an assistant coach and regarded them as a vital source of support.

A total of 100% of the coaches indicated that management influences the selection of teams. This meant that professional coaches do not own the end product of the coaching process. This marginalisation of coaches from the final decision making process renders them powerless, but yet accountable should the team fail to win. All coaches (100%) indicated that they should not be held accountable to individuals with little or no training in the mechanics or psychology of training.

All of the respondents (100%) also indicated that it was unfair for a coach to be dismissed in the event of losing a season. Some of their reasons were as follows: success comes over a period of time and not just a season; although a coach may have a losing season, s/he must have impacted on the skills of the players; the main goal of coaching is to help players to perform effectively and not just to win; and winning is dependent on many factors other than the coach. This situation of unfairness adds to the many instances cited earlier as evidence of

the impact that a spate of losses usually has on coaches in South Africa. Regardless of their contracts, many have been dismissed prematurely. It appears that those who legally challenge their dismissal are offered out-of-court settlements.

CONCLUSION

It is essential to return to the critical questions that were addressed by this study. The results show that coaches do get dismissed frequently because of stress, pressures from administrators, public expectations and media pressure. Coaching is a very stressful profession. The majority of coaches felt pressured by the media, which exerts anxiety and stress on their lives. Public expectations of a coach to produce winners constantly are extremely high and this also places undue stress on them.

The second critical question ascertained that professional coaches should definitely not be dismissed solely because they have lost a game or had a losing season. Winning is dependent on more variables than the coach alone. If this factor is not taken into consideration it can undermine the stability and security of the profession. A further disturbing finding was that employment contracts do not promise stability or security in coaching. Coaches thus become extremely anxious and insecure about their jobs.

The third conclusion is that it is unfair to dismiss a coach when that person has been evaluated as an excellent instructor by the management and players. The results indicate that the primary criterion for coaching effectiveness has been winning. In the words of Gummerson (1992), the ideal coach is one who can help each individual to achieve his/her potential, no matter what the final level of performance might be.

Finally, all coaches felt strongly that they should be accountable, but not to individuals with little/no training in the mechanics or the psychology of coaching.

It is recommended that all coaches, both amateur and professional, in the interests of their own self-determination and professionalization, should constitute a strong coaches association. This would afford an opportunity to an emerging profession to protect its specialized skills, control entry to the profession and establish codes of ethical behaviour.

REFERENCES

ANONYMOUS (1999). Perceptions of job security. *Monthly Labor Review (Washington)*, 122(4): 47.

BOOTH, F.A. (1999). Back to the basics: Generation X needs to connect to people, not just computers. *Nation's Restaurant News (New York)*, 33(12): 30,66.

CHELLADURAI, P. (1986). Professional development of coaches. *Proceedings of the VIII Commonwealth and International Conference on Sport, P.E., Dance, Recreation & Health.* Glasgow: 18-23 July 1986. London: E. & F. N. Spon.

DE MARCO, T. & LISTER, T. (1987). *Peopleware. Productive projects and teams.* New York, NJ: Dorset House Publishing.

GUMMERSON, T. (1992). *Sports coaching and teaching.* London: A & C Black.

LACKEY, D. (1977). Why do high school coaches quit? *Journal of Physical Education, Recreation and Dance*, 44(1): 11-12.

LANDRY, J.T. (1999). Human Resources: What decline in job security? *Harvard Business Review,* 77(4): 22-23.

LEONARD, B. (2000). Employees feel good about job security. *HR Magazine (Alexandria),* 45(3): 29-30.

MAIL & GUARDIAN (1997). 26 February.

MAIL & GUARDIAN (2000). 3 August.

MARIANI, M. (1995). Sport jobs shine for Olympic summer. *Occupational Outlook Quarterly,* 39(2): 2-12.

MASSENGALE, J.D. (1985). Researching role conflict. *Journal of Physical Education, Recreation and Dance,* 23(6): 20-21.

NATAL MERCURY (1998). 11 July.

NIGRO, D. (1997). All the right moves. *Meetings & Conventions,* 32(11): 62-66.

PATERSON, G.D. (1990). The role of the physical education teacher: Need for reappraisal and job description. *South African Journal for Research in Sport, Physical Education & Recreation,* 13(1): 47-57.

POSPISIL, V. (1998). Stay or jump ship? *Industry Week (Cleveland),* 247(18): 12-14.

SCHMIDT, S.R. (1999). Long-run trends in workers' beliefs about their own job security: Evidence from the General Social Survey. *Journal of Labor Economics,* 17(4) part 2: S127-S141.

SUNDAY TIMES (1998). 18 October.

SUNDAY TIMES (2000). 13 February.

SUNDAY TIMES (2000). 9 July.

SUNDAY TIMES (2000). 1 October.

TEMPLIN, T.J. & WASHBURN, J. (1980). Winning isn't everything unless you're the coach. *Journal of Physical Education, Recreation and Dance,* 16(5): 16-17.

WEINGARTEN, G. (1980). Training systems for the preparation of coaches. *The Mobil symposium for national sport coaches.* Pretoria: University of Pretoria.

Prof. Paul C. Singh, Department of Sport and Movement Studies, Rand Afrikaans University, P.O. Box 524, Auckland Park 2006, Republic of South Africa. Tel: +27 (0)11 489-3005, Fax: +27 (0)11 489-2671, E-mail: psi@eb.rau.ac.za

(Review editor: Prof. E.J. Spamer)

A REVIEW OF 20TH CENTURY LITERATURE RELATED TO SPORT LAW

Paul C. SINGH
Department of Sport & Movement Studies, Rand Afrikaans University, Auckland Park, Republic of South Africa

ABSTRACT

The growing interaction between sport and the law has created a need for a greater understanding of how the law relates to the world of sport and physical recreation. This is a highly dynamic and rapidly expanding area of scientific inquiry. In this review article an attempt is made at reviewing the local literature related to the field of sport law, and to undertake a content analysis of international literature sources on the topic.

Key Words: Sport law; Safety; Liability; Negligence; Risk management.

INTRODUCTION

Administrators, supervisors and teachers of physical activity as sport, recreation and physical education or fitness have become increasingly concerned, over the years, about the possibility of being implicated in a lawsuit. Because of an increase in the amount of time dedicated to physical activity, and more intense levels of participation, an increase in the number of accidents and injuries is imminent (Van Heerden, 1996; Singh, 1999). As the number of injuries increase, victims turn to someone other than themselves to blame. Further, when the extent of the injury is such that medical assistance and rehabilitation expenses become excessive, victims will also look to someone else to share the expense.

Physical activity is a risk profession. It provides one of the few environments in which people can experience risks in a controlled setting. Today many people are willing to take substantial risks in physical activity (Clement, 1988; Nygaard & Boone, 1989). This is borne out by the growing popularity of many forms of high-risk activities such as white-water rafting, bungee jumping and scuba-diving. Professionals need to communicate to participants that activities involve risk and at the same time, these professionals must learn to control the environment so that only the risks inherent in the activity remain. To do this, they need to be legally literate. In South Africa today, there are a number of reasons why an investigation into safety and general issues in sport law is relevant and imperative.

(i) The country has adopted a new constitution (Act 108 of 1996) which regulates all social activities, including sport.
(ii) The bill of rights enshrines the rights of all people in the country.
(iii) South Africa's re-entry into international sport. Players, management and spectators have to be aware of legal issues and responsibilities.
(iv) There is a growing interest in the academic study of the legal regulation of sport (Gardiner *et al*., 1998).

(v) "Sport Law" or "Sport and the Law" has now arrived as a legitimate legal subject in Britain, U.S.A., Canada, Australia, South Africa, the Netherlands, Germany and New Zealand.

(vi) There is increasing importance on the role of law in contemporary sport and a growing body of statutory and case law specific to sport.

PROBLEM STATEMENT

In order to create awareness of safety issues and to promote legal literacy among sport personnel, it is essential to develop a body of knowledge on sport law. The study of sport law is a relatively new worldwide phenomenon (Gardiner *et al*., 1998). Countries such as the USA, Canada and England have witnessed the emergence of a recognizable body of statutory and case law that can be designated as a distinct legal area, namely sport law. Some of the contributory reasons are that these countries originated and developed the system of professional sport; their high levels of commercialism in sport; and the litigious nature of these societies.

In South Africa, however, such a body of sport law has not developed. Very few cases concerning sport reach the courts. In the few cases that appeared in court, decisions were based on common law principles relating to negligence. Further, the courts have stifled the development of this area of the law by relying on Anglo-American developments as authority (Parmanand, 1987). Scott (1991) maintains that while a definite body of sport and recreation law does exist, the only reason for it not being widely recognised in South Africa is probably that there was no need for such an applied field of law. This situation has however, been drastically altered by the circumstances outlined above. There is clearly a serious need for the country to have a comprehensive and ordered set of guidelines to regulate the legal liability of sports persons.

AIMS OF THE STUDY

The aim of the this study is twofold: firstly, to provide a critical review of South African literature on the following:

- what has already been written on the topic of sport law.
- what has not been written on the topic or is written in such a way that it is conceptually inadequate.
- what gaps or weaknesses exist in the literature.

The second aim is to determine the concerns, principles and practices, from an international perspective, that sport departments should address to reduce the risk of litigation.

METHODOLOGY

The methodology used in addressing the first aim was library research and a review of legislation and case law. The South African Sports Information (SASI) database was used for the review of South African literature relevant to the investigation. In addition, the law

libraries at the University of Durban-Westville, University of Pretoria and University of South Africa were utilized. The literature was analyzed with the particular aims of this study in mind.

For the content analysis, the databases of the Sports Law Institute at Marquette University, Wisconsin, as well as the Society for the Study of Legal Aspects of Sport and Physical Activity (SSLASPA) were used. The methodology utilized for this part of the study involved the analysis of the contents of eighteen articles, journals and books published by sport law experts between 1975 and 1998 (figure 1). Articles that focussed on a single topic, such as insurance, were not included. The most frequently listed risk management practices were categorized into specific areas: supervision and instruction; equipment and facilities; medical care; travel and transportation; insurance; and civil rights (Rushing, 1986; Girvan, 1990).

LITERATURE STUDY AND DISCUSSION

Van der Merwe (1975) conducted a study on "precautionary measures that should be taken by teachers of physical education in the prevention of injuries". The study clarified the legal liability of the physical education teacher, particularly with regard to gymnastics lessons.

The precise methodology used in the study was not outlined, apart from the fact that it "was based on self-observation through self-participation". A questionnaire was used to elicit information on accidents and injuries resulting from physical education activities. The study sample and sampling procedure were not described, but it was delimited to schools in the Free State Province. Van der Merwe provides a valuable entry point in an investigation of the field of Sport Law in South Africa. However, his research is rather limited in that it confines itself to legal principles related to the subject of physical education that is applicable mostly in schools. The study had a strong focus on the teaching of gymnastics and the specific safety precautions that should be taken into account. Prior to this investigation there was no documented research on the topic in the country. However, there existed Department of Education circulars that gave directions to teachers of the subject.

The Human Sciences Research Council (HSRC) completed a national sports investigation in 1980. The law committee had been briefed to conduct a jurisprudential investigation into sports legislation. Report number one was entitled: "The Report of the Law Committee on Legislation hampering the normalization of Sports Relations in the Republic of South Africa". It can therefore be concluded that this study was narrowed in focus to one problem area which centered around discriminatory legislation and other official enactments and decisions which hampered the normalization of sporting relations and the achievement of autonomy in sport. Further, the investigation was conducted only at national level. Provincial and municipal legislation and enactments and their impact on sport were not researched (HSRC, 1980).

Relevant legislation, ordinances, proclamations, policy statements, official documents, parliamentary and senate reports, congress reports, official circulars, press and research reports, books and other relevant information sources were scrutinized.

Interviews were held with senior officials of the Department of National Education (Branch: Sport Advancement), the Department of Cooperation and Development, national sporting

bodies and persons and institutions (HSRC, 1980). The study was delimited to an analysis of and investigation into four acts of parliament that formed the major obstacles to the normalization of sporting relations. These acts were as follows:

(i) The Group Areas Act, No.36 of 1966, as amended;
(ii) The Liquor Act, No. 87 of 1977, as amended;
(iii) The Reservation of Separate Amenities Act, No. 49 of 1953, as amended;
(iv) The Blacks (Urban Areas) Consolidation Act, No.25 of 1945, as amended.

The concepts that were dealt with were the right to participate in sport, discrimination in sport, sporting autonomy, the relation between sport and politics, legislation which places curbs on sport, sport policy, multi-nationalism in sport, the normalization of sport and sporting relations, and basic rules of interpretation of statutes (HSRC, 1980).

Based on findings in the aforementioned areas, recommendations were made. The major recommendation was that the state should not use sport as a political instrument to justify the ideology of apartheid.

Tempelhoff (1983) conducted a study on sport as a recreational activity at South African English-medium universities. The purpose was to ascertain the strengths and weaknesses in administrative principles at these institutions. The author adopted the following procedures:

(i) documenting the contribution of sport to the holistic development of the individual
(ii) tracing the historical development of universities and the role of sport in these institutions
(iii) determining what the sports management policies and practices were in selected Afrikaans-medium and English-medium universities.

The field of sport safety and risk management was only investigated in respect of insurances, transport, indemnities and general safety. The body of knowledge in this field has developed significantly over the past seventeen years since the completion of the study. Further, the study did not focus on the legal bases upon which sport is managed. The era in which the study was undertaken and the sample used has little relevance in post-apartheid South Africa. This is so because of constitutional changes that affect the way in which both universities and sport function today. Also, universities today do not compete only among themselves in tertiary sport at national and international levels. Colleges of education and technikons also belong to the same sport union as universities do, namely South African Student Sports Union (SASSU).

Parmanand (1987) published the most comprehensive investigation to-date in South Africa. His research focus was sport injuries in the civil law. The methodology involved library research into two of the main sources of law in any country, viz. legislation and case law. Constitutional issues in sport arising from human rights were not included in this study.

Parmanand's study established that there was a dearth of sports injury litigation amongst participants in South Africa due to a number of factors, particularly the following:

(i) The strong feeling of camaraderie amongst athletes, their adherence to the macho-man syndrome, and their ill-founded belief that "cowboys don't cry".
(ii) The belief that violence is part of the game dissuades players from even contemplating legal action.
(iii) It is simply not sporting to seek judicial relief (Parmanand, 1987).

He stated that South Africa did not have a body of sport law. He found that the several problems that plagued this field of law, in most countries, arose from the judges and juries who tried strictly to interpret and manipulate laws which had evolved without the problem of sport injury litigation in mind. His study thus aimed to add to the body of knowledge of sport law proper.

Parmanand's approach was to focus on the *volenti non fit iniuria* principle which he found received the widest respect and acceptance internationally. The investigation primarily considered the following aspects: injuries to participants inter-se; injuries between participants and spectators.

A major objective was "to identify those situations occasioning delictual liability for a sports injury received and to make recommendations to promote more safety in sport". The liability of coaches and instructors for improper instruction was very briefly discussed, while contractual issues and product liability for defective equipment were excluded (Parmanand, 1987).

A particular strength of the foregoing study was the fact that the researcher viewed injuries in sport and the South African positive law in a historical perspective. The *volenti* principle was traced in Roman Law, Canon Law, Roman Dutch Law and South African Case Law. A comparative view of sport injury litigation and the *volenti* defence was provided across the U.S.A., Canada, England, Scotland, Australia and New Zealand. The study also included a valuable section on evaluation, conclusions and recommendations to promote safety in sport.

Gouws (1997) included a chapter on sport law in his book on "Sport Management". Unfortunately, the author dealt very cursorily with the following aspects: factors that may prevent legal action in sport, liability, negligence, and contract law. The foregoing issues were presented factually as responsibilities of a sport manager. There were no references made to case law, legislation or to the constitution. Except for the section on contract law, in the entire chapter only one dated American reference work was acknowledged. The author did not provide an analysis or an evaluation of the law in sport.

CONTENT ANALYSIS OF RISK MANAGEMENT PRACTICES

The topic of sport risk management began appearing in the literature in 1982 and by 1986, books by sport law experts surfaced (Kaiser, 1986; Parmanand, 1987; Clement, 1988). The potential for litigation permeates all of society, including sport. The purpose of conducting a content analysis was to complement the review of South African literature on legal aspects of sport. This was achieved by focusing on international concerns, principles and practices that sport organisations should apply in order to promote safety in sport.

The analysis revealed that the use of printed documentation was overwhelmingly recommended. Therefore, the category "use of written form" was then added to the matrix to determine its suggested frequency by the authors (Girvan, 1993).

		Staff Training	Instruction Methods	Ability Grouping	Warning of Injuries	Rule Conformance	Activity Supervision	Public Relations	Hiring Qual. Personnal	Crowd Control	**Equip. & Facilities**	Emergencies Proced.	Pre-partic Phys Exam	Injury Report	Return to Activity	**Travel & Transport**	Liability	Accident/Catastrophy	**Civil Rights**	Written form
Books used		**Supervision & Instruction**										**Medical Care**					**Isur.**			**Approach**
Gardiner *et al.*	1998	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Carpenter	1995	✓	✓		✓		✓		✓		✓	✓					✓	✓	✓	✓
Grayson	1994	✓	✓			✓	✓		✓		✓	✓					✓		✓	✓
Marquette Law S.J.	1993	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Opie	1992	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓				✓			✓
Peterson & Hronek	1992	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓			✓	✓	✓	✓
Carpenter	1992	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓			✓	✓	✓	✓	✓
U.P. Symposium	1991		✓	✓	✓		✓		✓		✓	✓				✓	✓	✓	✓	✓
Girvan	1990	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓
Trisley	1990	✓	✓	✓	✓	✓	✓		✓	✓	✓						✓	✓		✓
Nygaard & Boone	1989	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
Baley & Mathews	1989	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓		✓	✓	✓	✓	✓
Clement	1988		✓	✓	✓	✓	✓				✓	✓		✓			✓		✓	✓
Parmanand	1987	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓
Kaiser	1986		✓		✓	✓	✓		✓		✓	✓	✓			✓	✓	✓	✓	✓
Rushing	1986	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Tempelhoff	1983				✓		✓		✓		✓					✓	✓	✓		✓
Van der Merwe	1975	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓			✓	✓	✓	✓

FIGURE 1. **CONTENT ANALYSIS OF RISK MANAGEMENT PRACTICES**

The content analysis (figure 1) revealed that instruction to staff, from staff to students, and from staff to the community dominated the literature. Nine specific concerns surfaced in this area, with virtually every author addressing at least four aspects of supervision and instruction. Firstly, staff must be trained to adopt existing legal standards (Carpenter, 1995). Secondly, qualified personnel must be hired to utilize safe teaching methods and techniques and to provide safe environments. The active supervision of activities was cited by all authors. The responsibility to adequately warn participants and spectators of the risk of injuries was discussed by all but one writer. The matching of participants in sport was mentioned by most

of the writers. The importance of educating the public in reducing litigation cannot be underestimated (Parmanand, 1987; Girvan, 1990; Peterson & Hronek, 1992; Gardiner *et al*., 1998).

The duty to provide safe facilities for athletes and spectators and proper equipment for athletes was another area that was outlined by all authors. All but two of the authors recognized the importance of well-defined emergency procedures for an accident or injury to athletes. Only half the researchers saw the necessity for accurately compiled injury reports based on facts. Even fewer (four) authors discussed the issue of medical permission to return to activity following an injury incurred by an athlete.

Eleven of the authors mentioned safe travel and transportation as important concerns, while all discussed the need for insurance, emphasizing liability insurance rather than accident/catastrophic insurance.

The majority of authors indicated civil rights, including discrimination, free speech, search and seizure procedures, due process, drug testing, privacy and policies for hiring and terminating personnel. According to Girvan (1993), this could well become a much greater loss for sport programmes than recovery for the treatment of serious injuries.

The one approach recommended by every author to identify and reduce risk was the use of printed forms to record what had been done and to provide evidence as a solid defense against liability (Tempelhoff, 1983; Trisley, 1990; Carpenter, 1992; Opie, 1992; Carpenter, 1995).

The courts demand that any practice used to reduce risk be verified in writing to provide any protection. The writing could take a variety of forms eg. checklists, log-sheets, handbooks, manuals and record of events. Documentation should cover accident reporting, medical history, staff meetings, coach/instructor certification, hiring procedures, requests for equipment repair etc. Even the documentation of the risk management plan is important.

CONCLUSION

The literature study has revealed that most of the investigations had a very specific or narrow focus, such as safety in gymnastics lessons, and that they lacked a legal basis for an explanation of responsibility for safety in sport. Further, several components of legal liability were only cursorily dealt with. The methodology used by most studies did not involve an approach that is common in sport law, where a combination of case law, legislation and constitutional provisions are analyzed.

The content analysis not only revealed areas of concerns to be addressed by sport departments, but also the most prominent concerns that have surfaced over the past two decades. These concerns are a sign of the times and those that have created problems for managers of sport programmes. The study points to the need for awareness of current risk management concerns and practices that could help everyone involved in the production and management of sport.

REFERENCES

BALEY, J.A. & MATHEWS, D.L. (1989). *Law and liability in athletics, physical education and recreation* (2nd ed.). Dubuque, IA: Wm C. Brown.

CARPENTER, L.J. (1995). *Legal concepts in sport: A primer*. Reston, VA: AAHPERD.

CARPENTER, L.J. (Ed.) (1992). Legal issues in sport and physical education. *Strategies/Courtsides*. Reston, VA: AAHPERD.

CLEMENT, A. (1988). *Law in sport and physical activity*. Dubuque, I.A.: Brown and Benchmark.

GARDINER, S.; FELIX, A.; JAMES, M.; WELCH, R. & O' LEARY, J. (1998). *Sports law*. London: Cavendish.

GIRVAN, G. & GIRVAN, J.T. (1993). Risk management practices in athletics - A content analysis. *Journal of Physical Education, Recreation and Dance*, 64(4): 26-28.

GIRVAN, G. (1990). The development of an instrument to assess how risk management practices are addressed in intercollegiate athletic programs. Unpublished M.H.E. thesis. Pocatello, ID: Idaho State University.

GOUWS, J. (1997). *Sport management, theory and practice*. Randburg: Knowledge Resources.

GRAYSON, E. (1994). *Sport and the Law* (2nd ed). London: Butterworths.

H.S.R.C. (1980). National Sports Investigation. The report of the law committee on legislation hampering the normalization of sports relations in the Republic of South Africa, Report 1: 7-33.

KAISER, R.A. (1986). *Liability and law in recreation, parks and sports*. Englewood Cliffs, NJ: Prentice Hall.

MARQUETTE UNIVERSITY LAW SCHOOL (1993). *Marquette Sports Law Journal*. 3(2): 123-240.

NYGAARD, G. & BOONE, T.H. (1989). *Law for physical educators and coaches* (2nded). Columbus, OH: Publishing Horizons.

OPIE, H. (1992). Coaching and the Law. Paper presented at the N.O.P. Conference, Canberra, 1994: 34-42. Canberra: Australian Institute of Sport.

PARMANAND, S.K. (1987). *Sport injuries in the civil law*. Johannesburg: Lex Patria.

PETERSON, J.A. & HRONEK, B.B. (1992). *Risk management for park, recreation and leisure services* (2nd ed). Champaign, IL: Sagamore Publishing.

RUSHING, G.M. (1986). The development of a self-appraisal instrument to evaluate the legal vulnerability of secondary school athletic programs. Unpublished D.Ed. dissertation. Greeley, CO: University of Northern Colorado.

SCOTT, T.J. (1991). Knowledge of the law: The real value for the recreation and sport practitioner. Proceedings of a symposium on recreation, sport and the law, University of Pretoria, 25-26 July 1991. Pretoria: University of Pretoria.

SINGH, C. (1999). Tertiary sport and recreation: Playing it safe. Unpublished D.Phil. dissertation. Pretoria: University of Pretoria.

SOUTHERN AFRICAN ASSOCIATION For RECREATION And TOURISM (1991). Proceedings of a symposium on Recreation, Sport & The Law, University of Pretoria, 25-26 July 1991. Pretoria: University of Pretoria.

TEMPELHOFF, L.J. (1983). A study of sport as a recreational activity at South African English medium universities with specific reference to management policies and practices. Unpublished Ph.D. dissertation. Pretoria: University of Pretoria.

TRISLEY, P. (1990). Litigation and School Sport. Paper delivered at Sport in Schools National Congress. Newcastle (Australia): Hunter Academy of Sport.

VAN DER MERWE, R. (1975). Voorsorgmaatreels wat deur die liggaamlike opvoedingonderwyser getref moet word ter voorkoming van beserings. Unpublished M.A. thesis. Bloemfontein: University of Orange Free State.

VAN HEERDEN, H.J. (1996). Preparticipation evaluation and identification of aetiological risk factors in the epidemiology of sports injuries among youths. Unpublished D.Phil. dissertation. Pretoria: University of Pretoria.

Prof. Paul C. Singh, Department of Sport & Movement Studies, Rand Afrikaans University, P.O. Box 524, Auckland Park 2006. Tel: +27 (0)11 489-3685, Fax: +27 (0)11 489-2671, E-mail: psi@eb.rau.ac.za

(Review editor: Dr. J. Bloemhoff)

OORSPRONKLIKE VOETBAL AAN DIE KAAP EN DIE ONTSTAAN VAN DIE STELLENBOSCH RUGBYVOETBALKLUB: NUWE FEITE

Floris J.G. VAN DER MERWE
Departement Sportwetenskap, Universiteit van Stellenbosch, Stellenbosch, Republiek van Suid-Afrika

ABSTRACT

This research brought two new aspects of (rugby) football history in South Africa to the fore. Firstly, the original game mainly played in the Cape seems to have been a creation of Canon Ogilvie of the Diocesan College and not the traditional Winchester Game as commonly believed. The number of players a-side, the size of the field and the duration differed from the Winchester Game, all of which imply that it was a game peculiar to the Cape. In May 1873 representatives of the Civilians, Civil Service, Diocesan College and South African College also established their own rules for playing football. Secondly, that the Stellenbosch Rugby Football Club was founded in 1875 and not in 1880 as formerly believed, thus becoming the second oldest club in the country and in the Southern Hemisphere. This fact came to light with a report discovered in the Cape Town Daily News of 21 August 1875 in which the "Stellenbosch Foot-ball Club", as a "new club", was praised for "their pluck, by challenging, in their infancy, a Club of so long standing as the Civil Service Club".

Key words: Football; Rugby; Winchester game; Bradfield game; Matie rugby; Stellenbosch Foot-ball Club.

INLEIDING

Sportgeskiedenis gaan gedurig gebuk onder napratery en naskrywery omdat min mense die feite wat aan hulle voorgelê word, in twyfel trek. Die William Webb Ellis-verdigsel is 'n uitstekende voorbeeld hiervan. Indien hierdie verkeerde feite op 'n histories-wetenskaplike wyse blootgelê kan word, kan dit in sommige gevalle 'n paar rooi gesigte tot gevolg hê. In die geval van die Stellenbosch Rugbyvoetbalklub het hierdie klub verlede jaar (2000) hul 120ste verjaardag gevier. Kort daarna is dié nuwe inligting opgediep en kon die klub vyf jaar by hul bestaanstydperk voeg.

PROBLEEMSTELLING

Na meer as 140 jaar van voetbal aan die Kaap is daar nog steeds onsekerheid oor presies watter spel gespeel is voordat die Rugbyspel sy verskyning gemaak het. Hierdie artikel gaan egter ook oor die stigtingsdatum van die Stellenbosch Rugbyvoetbalklub. Laasgenoemde is die amptelike naam van die huidige universiteitsklub wat ook populêr as die Matie-rugbyklub bekend staan. In die 1870's het skoliere, studente en personeel (volwassenes) nog saam sport beoefen (Van der Merwe, 1984:ix) en sou 'n "Stellenbosch Foot-ball Club" dus uit 'n verteenwoordiging van hierdie groepe bestaan het. Geen wetenskaplik-gefundeerde basis het voorheen bestaan vir die keuse van 1880 as die datum waarop dié klub gestig sou gewees het nie. Nuwe inligting word hiermee voorgelê wat die rekords van die Matie-klub sal herskryf.

METODOLOGIE

Dit was tydens 'n sporthistoriese navorsingsprojek van 'n heeltemal ander aard dat daar in die Nasionale Biblioteek van Suid-Afrika (Kaapstad Divisie) op die *Cape Town English press index for the year 1871-1976* (Coates, 1980-1996) afgekom is. In die 1875-volume was 'n indeksverwysing "Stellenbosch vs Civil Service match discussed". Dit was hierdie riglyn wat tot die koerantberig in die *Cape Town Daily News* van 21 Augustus 1875 gelei het en waarin die nuwe inligting omtrent die herkoms van die Stellenbosch Rugbyvoetbalklub blootgelê is.

Koerantberigte in die verskillende Kaapstadse dagblaaie soos die *Cape Argus*, *Cape Times*, *Cape Town Daily News* en die *Standard and Mail* vanaf 1860 is daarna geraadpleeg om meer agtergrond omtrent die "Stellenbosch Foot-ball Club" te vind. Al wat egter gevind was, is bevestiging dat voetbal wel in daardie jaar op die Braak gespeel is. Soos die soektog uitgekring het, het dit ook nuwe inligting aangaande die tipe voetbal wat oorspronklik in die Kaap gespeel is, blootgelê.

Die bogenoemde Kaapse dagblaaie as primêre bronne is aangevul deur sekondêre bronne om die aard en herkoms van die spel(e) soos dit in die Kaap gespeel is, vas te stel.

BESPREKING

Voetbal aan die Kaap

Victoriaanse beskouinge het danksy die snelgroeiende industrialisasie en imperiale strewes spoedig sy inslag in die onderlinge kolonies gevind. Daar is dus van die lojale, dapper en aktiewe man verwag om ook in die Kaap sy Victoriaanse beeld deur middel van sport te poets. Die term "Christian masculinity" word hieraan gekoppel. Sport het nou 'n goeie alternatief vir dobbel en drankmisbruik geword (Worden *et al*., 1998:196).

So het dit dan gebeur dat 'n voetbalwedstryd op Saterdag 23 Augustus 1862 om 15:00 by Groenpunt, Kaapstad, tussen 15 offisiere van die 11th Regiment Royal Engineers en Royal Artillery en 15 here uit die siviele diens van Kaapstad plaasgevind het. Dit blyk die eerste volwaardige voetbalwedstryd in die Kaap te gewees het …"As this is the first within our recollection that so large a party of gentlemen have made a public appearance at Cape Town in this manly English schoolgame…"(*Cape Argus*, 1862a:3). Die moontlikheid dat informele of spontane wedstryde binne die militêre kampopset vóór 23 Augustus 1862 al gespeel is, word nie uitgesluit nie. Kanunnik Ogilvie se leerlinge by Biskoppe het klaarblyklik ook sedert sy aanstelling in 1861 aan sy unieke voetbalspel deelgeneem (*Cape Times*, 1937:7).

Die siviele span was een man kort en daarom is daar met 14 man teen 15 gespeel (alhoewel die *Argus* ook net 14 name by "military" lys). Die wedstryd het 105 minute geduur en geen doel is aangeteken nie. Skynbaar het die wind om 16:45 gedraai en tot die voordeel van die militêre span gewaai. Dit was die sportiewe rede vir die beëindiging van die wedstryd (*Cape Argus*, 1862a:3). 'n Herontmoeting is vir Vrydag 5 September gereël (*Cape Argus*, 1862b:2) wat die militêre span toe met 2-0 gewen het (*Cape Argus*, 1862c:2; *Cape Argus*, 1862d:3). Die veld was oor 100 tree afgemeet teenoor die 150 tree van die eerste kragmeting en hierdie keer is die wedstryd oor drie en 'n kwart uur beslis (*Cape Argus*, 1862d:3).

Op 13 September dieselfde jaar is berig dat die Diocesan College hul eerste wedstryd op die Rondebosch krieketterrein sou speel. Hul teenstanders was 'n span bestaande uit militêre en siviele spelers (*Cape Argus*, 1862e:2). Die skoliere het met 3-1 gewen (*Cape Argus*, 1862f:2).

Die volgende berigte oor voetbal aan die Kaap het eers weer in 1864 verskyn. Dit was op 2 Junie toe Diocesan Collegiate School teen 15 here van Kaapstad en omliggende dele gespeel het (*Cape Argus*, 1864:2). Op 17 Junie 1865 het Diocesan College, met Ogilvie in die span, hul wedstryd teen die 1-10th Regiment verloor. Dit is interessant om daarop te let dat hulle in hierdie wedstryd met 10 man aan 'n kant gespeel het (*Cape Argus*, 1865a:2). 'n Maand later is 'n wedstryd tussen die 10th Regiment en Mr. Vigors se span met 12 spelers aan 'n kant (*Cape Argus*, 1865b:2) gespeel en in Augustus het twee weermagspanne met 17 spelers aan 'n kant gespeel (*Cape Argus*, 1865c:2). Teen einde Mei 1869 het 25 spelers van Diocesan College en 25 here vanuit Kaapstad in 'n wedstryd betrokke geraak. Die College het na 90 minute met 7-3 gewen (*Cape Argus*, 1869a:3).

Enkele aspekte wat uit hierdie berigte opduik is dat hierdie wedstryde op 'n ad hoc-basis plaasgevind het en meestal op uitnodigings of uitdagings berus het. Die feit dat daar geen vasgestelde getal spelers in 'n span was nie en dat die verskil in tydsduur van die wedstryde opvallend is, plaas 'n vraagteken of dit wel die tradisionele Winchesterspel was wat hier gespeel is. Die speelveld was ook groter. Kanunnik H.E. Morris het vertel dat daar geen geskrewe reëls van die Winchesterspel in Kaapstad was nie en dat die reëls in elk geval so baie keer gewysig is, dat niemand die spel sou herken het nie (Difford, 1933:700).

Tog verwys die Kaapse koerante inderdaad na reëls. Alreeds op 12 Junie 1869 het kapt. Sandford van die Britse garnisoen 'n stel reëls aan die *Cape Argus* (1869b:3) voorgelê, wat volgens hom die spel sou bevorder. Dan was daar ook die *Cape Argus* van 7 Junie 1873 (p.4) wat al die spelers wat op daardie middag op Groenpunt sou speel, gemaan het om die "nuwe" reëls aandagtig deur te lees. Dit moet dieselfde reëls wees wat in die *Standard and Mail* (1873:2) gepubliseer is. Hierdie 15 reëls is op 'n vergadering op 27 Mei 1873 tussen die verteenwoordigers van Civilians, Civil Service en die twee kolleges, Diocesan College en South African College, opgestel. Dit moes dien as 'n eenvormige stel reëls vir voetbal soos dit toe op die verskillende velde van die Kaap gespeel is.

Hierdie reëls skep die indruk dat die Winchesterspel se reëls, soos dit aan die Kaap gespeel is, ietwat aangepas is. Die "Kaapse reëls" (van 27 Mei 1873) het onder andere bepaal dat 'n doel aangeteken was wanneer die bal op enige hoogte tussen die twee doelpale geskop en nie gegooi, gedra of gestamp was nie. In die Winchesterspel was 'n doel aangeteken wanneer die bal die doellyn (op enige plek) oorskrei het. Die enigste probleem hier, is die wydte van die doelpale. In die Winchesterspel was hulle in die hoeke geplant, met ander woorde 25 tree van mekaar, terwyl bogenoemde Kaapse reëls bepaal het dat die doelpale nie nader as 10 tree van mekaar moes wees nie (volgens die 1869-reëls was dit sewe tree (*Cape Argus*, 1869b:3)). Die Winchesterveld was 80 tree lank en 25 tree wyd, terwyl die Kaapse reëls 'n veld van maksimum 200 tree lank en 'n maksimum van 100 tree wyd toegelaat het (Arlott, 1977:350; *Standard and Mail*, 1873:2).

Die oorsprong van die spel aan die Kaap word tans aan kanunnik George Ogilvie gekoppel. Hy het onmiddellik ná sy aanstelling by Biskoppe in 1861 sy leerders 'n voetbalspel geleer. Ogilvie, of Gog soos sy leerlinge hom gedoop het (afgelei van die eerste drie prominente

letters in sy handtekening), is op 30 Junie 1826 in Colne, Wiltshire in Engeland gebore. Hy het op 1 Mei 1915, op 89-jarige ouderdom, in Rondebosch te sterwe gekom. In Engeland het hy aan Winchester College en Wadham College (in Oxford) gestudeer, alvorens hy van 1852 tot 1855 'n onderwyspos aan die Bradfield College aanvaar het. Van 1855 tot 1858 was hy in Buenos Aires voordat hy na Kaapstad gekom het om die eerste hoof van die "St. George's Grammar School" te word. In 1861 is hy as hoof van die "Diocesan Collegiate School" aangestel. Laasgenoemde skool het sedert 1867 as die Diocesan College ("Bishops") bekend gestaan (Difford, 1933:700).

Sekondêre bronne voer aan dat Ogilvie die Winchesterspel aan die Kaap bekendgestel het (Difford, 1933:12,41,547,700; Arlott, 1977:352) terwyl Worden en Van Heyningen (1998:196) selfs beweer dat ’n spel soortgelyk aan die Eton Field Game in die beginjare hier gespeel is. Daar word ook beweer dat “Gog se spel” elemente van die Winchester- en Bradfieldspele bevat het (Suid-Afrikaanse Rugbyraad, 1964:10). Die genoemde verwarring spruit uit die feit dat die Winchesterspel tradisioneel met 15 (22 tot voor 1863) of ses spelers aan ’n kant gespeel is en die duur van ’n wedstryd op een uur vasgepen is (Arlott, 1977:350; Shearman, 1899:77) terwyl daar alreeds verwys is na die afwykings by die Kaapse spel.

Die opvatting dat George Ogilvie “rugby” na die Kaap gebring het (McIntyre, 1950:18), verdraai egter die ware stand van sake. Ten eerste was dit nie rugby nie, maar vermoedelik die Bradfieldspel.

> "When Canon Ogilvie came to Bishops he found that soccer was the winter sport. The game he himself played was different. This game he introduced at Woodlands, where the boys called it 'Gog's football'. It was...a combination of the game as played...at Winchester, Eton and Harrow. It was first played at St. Andrew's College, Bradfield, and thence transplanted to the Diocesan College." (McIntyre, 1950:113)

Hierdie inligting is deur kanunnik H.E. Morris, 'n byna lewenslange vriend van Ogilvie, in dié skool se 50-jarige gedenkblad bekend gemaak (McIntyre, 1950:113). Difford (1933:12) verskil weer en beweer dat die Winchesterspel, en later rugby, sokker in Suid-Afrika voorafgegaan het. Indien bogenoemde gegewens korrek is, was "Gog se spel" die Bradfieldspel (wat 'n kombinasie van die Winchester-, Eton- en Harrowspel was) en nie die suiwer Winchesterspel soos beweer word nie (*Cape Times*, 1937:7). Selfs in Montague Shearman (1899:84) se gesaghebbende werk oor die geskiedenis van voetbal word spyt uitgespreek dat wanneer die Winchesterskool verlaat word, die Winchesterspel ook agtergelaat word. Dit wys dus daarop dat hierdie spel se gewildheid nie ver buite die skoolgrense gestrek het nie. In Suid-Afrika was daar tot op datum ’n napratery en naskrywery sodat die Winchesterspel algemeen aanvaar word as dié een wat die Rugbyspel voorafgegaan het.

Die *Cape Times* van 18 Julie 1876 werp ietwat meer lig op die onderwerp, naamlik dat “there is a well known game which has grown up in the colony, has its own pecularities, and has been called football: its principles are generally understood by young South Africa” (*Cape Times*, 1876b:3). In sy brief aan die *Cape Times*, skryf An Old Rugbeian dat “[rugby] seems to be very much out of favour, whilst the game as generally played here (though under what rules it would be difficult to say) is held up as being superior” (*Cape Times*, 1876c:3). Dit wil tog voorkom asof ’n unieke Kaapse spel mettertyd ontwikkel het voordat dit deur rugby

vervang is. Indien dit so was, is hierdie "Kaapse spel" deur kanunnik Ogilvie ontwikkel. So blyk dit altans uit die volgende aanhaling:

> "…the rough game [rugby] played on Saturday was neither as pleasant to look at nor as scientific as the game which we have seen played on the ground of the Diocesan College, under the experienced eye of the Rev. Canon Ogilvie." (*Cape Argus*, 1876:2)

Hierdie is egter 'n studie wat meriete van sy eie het en nog aan 'n intensiewer ondersoek onderwerp kan word.

Voetbal op Stellenbosch

Ivor Difford (1933) het die enigste boek saamgestel wat tot op datum en op só 'n omvangryke skaal die onderwerp van Suid-Afrikaanse rugby-geskiedenis aangespreek het. Menige ernstige foute kom ongelukkig in hierdie werk voor, soos onder andere dat William Webb Ellis die rugbyspel begin het (p.8); dat P.J. en P. Blignaut saam met L.S. Meintjes in 1894 gestuur is om aan die Engelse kampioenskappe te gaan deelneem (p.34) (in werklikheid is Meintjes in 1893 en die Blignaut-broers in 1895 oorsee); én dat die Stellenbosch-klub in 1883 gestig was (p.15).

> "About 1883 an event which was to have a very far reaching effect on the future of the Rugby game in South Africa took place. That was the formation of the Stellenbosch Club in the farming district of that name some thirty miles from Cape Town." (Difford, 1933:15)

Dok Craven het 'n ander opinie gehad. In sy *Die groot rugbygesin van die Maties* (1980:1) skryf hy dat "hierdie bestaan dateer terug na 1880 omdat ons die eerste spanfoto van daardie jaar in die hande kon kry". In sy *Met die Maties op die rugbyveld* (1955:32) skryf Craven dat 1955 die regte jaar vir die viering van Maties se 75ste verjaardag was omdat 1880 die jaar was wat die eerste rugbywedstryd op Stellenbosch plaasgevind het en dat dit ook die jaar was wat Adderley Square (Die Braak) amptelik as rugbyveld erken is. Dit kan wees dat Craven hier na die Rugbyspel verwys en nie die spel wat rugby in die Kaap voorafgegaan het nie. Die voetbalklubs in die Kaap se ouderdom word egter nie aan die Rugbyspel se koms gekoppel nie, maar aan wanneer hierdie klubs vir die eerste keer gestig is met die doel om voetbal te speel, ongeag die kode.

Stellenbosse voetbal was al op 27 April 1875 in die nuus toe 'n skoolseun die magistraat aangerand het toe laasgenoemde hulle wou verbied om voetbal op die Braak te speel. Die seuns het "soos gewoonlik" voetbal op die Braak gespeel toe 'n polisieman in opdrag van die magistraat hul spel wou staak. Toe hulle nie gehoor wou gee nie, het die magistraat self sy verskyning gemaak en een van die seuns 'n paar houe met sy kierie gegee. Hierop het die seun die magistraat aan sy keel gegryp en gewurg totdat 'n paar polisiemanne die magistraat kon red (*Cape Argus*, 1875:2). 'n Hofsaak het gevolg, alhoewel die uitslag nie bekend is nie.

Die Stellenbosse Munisipaliteitsnotules van 4 Mei 1875 staaf dat voetbal, krieket, ens. op die Braak gespeel kon word, mits dit nie 'n gevaar vir die bewoners van die omliggende dele of die publiek wat van die deurpaadjies gebruik gemaak het, ingehou het nie (Stellenbosch Municipality, 1875:164).

Voetbal is natuurlik al lank voor 1875 op Stellenbosch gespeel. Daar word beweer dat dit "teen 1870 al druk gespeel" is (Ou kaptein, 1918:165).

Hierdie volgende berig uit die *Cape Town Daily News* van Saterdag, 21 Augustus 1875 (p.3) bewys dat die klub al in 1875 bestaan het:

> "New Club praised for taking-on Civil Service team
>
> A foot-ball match will be played, between the Civil Service and Stellenbosch, to-day at Stellenbosch. This being the first match of the kind played we cannot of course give any opinion on it, but, judging from some of the Stellenbosch players we have from time to time come in contact with in other matches, we think we may venture to say that the Civil Service will have to encounter a tough lot. We must also give the Stellenbosch Foot-ball Club every praise for their pluck, by challenging, in their infancy, a Club of so long standing as the Civil Service Club; and, at the same time, wish them every success. The following is a list of the players on the Service side:- Messrs. E. Pillans, W. Bovell, W. Blenkins, W. Haswell, P. Breda, H. Ford, C. Graham, A. Ham, H. Kay, J. Spyker, F. Cole, A. Nicholson, F. Bindon, C. Borcherds, and F. Oliff. Players are requested to leave town by the 7.15 a.m. train."

Die woorde "new club" en "infancy" wil daarop dui dat die "Stellenbosch Foot-ball Club" in daardie seisoen gestig is. Ongelukkig word net die Civil Service-spelers se name genoem. Dit is ook nie bekend in watter ander wedstryde die Stellenbosse spelers opgetree het nie.

Hierdie berig sê ook dat die Civil Service Club al lankal bestaan het. Hierdie klub was natuurlik nie 'n voetbalklub nie, maar 'n klub wat in 1861 gestig is vir die stadsjapies om hulle met gesonde vermaak besig te hou (Worden *et al*., 1998:239). Omdat die Hamilton Rugby Football Club in Maart 1875 gestig is (Difford, 1933:437) en die Western Province Club op 31 Mei (Difford, 1933:42-43) en Villager Rugby Football Club op 2 Junie (Difford, 1933:455), albei in 1876, maak dit die Matie-klub die tweede oudste in die Kaap asook in die Suidelike Halfrond.

Villager-ondersteuners wil natuurlik graag glo dat hul klub ook in 1875 gestig is (Stent, [1975]:2), maar die getuienis (indien korrek) spreek anders.

SAMEVATTING

Mits Ogilvie voetbal aan die Kaap bekend gestel het, het dit vinnig posgevat. Veral die koerante van die 1870s wys dat die spel geesdriftig gespeel en ondersteun is. Sommige sekondêre bronne verskil oor presies wanneer die Rugbyspel aan die Kapenaars bekendgestel is. Babrow en Stent (1963:3-4) beweer dat dit in 1878 was, toe W.M. (later Sir William) Milton, 'n Engelse internasionale rugbyspeler, die klubs Hamiltons en Villagers oorreed het om na hierdie kode oor te slaan. Volgens hierdie bron het die twee Kaapse kolleges eers in 1883 begin om die Rugbyspel te speel.

Kontemporêre koerantberigte getuig egter anders. Die Western Province Club het al in 1876 die rugbyreëls aanvaar en op Saterdag 15 Julie in so 'n wedstryd teen Villagers gespeel.[1]

> "The game played was unlike that usually seen at the Cape, owing, as we are informed, to the fact that Western Province Club have adopted the rules published by the Rugby Union Committee." (*Cape Town Daily News*, 1876a:3)

Volgens die *Cape Times* was dit nie 'n suksesvolle poging nie en die joernalis het geskryf dat hulle gehoop het dat dit vir die laaste keer gespeel is. "It certainly seems to be a mistake to introduce a new game in place of the old one" (1876b:3). Ook die *Cape Town Daily News* (1876a:3) het soos volg oor rugby berig: "we fancy the new game will hardly be a very popular one at the Cape". In hul herontmoeting, twee weke later, het Western Province en Villagers in laasgenoemde se kode gespeel (*Cape Times*, 1876e:3).

Dit wil voorkom asof die baie reëls (*Cape Times*, 1876a:3), die ruwe aard van die spel, veral die skeenskoppery in die baie skrums, die antagonisme by sommige spelers veroorsaak het. Daarbenewens het die twee skeidsregters ook probleme vir die spelers geskep (*Cape Times*, 1876d:3; *Cape Town Daily News*, 1876b:3).

Die gewildheid van rugby het egter van Brittanje na die Kaap oorgespoel en binne enkele jare (teen einde 1878) die tradisionele spel, soos dit in die voorafgaande jare hier gespeel is, verdring. Dit is interessant om daarop te let dat onder andere drie van die spelers wat op 21 Augustus 1875 die Civil Service-span teen Stellenbosch Foot-ball Club verteenwoordig het, by name C. Eustace Pillans, C. Graham en F. Bindon, die volgende jaar leiersfigure in die stigting van die Western Province Club was (Difford, 1933:455). Laasgenoemde klub het die Rugby-kode aangehang.

Ten slotte kan saamgevat word dat die voetbalwedstryd wat op 21 Augustus 1875 op Stellenbosch plaasgevind het, nie die begin van voetbal op die dorp was nie. Die belangrikste feit hier is egter dat 'n "Stellenbosch Foot-ball Club" al daardie jaar bestaan het. Dit blyk dieselfde klub te wees wat mettertyd die rugbyreëls aanvaar het en wie se "oudste" spanfoto uit 1880 dateer. Indien daar met hierdie argument saamgestem word (en dit is nie noodwendig die einde daarvan nie), beteken dit dat die klub in die jaar 2000 al 125 jaar oud was.

SUMMARY

Original football at the Cape and the formation of the Stellenbosch Rugby Football Club: New facts

The Stellenbosch Rugby Football Club celebrated its 120th anniversary in 2000, just before new information was discovered regarding its real age. This discovery was made possible by the *Cape Town English press index for the year 1871-1976* which led this sport historical investigation to deal mainly with primary sources like the *Cape Argus*, *Cape Times*, *Cape Town Daily News* and the *Standard and Mail* from 1860 onward.
This research actually brought two new aspects of (rugby) football history in South Africa to the fore.

[1] Die Rugby Football Union is terloops in 1871 in Brittanje gestig (Reason & James, 1979:28).

Firstly, the original game played in the Cape seems to be a creation of Canon Ogilvie of the Diocesan College and not the traditional Winchester Game as commonly believed. The number of players a-side, the size of the field, the width of the goals, and the duration that differed from the Winchester Game, all of which implies that it was a game peculiar to the Cape. Representatives of the Civilians, Civil Service, Diocesan College and South African College also established their own rules for playing football in May 1873. This followed on previous rules set by the military in 1869.

Secondly, that the Stellenbosch Rugby Football Club was founded in 1875 and not in 1880 as formerly believed. The following report from the *Cape Town Daily News* of Saturday, 21 August 1875 (p.3) proves that the club already existed in 1875:

> "New Club praised for taking-on Civil Service team"
>
> "A foot-ball match will be played, between the Civil Service and Stellenbosch, to-day at Stellenbosch. This being the first match of the kind played we cannot of course give any opinion on it, but, judging from some of the Stellenbosch players we have from time to time come in contact with in other matches, we think we may venture to say that the Civil Service will have to encounter a tough lot. We must also give the Stellenbosch Foot-ball Club every praise for their pluck, by challenging, in their infancy, a Club of so long standing as the Civil Service Club; and, at the same time, wish them every success. The following is a list of the players on the Service side:- Messrs. E. Pillans, W. Bovell, W. Blenkins, W. Haswell, P. Breda, H. Ford, C. Graham, A. Ham, H. Kay, J. Spyker, F. Cole, A. Nicholson, F. Bindon, C. Borcherds, and F. Oliff. Players are requested to leave town by the 7.15 a.m. train."

The words "new club" and "infancy" refer to the "Stellenbosch Foot-ball Club" being founded in that season. It is unfortunate that only the Civil Service players are listed. It is also unknown for which teams the Stellenbosch players had played previously.

In the mid 1950s Doctor Danie Craven set the date as 1880, since this was also the date of the oldest team picture he could trace. The implication of this new information is that the club is actually five years older, thus becoming the second oldest club in the country and in the Southern Hemisphere.

VERWYSINGS

ARLOTT, J. (1977). *The Oxford companion to sports and games*. St. Albans (U.K.): Paladin.

BABROW, L. & STENT, R.K. (1963). *The Varsity spirit. The story of Rugby Football at the University of Cape Town, 1883-1963*. Cape Town: Johnston & Neville.

CAPE ARGUS, The (1862a). 26 August.

CAPE ARGUS, The (1862b). 2 September.

CAPE ARGUS, The (1862c). 6 September.

CAPE ARGUS, The (1862d). 11 September.

CAPE ARGUS, The (1862e). 13 September.

CAPE ARGUS, The (1862f). 18 September.

CAPE ARGUS, The (1864). 2 June.

CAPE ARGUS, The (1865a). 17 June.

CAPE ARGUS, The (1865b). 13 July.

CAPE ARGUS, The (1865c). 8 August.

CAPE ARGUS, The (1869a). 1 June.

CAPE ARGUS, The (1869b). 12 June.

CAPE ARGUS, The (1873). 7 June.

CAPE ARGUS, The (1875). 27 April.

CAPE ARGUS, The (1876). 18 July.

CAPE TIMES, The (1876a). 11 July.

CAPE TIMES, The (1876b). 18 July.

CAPE TIMES, The (1876c). 20 July.

CAPE TIMES, The (1876d). 21 July.

CAPE TIMES, The (1876e). 2 August.

CAPE TIMES, The (1937). 10 April.

CAPE TOWN DAILY NEWS, The (1875). 21 August.

CAPE TOWN DAILY NEWS, The (1876a). 18 July.

CAPE TOWN DAILY NEWS, The (1876b). 22 July.

COATES, P.R. (Comp.) (1980). *The Cape Town English press index for the year 1871*. Cape Town: [South African Library].

COATES, P.R. (Comp.) (1983). *The Cape Town English press index for the year 1872*. Cape Town: [South African Library].

COATES, P.R. (Comp.) (1986). *The Cape Town English press index for the year 1873*. Cape Town: [South African Library].

COATES, P.R. (Comp.) (1988). *The Cape Town English press index for the year 1874*. Cape Town: [South African Library].

COATES, P.R. (Comp.) (1991). *The Cape Town English press index for the year 1875*. Cape Town: [South African Library].

COATES, P.R. (Comp.) (1996). *The Cape Town English press index for the year 1876*. Cape Town: [South African Library].

CRAVEN, D.H. (1955). *Met die Maties op die rugbyveld, 1880-1955*. Kaapstad: Nasionale Boekhandel.

CRAVEN, D.H. (1980). *Die groot rugbygesin van die Maties*. Kaapstad: Galvin & Sales.

DIFFORD, I.D. (Ed.) (1933). *The history of South African rugby football (1875-1932)*. Wynberg: The Specialty Press.

McINTYRE, D. (1950). *The Diocesan College, Rondebosch, South Africa. A century of "Bishops"*. Cape Town: Juta.

OU KAPTEIN (pseud) (1918). Sport. In N.J. Brümmer & J.J. Smith (reds.). *Gedenkboek van het Victoria-Kollege (164-175)*. Kaapstad: De Nationale Pers.

REASON, J. & JAMES, C. (1979). *The world of rugby. A history of Rugby Union Football*. London: British Broadcasting Corporation.

SHEARMAN, M. (1899). *Football history (The Badminton Library)*. London: Longmans, Green.

STANDARD AND MAIL (1873). 7 June.

STELLENBOSCH MUNICIPALITY (1875). Minutes of the meeting of commissioners, 4 May, p.164 (Cape Archives, 3/STB, 1/1/1/4).

STENT, R.K. ([1975]). *100 Years of rugby. The story of the Villager Football Club*. Cape Town: Villager Football Club.

SUID-AFRIKAANSE RUGBYRAAD (1964). *Rugby in Suid-Afrika.* Kaapstad: Nasionale Boekhandel.

VAN DER MERWE, F.J.G. (1984). *Honderd jaar Matie-atletiek, 1885-1985*. Stellenbosch: Stellenbosch-Atletiekklub.

WORDEN, N.; VAN HEYNINGEN, E. & BICKFORD-SMITH, V. (1998). *Cape Town: The making of a city*. Cape Town: David Philip.

Dr. Floris J.G. van der Merwe, Departement Sportwetenskap, Universiteit van Stellenbosch, Privaatsak X1, Matieland 7602, Republiek van Suid-Afrika. Tel: +27 (0)21 808-4915, Faks: +27 (0)21 808-4718, E-pos: fjgvdm@maties.sun.ac.za

(Vakredakteur: Prof. J.R. Potgieter)

DIE RELATIEWE LIGGAAMSGROOTTES VAN ADOLESSENTE EN VOLWASSE SUID-AFRIKAANSE RUGBYSPELERS

Cilas J. WILDERS & J. Hans DE RIDDER
Skool vir Biokinetika, Rekreasie en Sportwetenskap, Potchefstroomse Universiteit vir CHO, Potchefstroom, Republiek van Suid-Afrika

ABSTRACT

The purpose of this study was to determine whether there is a morphological correlation between rugby players from different age groups and different playing positions when compared proportionally with each other. A total of 369 provincial high school players of an average age of 18.1 years, and 349 adult provincial players of an average age of 24.8 years were used as subjects for the study. Twenty-three kinanthropometric variables were used in the comparison. The two groups were compared to one another in a proportional manner, by using the so-called "phantom figure". The results of the experiment indicate that the players still differ proportionally, even if they were in the same playing position and in spite of the compensation made for growth and age differences. Morphological models that are applicable to the adult players cannot be made applicable to adolescents in the same playing positions.

Key words: Kinanthropometry; Rugby; Relative body size; Proportionality, Morphology.

INLEIDING

Rugbyvoetbal word tans in meer as 'n honderd lande wêreldwyd gespeel en beklee die sesde plek op die lys van sportsoorte wat die meeste in die wêreld beoefen word (Rhys, 1992:6). Aansluitend by bogenoemde beweer Rhys (1992:6) dat rugbyvoetbal die sportsoort is wat die vinnigste groei, wat spelende lande betref, in die wêreld en dat die sport beoefen word van Andorra tot in Zimbabwe. Gesien in die lig van bogenoemde, is dit dus belangrik dat rugby en sy deelnemers deeglik nagevors word ten einde antwoorde te verskaf aan afrigters en sportwetenskaplikes by die begeleiding, ondersteuning en afrigting van rugbyspelers.

Die belangrikheid van navorsing wat die morfologiese karaktertrekke van rugbyspelers ondersoek, word deur verskeie navorsers beklemtoon en ondersteun (Lübbert *et al*., 1984; Bolonchuk & Lukaski, 1987; De Ridder, 1993; Bell, 1995). Quarrie *et al*. (1995:263) beweer dat die uniekheid van die spel rugby veral met betrekking tot bepaalde posisies, meebring dat die morfologiese aspek 'n hoë prioriteit geniet by afrigters en keurders by die kies van spelers. Volgens Bell (1995) en Lübbert *et al*. (1984:90) is bevind dat suksesvolle rugbyspelers posisie-spesifieke morfologiese kenmerke toon. Aansluitend hierby beweer Gleim (1984:191) dat morfologiese modelle gebruik kan word om met 'n groot mate van akkuraatheid 'n rugbyspeler se posisie te bepaal.

PROBLEEMSTELLING

Hoewel daar navorsers is wat die voorkoms van morfologiese eiesoortigheid by elite jeugsportlui aantoon, is daar volgens De Ridder (1993:3) nog baie min morfologiese navorsing op elite jeugrugbyspelers gedoen. As in ag geneem word dat jeugrugbyspelers die fondament vorm waarop volwasse rugby gebou moet word, is navorsing oor morfologiese karaktertrekke van hierdie jeugsportlui 'n aspek wat nie verwaarloos mag word nie. Volgens De Ridder (1993:5-6) kan navorsing op jeugrugbyspelers veral lig werp op vrae soos:

- Kom die morfologiese verskille of ooreenkomste wat by volwasse rugbyspelers in die verskillende spelposisies aangetref word, ook by jeugrugbyspelers voor?
- Is jeugrugbyspelers posisionele ewebeelde van hul volwasse eweknieë?
- Kan "morfologiese modelle" wat as norm vir volwasse rugbyspelers gebruik word, direk op jeugrugbyspelers geïmplementeer word?

Om 'n vergelyking tussen verskillende groepe op grond van absolute kinantropometriese waardes te tref, sal 'n skewe beeld tot gevolg hê. Die rede hiervoor is dat daar nie vir groei- en ouderdomsverskille voorsiening gemaak word nie. Laasgenoemde probleem kan egter oorkom word deur van relatiewe liggaamsgroottes of proporsionaliteit (Van der Walt *et al*., 1986:230) gebruik te maak. De Ridder (1993:291) is van mening dat meer aandag aan die kinantropometriese vergelyking van rugbyspelers ten opsigte van mekaar gegee sal moet word en in meer onlangse navorsing het Quarrie *et al*. (1996:53) hierdie leemte duidelik uitgewys. Die vraag wat met hierdie navorsing beantwoord wil word, is of spelers van verskillende ouderdomsgroepe werklike posisionele ewebeelde van mekaar is wanneer hulle met behulp van proporsieprofiele vergelyk word. Verder kan die vraag gevra word of morfologiese modelle wat vir volwasse spelers gebruik word, direk op adolessente spelers van toepassing gemaak kan word.

METODE VAN ONDERSOEK

Die rugbyspelers wat in hierdie studie gebruik is, het eerstens bestaan uit adolessente seuns wat aan die nasionale Danie Craven Rugbyweek vir skole deelgeneem het wat vanaf 3 Julie 1989 tot 7 Julie 1989 in Johannesburg plaasgevind het. 'n Totaal van 369 adolessente seuns met 'n gemiddelde ouderdom van 18.1 jaar (s=0.68) is gemeet. Die tweede groep rugbyspelers het bestaan uit volwasse spelers wat gemeet is tydens die Nasionale Weermag Rugbyweek wat plaasgevind het in Pretoria gedurende Julie 1995. Die proefgroep het uit 349 volwassenes met 'n gemiddelde ouderdom van 24.8 jaar (s=4.31) bestaan. Die *metingsprotokol* wat vir die studie gebruik is, is die internasionale gestandaardiseerde protokol wat tans deur die "International Society for the Advancement of Kinanthropometry" onderskryf word (Carter & Ackland, 1994).

Die data van 10 verskillende speelposisies is afsonderlik gerapporteer vir liggaamsmassa, deursnee, omtrek en velvoumates. Die spelers is ingedeel in speelposisies na aanleiding van indelings soos in vorige studies (Van der Walt & Oosthuizen, 1980; De Ridder, 1993). Die universele metaforiese model van Ross en Wilson is gebruik om die proporsieprofiele te bereken (Ross & Marfell-Jones, 1991:255). Op grond van die sogenaamde skimfiguur word daar voorsiening gemaak vir groeiverskille deur alle persone met behulp van die berekening van z-waarde ewe lank (170.18cm) te maak. 'n Positiewe z-waarde sal impliseer dat die

individu groter as die skimfiguur se gegewe veranderlike is, terwyl 'n negatiewe waarde die teenoorgestelde sal impliseer (Ross *et al*., 1981:76). Bogenoemde berekeninge is gedoen met behulp van die Statistical Analysis System aan die Potchefstroomse Universiteit vir CHO, beter bekend as SAS (Helwig, 1983:2).

RESULTATE

Omtrekmates

In die algemeen vertoon die Suid-Afrikaanse adolessente - en volwasse rugbyspelers groter omtrekmates as die gemiddelde man wat deur die skimfiguur verteenwoordig word (vergelyk Figure 1.1-1.10). Dit kan toegeskryf word aan die feit dat die spel rugby 'n kontakspel is wat groot fisieke eise aan die spelers stel. Gevolglik bring laasgenoemde mee dat aspekte soos spier- en beenmassa beter ontwikkeld is, as die van die gemiddelde man. Sodanige ontwikkeling stel spelers instaat om aan te pas by die eise van die spel. Dit blyk dan ook duidelik uit die feit dat adolessente en volwasse rugbyvoorspelers, veral die vaste voorspelers (voorrye, hakers en slotte), groter waardes as die agterspelers vertoon. Die omtrekmates (wat hoofsaaklik op spier- en beenmassa dui) van die adolessente rugbyspelers vertoon deurgaans groter as die volwasse rugbyspelers s'n. Die enigste uitsondering ten opsigte van laasgenoemde is die gespanne bo-arm-, kuit-, abdomen- en dyomtrekke van die volwasse rugbyspelers wat betekenisvol verskil ($p \leq .05$) van die adolessente rugbyspelers (vergelyk Tabel 1).

TABEL 1. **'N SAMEVATTING VAN PROEFPERSONE SE OMTREKMATES MET BETREKKING TOT HUL PROPORSIEPROFIELE**

	Speelposisie									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Boarm gespanne	_>	_>	_>	_>	_>	*** > a**	_>	_>	_>	*** > a**
Boarm ontspanne	_>	_>	_>	_>	_>	_>	_>	_>	_>	_>
Voorarm	*** > a**	_>	_>	*** > a**	_>	_>	_>	_>	*** > a**	_>
Pols	*** > a**	*** > a**	*** *> a**	*** > a**	>	*** > a**	>	*** > a**	*** > a**	*** > a**
Bors	_>	_>	_>	_	_>	_>	_>	_>	_>	_>
Abdomen	_>	_>	_>	_	_>	_	_	_	_	_
Dy	_>	_>	_>	_>	_>	_>	_>	_>	_>	_>
Kuit	_>	_>	_>	_>	_>	_>	_>	_>	_>	_>
Enkel	_>	*** > a**	_>	*** > a**	_>	*** > a**	_>	_>	*** a**	_>

_ Geen betekenisvolle verskil
*Adolessente is betekenisvol groter as volwassenes
**Volwassenes is betekenisvol groter as adolessente
> Veranderlike is groter as die skimfiguur
a = $p \leq .05$

1=Voorry
2=Haker
3=Slot
4=Flank
5=Agsteman
6=Skrumskakel
7=Losskakel
8=Senter
9=Vleuel
10=Heelagter

Velvoumates

Interessant genoeg is die feit dat daar slegs met betrekking tot die kuit- (vleuels) en trisepsvelvoumate (heelagters en slotte) betekenisvolle verskille tussen die volwasse- en adolessente rugbyspelers voorkom ($p \leq .05$) (vergelyk Tabel 2). Die volwasse rugbyspelers se gemiddelde z-waardes vertoon deurgaans groter met betrekking tot die voorspelers, terwyl die adolessente rugbyspelers in sekere opsigte wat betref die agterspelers, groter vertoon. Die feit dat slegs die voorrye en hakers se gemiddelde waardes groter is as die gemiddelde skimfiguur, bevestig die gevolgtrekking uit vorige navorsing dat 'n groter persentasie liggaamsvet as 'n buffer in die kontaksituasie dien (Quarrie *et al*., 1995:263). Dit is duidelik dat die ouer, volwasse spelers, oor groter velvoumates beskik, wat 'n aanduiding is van meer onderhuidse vet. Alhoewel daar tog 'n sekere patroon gevolg word met betrekking tot die gemiddelde z-waardes, kan die profiele van volwasse rugbyspelers, wat velvoumates betref, nie direk op adolessente rugbyspelers van toepassing gemaak word nie.

TABEL 2. **'N SAMEVATTING VAN PROEFPERSONE SE VELVOUMATES MET BETREKKING TOT HUL PROPORSIEPROFIELE**

	Speelposisie									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Triseps	_>	_	*** * > a**	_	_	_	_	_	_	*** > a**
Biseps	_>	_>	_	_	_	_	_	_	_	_
Subskap	_>	_>	_	_	_	_	_	_	_	_
Supraspin	_>	_>	_	_	_	_	_	_	_	_
Abdomen	_>	_>	_	_	_	_	_	_	_	_
Bobeen	_>	_>	_>	_	_>	_	_	_	_	_
Kuit	_>	_	_	_	_	_	_	_	*** * > a**	_

_ Geen betekenisvolle verskil
*Adolessente is betekenisvol groter as volwassenes
**Volwassenes is betekenisvol groter as adolessente
> Veranderlike is groter as die skimfiguur
a = $p \leq .05$

1=Voorry
2=Haker
3=Slot
4=Flank
5=Agsteman
6=Skrumskakel
7=Losskakel
8=Senter
9=Vleuel
10=Heelagter

Deursneemates en liggaamsmassa

Aangesien deursneemates 'n aanduiding van skeletgroottes is, is dit by hierdie veranderlikes waar die mees betekenisvolle verskille tussen adolessente en volwasse rugbyspelers gevind is. Die ouer volwasse rugbyspelers vertoon deurgaans, met uitsondering van die borsdeursnee, betekenisvol groter ($p \leq .05$) as die adolessente rugbyspelers (Tabel 3). Laasgenoemde is 'n direkte bevestiging van die feit dat adolessente spelers nog in 'n groeifase is. Dit wil voorkom of die verskille tussen die volwasse en adolessente voorspelers groter is as wat die geval is by agterspelers. Die feit dat al die skeletgroottes deurgaans groter is as die skimfiguur, wys heen na die feit dat Suid-Afrikaanse rugbyspelers groter is as die gemiddelde man.

TABEL 3. **'N SAMEVATTING VAN PROEFPERSONE SE DEURSNEEMATES EN LIGGAAMSMASSA MET BETREKKING TOT HUL PROPORSIEPROFIELE**

	Speelposisie									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Biakromiaal	* **> a	* **> a	* **> a	* **> a	* **> a	* **> a	* **> a	* **> a	* **> a	* **> a
Humeris	* **> a	* **> a	* **> a	* **> a	* **> a	* **> a	* **> a	* **> a	* **> a	* **> a
Femur	* **> a	* **> a	* **> a	* **> a	* **> a	* **> a	* **> a	* **> a	* **> a	* **> a
Bors	_>	_>	_>	_>	_>	_>	_>	_>	_>	_>
Liggaamsmassa	_>	_>	_>	_>	_>	_>	_>	_>	_>	_>

_ Geen betekenisvolle verskil
*Adolessente is betekenisvol groter as volwassenes
**Volwassenes is betekenisvol groter as adolessente
> Veranderlike is groter as die skimfiguur
a =p≤.05

1=Voorry
2=Haker
3=Slot
4=Flank
5=Agsteman
6=Skrumskakel
7=Losskakel
8=Senter
9=Vleuel
10=Heelagter

Aangesien toename in ouderdom ook 'n toename in onderhuidse vet teweegbring, kan dit algemeen verwag word dat die ouer volwasse rugbyspelers oor meer onderhuidse vet sal beskik. Saam met die skeletgroottes sou verwag word dat die volwasse spelers oor groter liggaamsmassas beskik. Afgesien van laasgenoemde het daar geen betekenisvolle verskille ten opsigte van die adolessente en volwasse rugbyspelers voorgekom nie.

BESPREKING

Uit die resultate toon die proporsieprofiele van die omtrekmates in die voorrye (Figuur 1.1), hakers (Figuur 1.2), skrumskakels (Figuur 1. 6) en losskakels (Figuur 1.7), 'n tipiese grafiese patroon wat die gemiddelde z-waardes betref (vergelyk lyn wat gemiddelde z-waardes verbind). Dit lyk egter of die spesialisposisies soos hakers, voorrye, skrumskakels, losskakels en heelagters, meer eiesoortig tot mekaar is.

Ten opsigte van die velvoumates, vertoon proporsieprofiele, met uitsondering van drie gevalle (slotte-trisepsvelvou, heelagters-trisepsvelvou, vleuls-kuitvelvou), geen betekenisvolle verskille tussen die adolessente en volwasse rugbyspelers nie. Sover die proporsieprofiele van deursneemates (Figure 3.1-3.10) betref, toon die lyn wat die gemiddelde z-waardes verbind, 'n soort eweredige verspreiding soos byvoorbeeld in die geval van die voorrye (Figuur 3.1), hakers (Figuur 3.2) en losskakels (Figuur 3.6), waar beide groepe dieselfde neiging vertoon. Geen betekenisvolle verskille ten opsigte van borsdeursnee en liggaamsmassa is gevind nie. Die gevolgtrekking wat gemaak kan word, is dat die volwasse rugbyspelers wat reeds volgroeid is, oor groter liggaamsmassa en groter velvoumates beskik.

Hoewel baie van die verskille wat as gevolg van die groeifaktor tussen adolessente en volwasse rugbyspelers voorkom, verdwyn wanneer hierdie groepe proporsioneel met mekaar

vergelyk word, kan daar nie ten volle vir die groeiverskille gekompenseer word nie. Deursneemates, soos reeds genoem, verteenwoordig skeletgroottes en dit het duidelik aan die lig gekom dat volwasse rugbyspelers betekenisvol groter as adolessente rugbyspelers is in al die speelposisies (Figure 3.1-3.10) ten opsigte van die biakromiale, humerus- en femurdeursneemates. Laasgenoemde is 'n duidelike aanduiding dat adolessente nog in 'n groeifase verkeer. Navorsing (De Ridder, 1993) het egter gewys dat daarteen gewaak moet word om morfologiese modelle van volwasse spelers direk op adolessente spelers toe te pas, aangesien adolessente in die verskillende speelposisies nie in alle opsigte posisionele ewebeelde van volwasse spelers word wanneer vir groeiverskille voorsiening gemaak word nie. Dit benadruk die feit dat elke ouderdomsfase of groep oor afsonderlike morfologiese norme moet beskik.

GEVOLGTREKKING

Wat die toekoms betref, sal dit van groot waarde wees indien elke ouderdomsgroep in rugby van 'n regressiemodel voorsien kan word wat saamgestel is vir die behoefte van die spesifieke speelposisie. Dit sal afrigters se taak aansienlik vergemaklik om die regte besluite te neem ten opsigte van posisionele toewysings en of verskuiwings.

Ander faktore soos ondermeer balvaardighede, motoriese vermoëns, hand-oog-koördinasie wat 'n belangrike rol speel in die sukses van sportdeelname, sal ook in berekening gebring moet word ten einde die mees akkurate en korrekte voorspellings te maak. Om die praktiese gebruikswaarde van navorsing van hierdie aard te verhoog, sal van 'n meervoudige regressiemodel gebruik gemaak moet word wat nie net morfologiese parameters insluit nie, maar ook ander faktore soos fisiologiese, motoriese en psigologiese vaardighede in ag neem. So 'n regressiemodel sal die belangrikste parameters uitwys wat afrigters moet gebruik ten einde korrekte toewysings of verskuiwings ten opsigte van speelposisies te maak.

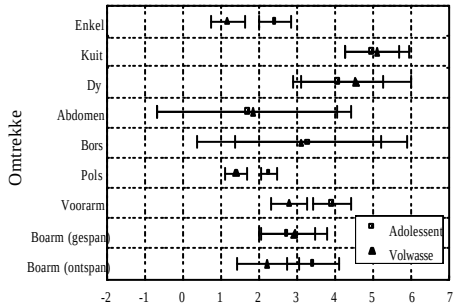
Verskillende dissiplines soos sportsielkundiges en sportwetenskaplikes sal moet saamwerk ten einde 'n holistiese benadering te volg by die identifisering en ontwikkeling van maksimale potensiaal. Op die manier sal antwoorde gebied kan word aan afrigters en sportwetenskaplikes wat nie net die spel tot voordeel sal strek nie, maar ook aan die wetenskap 'n praktiese betekenisvolheid sal gee.

SUMMARY

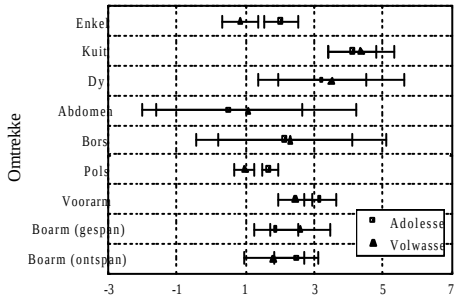
Relative body size of adolescent and adult South African rugby players

Nowadays there is a great emphasis on the correct morphology of rugby players by the selectors and coaches. The New Zealand Rugby Football Union went so far as to state in their "Coaches Manual" that "players with ectomorphic physiques should not be placed in the front row positions." This is a further indication of the importance of physique and body size that makes rugby football a unique sport (Quarrie *et al*., 1996:53-55). De Ridder (1993:291) and Houtkooper (1996:146) place definite emphasis on the fact that more attention should be given to the comparison of rugby players as far as their physiques and difference in playing positions are concerned. The problem originating in this way of thought, is the question whether or not adolescent rugby players can be selected on the same criteria and whether the physical models of adults can be also applicable to adolescents. By using proportional

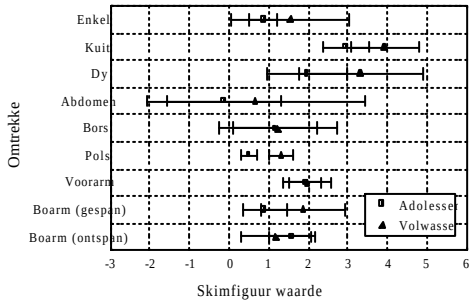
measurements one can predict which players from different age groups will be counterparts of each other in future. The aim of this study has been to determine whether there is a relation between the morphology of adolescent- and adult rugby players in different playing positions when being compared proportionally with each other. A total of 369 provincial high school players of an average age of 18.1 years, and 349 adult provincial players of an average age of 24.8 years were used as subjects for the study. A total of nine kinanthropometric variables were used in the comparison namely: Body weight, triceps' skinfold, subscapular skinfold, supraspinal skinfold, medial calf skinfold, front thigh skinfold, arm girth flexed, calf girth, humerus width, femur width. All kinanthropometric measurements were taken according to the International Work group on Kinanthropometry (IWGK) protocols (De Ridder, 1993:106.) Statistical analysis was done by using the Statistical Analysis System (SAS) (Helwig, 1983:2.) The two groups were compared to each other in a proportional manner, by using the so-called "Phantom figure." The results of the experiment indicate that even by making proportional adjustments, players of different age groups cannot be proportional counterparts of each other, because of the morphological differences that still exists between the different age groups. The players still differ proportionally, even if they are in the same playing position and in spite of the compensation made for growth and age differences. It is important that adolescent rugby players must be provided with their own morphological models, which would have to be copied by using lines of regression to the different age groups.



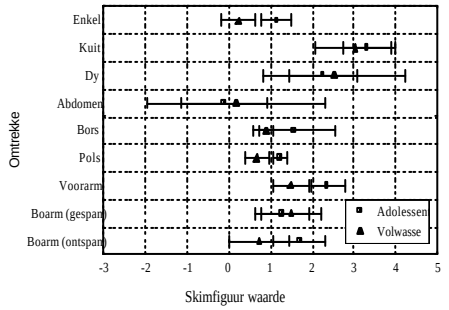
1.1: Posisie = Voorry



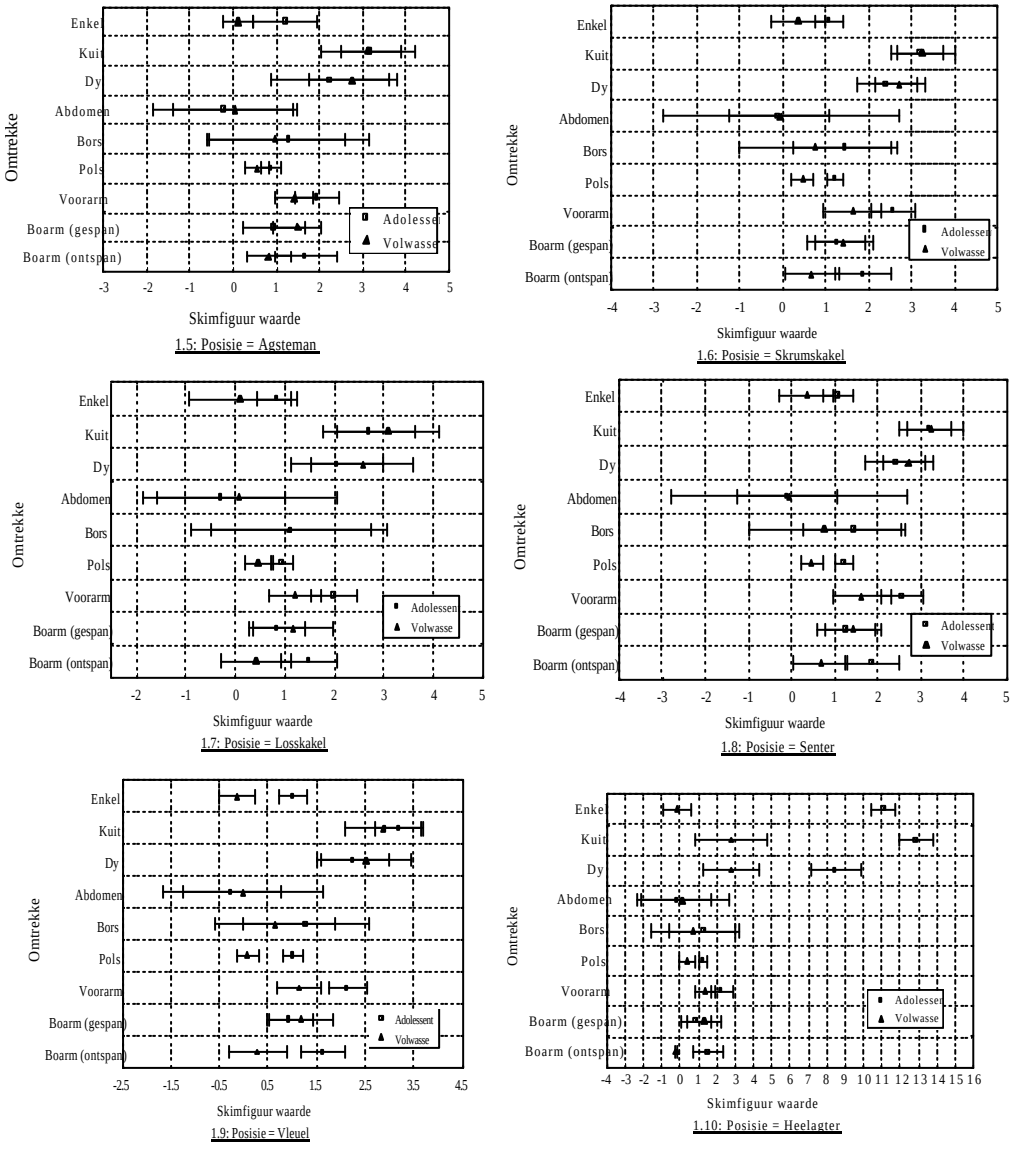
1.2: Posisie = Haker



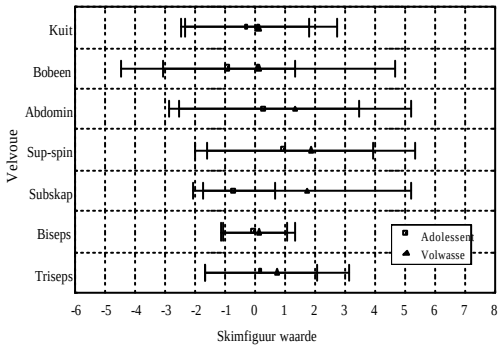
1.3: Posisie = Slot



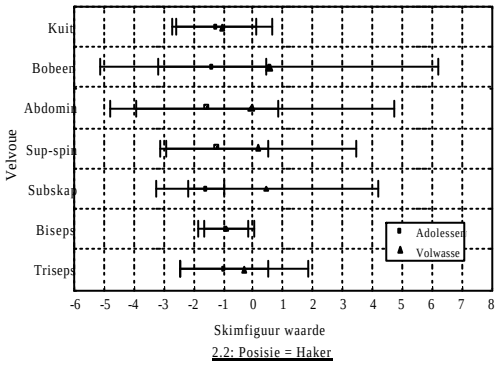
1.4: Posisie = Flank



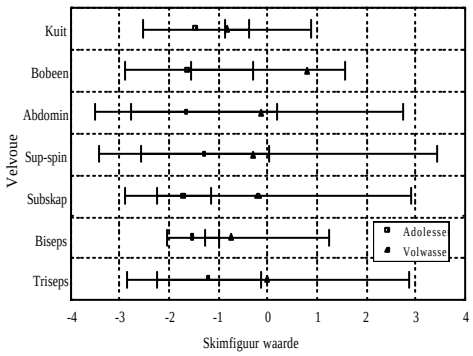
FIGUUR 1. **PROPORSIEPROFIELE VAN DIE Z-WAARDES VIR DIE OMTREKMATES VAN VOLWASSE – EN ADOLESSENTE RUGBYSPELERS**



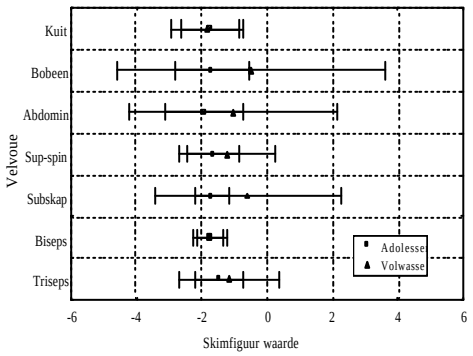
2.1: Posisie = Voorry



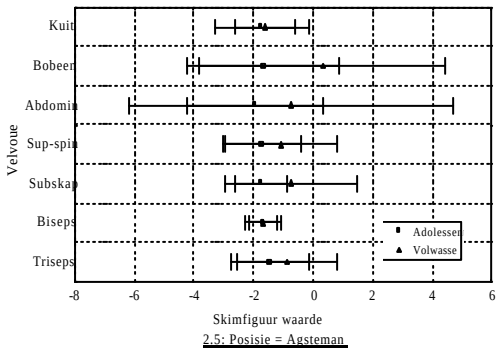
2.2: Posisie = Haker



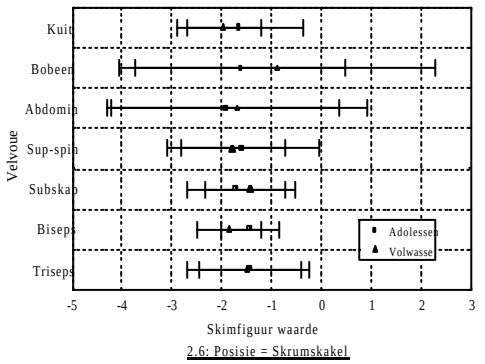
2.3: Posisie = Slot



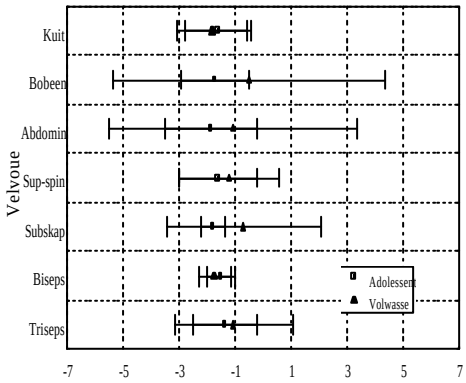
2.4: Posisie = Flank



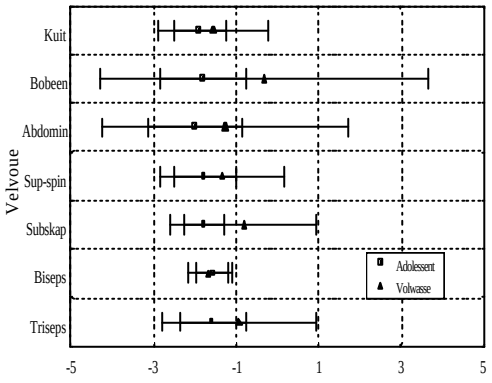
2.5: Posisie = Agsteman



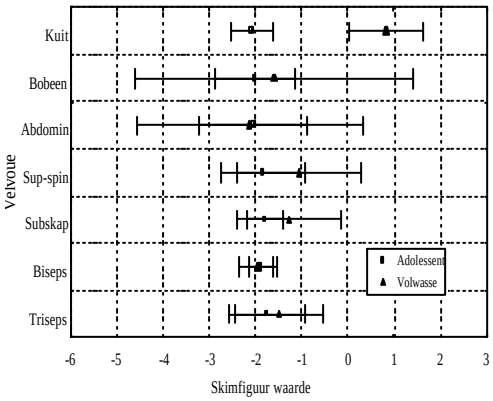
2.6: Posisie = Skrumskakel



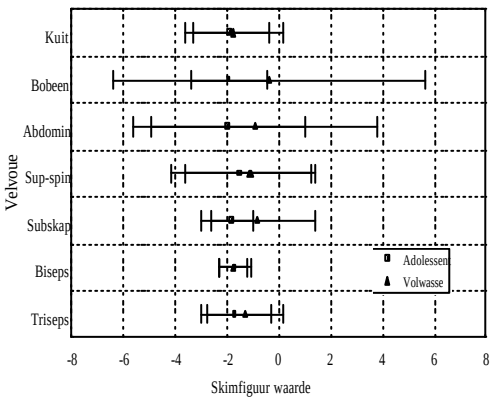
2.7: Posisie = Losskakel



2.8: Posisie = Senter

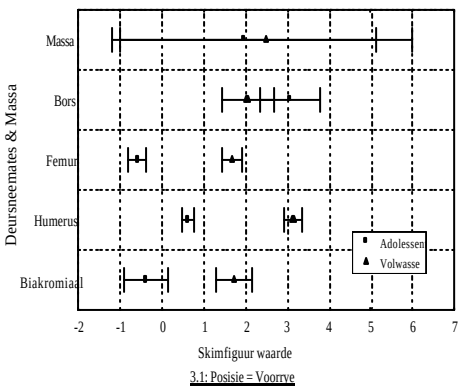


2.9: Posisie = Vleuel

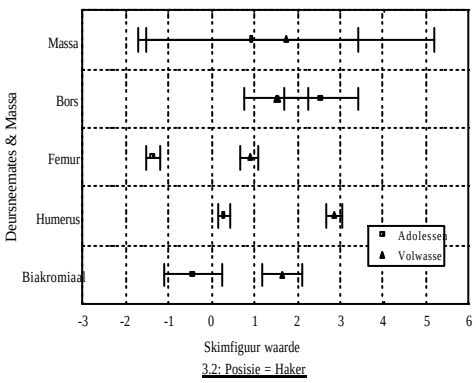


2.10: Posisie = Heelagter

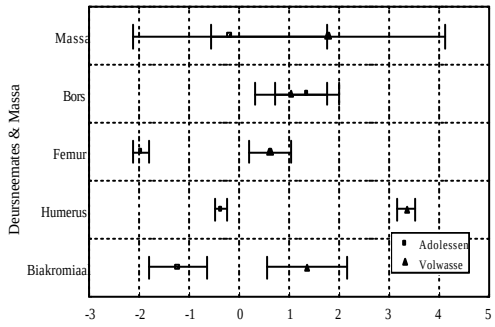
FIGUUR 2. **PROPORSIEPROFIELE VAN DIE Z-WAARDES VIR DIE VELVOUE VAN VOLWASSE – EN ADOLESSENTE RUGBYSPELERS**



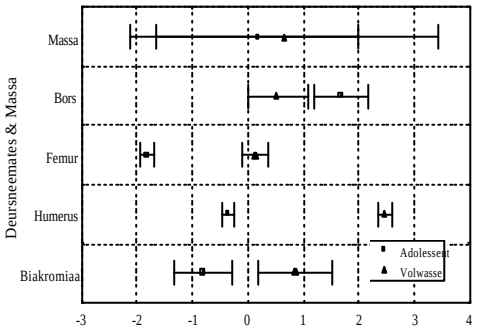
3.1: Posisie = Voorrye



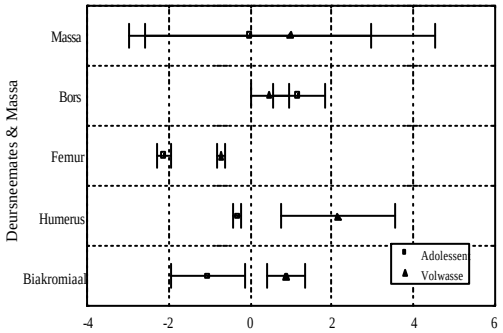
3.2: Posisie = Haker



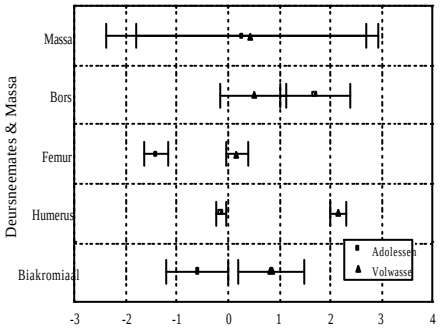
3.3: Posisie = Slot



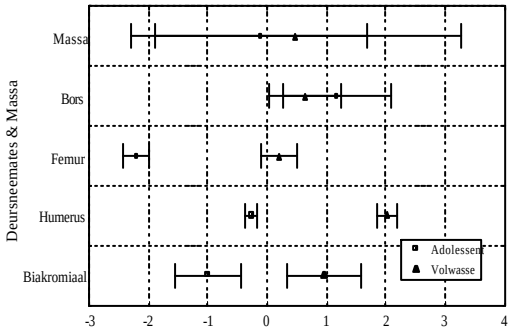
3.4: Posisie = Flank



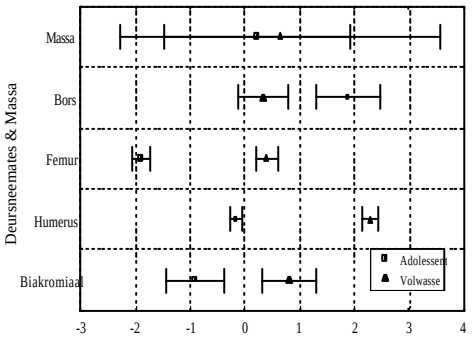
3.5: Posisie = Agsteman



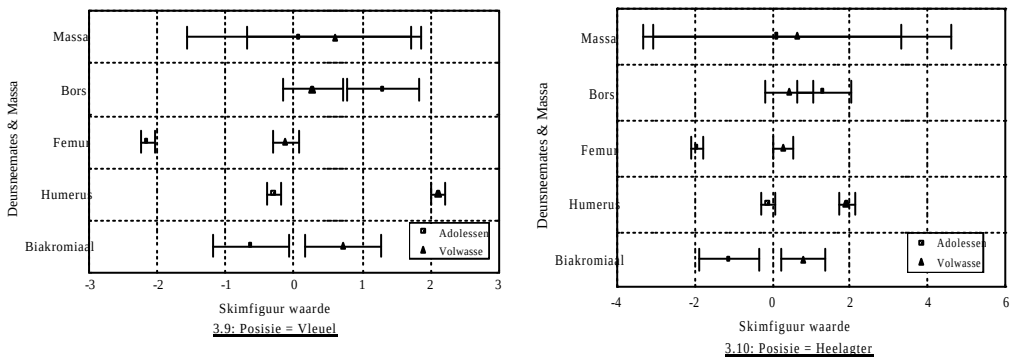
3.6: Posisie = Skrumskakel



3.7: Posisie = Losskakel



3.8: Posisie = Senter



FIGUUR 3. **PROPORSIEPROFIELE VAN DIE Z-WAARDES VIR DIE DEURSNEEMATES EN LIGGAAMSMASSA (MASSA) VAN VOLWASSE – EN ADOLESSENTE RUGBYSPELERS**

VERWYSINGS

BELL, W. (1995). The estimation of body density in rugby union football players. *British Journal of Sports Medicine,* 29(1):46-51.

BOLONCHUK, W.W. & LUKASKI, H.C. (1987). Changes in somatotype and body composition of college football players over a season. *Journal of Sports Medicine*, 27: 247-252.

CARTER, J.E.L. & ACKLAND, T.R. (1994). Kinanthropometry in aquatic sports: A study of world class athletes. Champaign, IL: Human Kinetics.

DE RIDDER, J.H. (1993). 'n Morfologiese profiel van junior en senior Cravenweek-rugbyspelers. Ongepubliseerde Ph.D.-proefskrif. Potchefstroom: PU vir CHO.

GLEIM, G.W. (1984). The profiling of profesional football players. *Clinics in Sports Medicine*, 3(1): 185-197.

HELWIG, J.T. (Ed.) (1983). *SAS introductory guide* (Rev.ed.). Cary, NC: SAS Institute.

HOUTKOOPER, L.B. (1996). Assessment of body composition in youths and relationship to sport. *International Journal of Sport Nutrition*, 6:146-164.

LÜBBERT, G.H.; VAN DER MERWE, G.W. & VAN DER WALT, W.H. (1984). Body composition of top sportsmen. *South African Journal of Research in Sport, Physical Education and Recreation,* 7(2): 79-92.

QUARRIE, K.L.; HANDCOCK, P.; WALLER, A.E.; CHALMERS, D.J.; TOOMEY, M.J. & WILSON, B.D. (1995). The New Zealand rugby injury and performance project III. Anthropometric and physical performance characteristics of players. *British Journal of Sports Medicine*, 29(4): 263-270.

QUARRIE, K.L.; HANDCOCK, P.; TOOMEY, M.J. & WALLER, D.J. (1996). The New Zealand rugby injury and performance project IV. Anthropometric and physical performance comparisons between positional categories of senior A rugby players. *British Journal of Sports Medicine*, 30: 53-60.

ROSS, W.D.; DRINKWATER, D.T. & SWENSON, P.L. (1981). Proportionality body composition in male and female Olympic athletes: A Kinantropometric overview. In E. Jokl (Ed.). *Medicine and Sport, vol. 15* (74-84). Basel: Karger.

ROSS, W.D. & MARFELL-JONES, J.M. (1991). Kinanthropometry. In J.D. Macdougal; H.A. Wenger & H.J. Green (Eds.). *Physiological testing of the high-performance athlete* (223-283). Champaign, IL: Human Kinetics.

RHYS, C. (1992). *The Guinness Rugby Union fact book*. London: Guinness Publishing.

VAN DER WALT, T.S.P. & OOSTHUIZEN, O.W. (1980). Evaluering van die liggaamlike toerusting van rugbyspelers deur middel van somatotipering. *Suid-Afrikaanse Tydskrif vir Navorsing in Sport, Liggaamlike Opvoedkunde en Ontspanning*, 3(1): 89-99.

VAN DER WALT, T.S.P.; BLAAUW, J.H.; DESIPRÉ, M.; DAEHNE, H.O. & VAN RENSBURG, J.P. (1986). Proportionality of muscle volume calculations of male and female participants in different sports. In A.P Day. (Ed.). *Perspectives in Kinanthropometry, vol.1*. (229-238). Champaign, IL: Human Kinetics.

Mnr. Cilas J. Wilders, Skool vir Biokinetika, Rekreasie en Sportwetenskap, Fakulteit Gesondheidswetenskappe, Potchefstroomse Universiteit vir Christelike Hoër Onderwys, Privaatsak X2001, Potchefstroom 2531, Republiek van Suid-Afrika. Tel: +27 (0)18 299-1801, Faks: +27 (0)18 299-1825, E-pos: mbwcjw@puknet.puk.ac.za

(Vakredakteur: Dr. H.J. van Heerden)