

NORMATIVE DATA OF POTENTIAL YOUNG MALAYSIAN ATHLETE FOR
TALENT IDENTIFICATION DECISION SUPPORT SYSTEM

KAMARUZAMAN BIN SOEED

A thesis submitted in fulfilment of the
requirements for the award of the degree of
Doctor of Philosophy (Health Science)

Faculty of Biosciences and Medical Engineering
Universiti Teknologi Malaysia

OKTOBER 2016

In dedication to Mak (Kalthom Hj Ismail), my lovely wife (Salimah Mohd. Rashid)
and my beautiful angel, Dahlia.

ACKNOWLEDGEMENT

I would like to express my deepest gratitude to my main supervisor, Prof Dr Haji Abdul Hafidz bin Haji Omar for all the patience, guidance, motivation and critics during the whole process of conducting this study. I am also thankful with the supervision of my co-supervisor, Dr Noorminshah A.Iahad (UTM) and PM Dr Mohad Anizu Mohd Noor (UiTM). Without them, I would not be able to finish up my thesis and work efficiently.

To the whole member of Sports Innovation and Technology Centre, thank you for all the guidance and tips, for the friendship and care for all the years we have been together especially to Muhammad Iqbal Tariq Idris, Izwyn Zulkapri and Mohd Fadhil Abdullah.

To the one who believing in me, through thick and thin, my mother, thank you for the tender love and trust and believe I can be a better person everyday. To my wife, Salimah Mohd Rashid, thank you for being the most amazing wife one could have. To my daughter, Dahlia, this is for you.

ABSTRACT

This study focused on the development of normative data of potential young Malaysian athlete for the Sports Talent Identification Decision Support System (STIDSS). The system helps to smoothen the process of the sports talent identification program in order to produce potential future athletes in Malaysia. Current approaches of talent identification programs only focused on physical and psychological attributes. The newly developed STIDSS focuses on four main attributes which include physical, physiological, psychological and sociological components. Basically, assessment of these attributes is the main focus of this study and acts as part of the objectives of the study, in line with the evaluation of the effectiveness of STIDSS. Four related anthropometric measurements and nine field tests were used to assess the ability of an individual's physical fitness. The 20 m multistage shuttle run test was used to test maximum oxygen uptake (VO_{2max}) for physiological while the mental toughness and the level of parental support tests were used to investigate psychological and sociological attributes. A total of 537 ball sports, racket sports and target sports junior athletes, aged 13 years old were selected from the Malaysian Sports School and State Sports School to be involved in the field testing. A total of 85 participants was involved in the testing of the usability of the system and 374 junior athletes were tested to evaluate the accuracy of the system based on physical and physiological characteristics. Three sets of questionnaires were used to test the level of mental toughness, the level of parental support and the usability of STIDSS. Findings showed that for ideal anthropometrics characteristics, only male racket sports and female ball sports achieved superior standard. This study developed a new norm based on the total population of junior potential national athletes which covered both Malaysian sports school and nine state sports schools. Speed, agility, reaction time and cardiovascular endurance did not contribute directly to the performance of target sports but it significantly contributed to ball sports and racket sports. This study found that measurement of VO_{2max} uptake is not a priority element for target sports. Most junior athletes have moderate mental strength, however there were big differences between the target sports and the racket sports in term of reboundability, pressure, concentration, confidence and motivation. This study also found that very few parents strongly supported their children to be involved in high level competitions. Majority of respondents were satisfied with the usability of the developed STIDSS and the accuracy test was satisfactory. Thus, the use of STIDSS is proven to be appropriate in the process of selecting young talent to match specific sports. Future research may include wider variety of sports to improve the system.

ABSTRAK

Kajian ini memberi tumpuan kepada pembangunan data normatif atlet muda Malaysia yang berpotensi bagi Sistem Sokongan Keputusan untuk Pengenalpastian Bakat Sukan (STIDSS). Sistem ini membantu melancarkan proses program pengenalpastian bakat sukan bagi melahirkan atlet berpotensi pada masa depan di Malaysia. Pendekatan terkini program pengenalpastian bakat hanya memberi tumpuan kepada pengujian ciri-ciri fizikal dan psikologikal. Pembangunan STIDSS yang baru memberi tumpuan kepada empat komponen utama iaitu fizikal, fisiologikal, psikologikal dan sosiologikal. Pada dasarnya, penilaian ciri-ciri ini merupakan fokus utama kajian ini dan bertindak sebahagian daripada objektif kepada kajian ini, selari dengan penilaian terhadap keberkesanan STIDSS. Empat pengukuran berkaitan antropometri dan sembilan ujian lapangan digunakan untuk menilai keupayaan kecergasan fizikal seseorang individu. Ujian *20 m multistage shuttle run* digunakan untuk menguji kadar pengambilan oksigen maksimum (VO_{2max}) bagi ciri fisiologikal manakala ujian tahap kekuatan mental dan tahap sokongan ibu bapa digunakan untuk mengkaji ciri-ciri psikologikal dan sosiologikal. Seramai 537 atlet junior sukan bola, sukan raket dan sukan sasaran, berusia 13 tahun dipilih dari Sekolah Sukan Malaysia dan Sekolah Sukan Negeri. Sejumlah 85 peserta terlibat dalam ujian kebolehgunaan STIDSS dan 374 atlet junior telah diuji untuk menilai ketepatan STIDSS berdasarkan ciri-ciri fizikal dan fisiologikal. Tiga set soal selidik telah digunakan untuk menguji tahap kekuatan mental, tahap sokongan ibu bapa dan kebolehgunaan STIDSS. Dapatan kajian menunjukkan untuk ciri-ciri anthropometrik yang ideal, hanya sukan raket lelaki dan sukan bola perempuan mencapai standard unggul. Kajian ini membangunkan data normatif baru berdasarkan jumlah populasi atlet junior kebangsaan yang berpotensi merangkumi dua Sekolah Sukan Malaysia dan sembilan Sekolah Sukan Negeri. Kelajuan, ketangkasan, masa tindak balas dan daya tahan kardiovaskular tidak menyumbang secara langsung kepada prestasi sukan sasaran tetapi ia ketara menyumbang kepada sukan bola dan sukan raket. Kajian ini mendapati bahawa pengukuran pengambilan oksigen maksimum (VO_{2max}) bukan elemen keutamaan untuk sukan sasaran. Sekumpulan besar atlet junior mempunyai kekuatan mental yang sederhana, namun terdapat perbezaan ketara antara sukan sasaran dan sukan raket dari segi kebolehbalikan, tekanan, tumpuan, keyakinan dan motivasi. Kajian ini juga mendapati bahawa hanya sekumpulan kecil ibu bapa amat menyokong anak-anak mereka untuk terlibat dalam pertandingan peringkat tinggi. Majoriti responden berpuas hati dengan kebolehgunaan dan ketepatan STIDSS yang dibangunkan. Oleh itu, penggunaan STIDSS terbukti sesuai dalam proses pemilihan bakat muda mengikut padanan sukan spesifik. Kajian akan datang boleh diperluaskan kepada sukan-sukan lain untuk penambahbaikan sistem.

TABLE OF CONTENTS

| CHAPTER | TITLE | PAGE |
|----------------|----------------------------------|-------------|
| | DECLARATION | ii |
| | DEDICATION | iii |
| | ACKNOWLEDGEMENTS | iv |
| | ABSTRACT | v |
| | ABSTRAK | vi |
| | TABLE OF CONTENTS | vii |
| | LIST OF TABLES | xi |
| | LIST OF FIGURES | xiii |
| | LIST OF APPENDICES | xv |
| 1 | INTRODUCTION OF THE STUDY | 1 |
| | 1.0 Introduction | 1 |
| | 1.1 Background of Study | 3 |
| | 1.2 Problem Statement | 7 |
| | 1.3 Importance of the Study | 10 |
| | 1.4 Objectives of the Study | 11 |
| | 1.5 Research Questions | 11 |
| | 1.6 Scope of the Study | 12 |
| | 1.7 Limitation of the Study | 12 |
| | 1.8 Operational Definitions | 13 |
| | 1.8.1 STIDSS | 13 |
| | 1.8.2 Ball sports | 13 |
| | 1.8.3 Racket sports | 13 |
| | 1.8.4 Target sports | 14 |
| | 1.8.5 TID | 14 |

| | | |
|----------|-----------------------------------------------|-----------|
| 1.8.6 | ISN | 14 |
| 1.9 | Summary | 15 |
| 2 | LITERATURE REVIEW | 16 |
| 2.0 | Introduction | 16 |
| 2.1 | The Phases of Talent Identification | 16 |
| 2.1.1 | Talent detection | 17 |
| 2.1.2 | Talent identification | 18 |
| 2.1.3 | Talent selection | 19 |
| 2.1.4 | Talent development | 19 |
| 2.2 | The basic attributes of talent identification | 20 |
| 2.3 | Physical attributes | 21 |
| 2.3.1 | The anthropometry evaluation | 22 |
| 2.3.2 | The physical fitness capabilities | 25 |
| 2.4 | Physiological | 29 |
| 2.4.1 | The aerobic capacity | 29 |
| 2.4.2 | The 20 meter multistage fitness test | 31 |
| 2.4.3 | Sports Specific attributes | 34 |
| 2.5 | The psychological attribute | 37 |
| 2.5.1 | Mental toughness assessment | 39 |
| 2.6 | Sociological attribute | 44 |
| 2.6.1 | The parental support in children's sports | 45 |
| 2.7 | Existing Expert System | 47 |
| 2.9 | Summary | 49 |
| 3 | RESEARCH METHODOLOGY | 50 |
| 3.0 | Introduction | 50 |
| 3.1 | Research Design | 51 |
| 3.2 | Operational Framework | 53 |
| 3.2.1 | Phase 1 | 55 |
| 3.2.2 | Phase 2 | 55 |
| 3.2.3 | Phase 3 | 56 |
| 3.2.4 | Phase 4 | 56 |

| | | |
|----------|--------------------------------------------------------------------------------|-----------|
| 3.2.5 | Phase 5 | 56 |
| 3.3 | Sampling Procedure | 57 |
| 3.3.1 | Sports selection | 57 |
| 3.3.2 | Subject selection | 58 |
| 3.4 | Tests and Measurement | 58 |
| 3.5 | Testing Administration | 60 |
| 3.6 | Instrument development | 60 |
| 3.6.1 | Pilot study | 61 |
| 3.6.2 | Validation of the instruments | 62 |
| 3.6.3 | Reliability of the instruments | 63 |
| 3.7 | The IsoMetrics ^s instrument | 66 |
| 3.8 | Data Analysis | 69 |
| 3.9 | Summary | 70 |
| 4 | THE INTEGRATION OF SPORTS TALENT IDENTIFICATION DECISION SUPPORT SYSTEM | 71 |
| 4.0 | Introduction | 71 |
| 4.1 | Determination of minimum requirement of general physical fitness | 71 |
| 4.2 | The attributes integration | 72 |
| 4.2.1 | The early stage assessment | 73 |
| 4.2.2 | The specific stage assessment | 74 |
| 4.2.3 | The final stage assessment | 75 |
| 4.3 | The STIDSS flowchart | 76 |
| 4.3.1 | Step 1 | 77 |
| 4.3.2 | Step 2 | 77 |
| 4.3.3 | Step 3 | 77 |
| 4.3.4 | Step 4 | 78 |
| 4.3.5 | Step 5 | 78 |
| 4.4 | Overview of the STIDSS process flow | 79 |
| 4.5 | Summary | 80 |

| | | |
|----------|-----------------------------------------------------------------------|------------|
| 5 | RESULTS AND DISCUSSION | 81 |
| 5.0 | Introduction | 81 |
| 5.1 | Demography | 82 |
| 5.2 | Specific physical characteristics investigation | 84 |
| 5.3 | The development of specific normative data for physical attributes | 90 |
| 5.3.1 | Power | 91 |
| 5.3.2 | Speed | 94 |
| 5.3.3 | Coordination | 97 |
| 5.3.4 | Balancing | 100 |
| 5.3.5 | Agility | 103 |
| 5.3.6 | Reaction time | 106 |
| 5.3.7 | Flexibility | 109 |
| 5.4 | Specific physiological characteristics investigation | 116 |
| 5.5 | Psychological evaluations | 119 |
| 5.6 | Sociological evaluations | 128 |
| 5.7 | Development of the STIDSS | 132 |
| 5.8 | The effectiveness of the STIDSS | 132 |
| 5.8.1 | The usability of the STIDSS | 132 |
| 5.8.2 | The accuracy of the STIDSS | 135 |
| 5.9 | Summary | 136 |
| 6 | CONCLUSION AND RECOMMENDATION | 137 |
| 6.0 | Introduction | 137 |
| 6.1 | Conclusion | 137 |
| 6.2 | Implication and Contribution | 139 |
| 6.3 | Recommendation | 140 |
| | REFERENCE | 142 |
| | Appendices A-E | 166 – 218 |

LIST OF TABLES

| TABLE NO. | TITLE | PAGE |
|------------------|-------------------------------------------------------------------------------------------------------------------------------|-------------|
| 2.1 | A summarized of the important features of physical fitness attributes | 28 |
| 2.2 | Equations to estimate vo2max from the 20-m shuttle run test in youths | 32 |
| 2.3 | The evaluation of the vo2max measurements obtained from five equations in youth aged 13-19 years. | 33 |
| 2.4 (a) | Standard normative data for male | 34 |
| 2.4 (b) | Standard normative data for female | 35 |
| 2.5 | A maximal multistage 20m shuttle run test to predict VO ₂ max | 36 |
| 2.6 | A systematic review of the existing expert system | 48 |
| 3.1 | Testing selection of each attribute | 58 |
| 3.2 | K value in Fleiss' Kappa | 62 |
| 3.3 | The consistency of the instruments | 63 |
| 3.4 | The distribution of the subjects in this study | 67 |
| 3.5 | Research objectives and data analysis | 69 |
| 4.1 | The findings of minimum requirement of general physical fitness specifically for ball sports, racket sports and target sports | 72 |
| 4.2 | A basic physical fitness requirement to be an athlete | 73 |
| 4.3 | The ball sports characteristics minimum requirement | 74 |
| 4.4 | The racket sports characteristics minimum requirement | 75 |
| 4.5 | The target sports characteristics minimum requirement | 75 |
| 5.1 | Subject's demography | 83 |
| 5.2 | The anthropometrics and general physical fitness characteristics. | 85 |
| 5.3 (a) | Mean and SD value for the Standing Broad Jump Test and the 3kg Weight Throw Test. | 91 |
| 5.3 (b) | Specific normative data for for the Standing Broad Jump Test and the 3kg Weight Throw Test | 91 |
| 5.4 (a) | Mean and SD value for the 30 Meter and 50 Meter Sprint Test | 94 |
| 5.4 (b) | Specific normative data for the 30 Meter and 50 Meter Sprint Test | |

| | | |
|----------|--------------------------------------------------------------------------------------|-----|
| 5.5 (a) | Mean and SD value for the Basketball Dribbling Test | 94 |
| 5.5 (b) | Specific normative data for the Basketball Dribbling Test | 97 |
| 5.6 (a) | Mean and SD value for the Stand Stork Test | 97 |
| 5.6 (b) | Specific normative data for the Stand Stork Test | 100 |
| 5.7 (a) | Mean and SD value for the 10m X 4 Shuttle Run Test | 100 |
| 5.7 (b) | Specific normative data for the 10m X 4 Shuttle Run Test | 103 |
| 5.8 (a) | Mean and SD value for the Ruler Drop Test | 103 |
| 5.8 (b) | Specific normative data for the Ruler Drop Test | 106 |
| 5.9 (a) | Mean and SD value for the Sit & Reach Test | 106 |
| 5.9 (b) | Specific normative data for the Sit & Reach Test | 109 |
| 5.10 | The specific general physical fitness of developed normative data for ball sports | 109 |
| 5.11 | The specific general physical fitness of developed normative data for racket sports. | 113 |
| 5.12 | The specific general physical fitness of developed normative data for target sports. | 114 |
| 5.13 (a) | Physiological characteristics | 115 |
| 5.13 (b) | Specific normative data for $VO_2\text{max}$ | 116 |
| 5.14 | Kruskal-Wallis H test result | 117 |
| 5.15 | The multiple comparison test and control type 1 error results. | 122 |
| 5.16 | Sociological evaluation; Parental support score distributions | 124 |
| | | 128 |

LIST OF FIGURES

| FIGURE NO. | TITLE | PAGE |
|-------------------|-------------------------------------------------------------------------|-------------|
| 2.1 | Key stages in the talent identification and development process | 17 |
| 3.1 | The integration of concepts of sports science and technology | 50 |
| 3.2 | Research Framework Steps | 52 |
| 3.3 | The Research Operational Framework | 54 |
| 3.4 | The STIDSS Architecture | 68 |
| 4.1 | The STIDSS flowchart | 76 |
| 4.2 | The STIDSS Process flow | 79 |
| 5.1 | The standing height boxplots | 86 |
| 5.2 | The sitting height boxplots | 86 |
| 5.3 | The arm span boxplots | 87 |
| 5.4 | The body weight boxplots | 88 |
| 5.5 | The standing broad jump test boxplots | 92 |
| 5.6 | The 3KG weight throw test boxplots | 92 |
| 5.7 | The 30 meter sprint test boxplots | 95 |
| 5.8 | The 50 meter sprint test boxplots | 95 |
| 5.9 | The basketball dribbling test boxplot | 98 |
| 5.10 | The Stand Strok Test boxplot | 101 |
| 5.11 | The 10m X 4 Shuttle Run Test boxplot | 104 |
| 5.12 | The Ruler Drop Test boxplot | 107 |
| 5.13 | The Sit & Reach Test boxplot | 110 |
| 5.14 | Overall mental toughness achievement by gender | 119 |
| 5.15 | The mental toughness evaluation score distribution by sports categories | 120 |
| 5.16 | The parental support scores | 129 |
| 5.17 | The usability of the STIDSS | 133 |

| | | |
|------|------------------------------------------------------------------|-----|
| 5.18 | The accuracy of the STIDSS | 135 |
| 5.19 | The breakdown number of accuracy according to the sport category | 136 |

| APPENDIX | LIST OF APPENDICES TITLE | PAGE |
|-----------------|-------------------------------------|-------------|
| A | Table of Sampling Procedure | 166 |
| B | Testing procedures | 168 |
| C | Research Instruments | 182 |
| D | Expert validation form | 194 |
| E | Raw Statistical Result | 215 |

CHAPTER 1

INTRODUCTION OF THE STUDY

1.0 Introduction

The measurement of physical fitness and sports skills should be implemented in schools to cultivate a healthy lifestyle among students. Besides that, the implementation of the measurement can also help in identifying students' talents in sports. The measurement should not just focus on active students, but also on sedentary and inactive students. This is essential to uncover the hidden talents and potentials of a student in physical activities and sports skills in order to help them expand their talents to the fullest.

The hidden talents and potentials of a student in physical activities and sports skills can be identified through Talent Identification. Talent identification is a process that involves making judgments on a performer's quality and offering that individual an opportunity to do something for which he or she is suited. Talented youngsters must be identified on their future abilities to be the best players, not on their current abilities (Gould & Carson, 2008; Meylan, et al., 2010; Davids et al., 2000). There are four common phases that should be considered in talent identification program which are Talent Detection, Talent Identification, Talent Selection and Talent Development (Willian and Franks, 1998).

Talent is a marked innate ability defined as artistic accomplishment, natural endowment or an ability of a superior quality. Talent can also be defined as any internal capacity that allows an individual to show a high performance in a domain

that requires skills and training (Malina, 2010). According to Meylan et al., (2010), talent is a quality or substance that a person or group has, that sets them apart from other people, usually in reference to a single subject.

In sports, talent can be defined as an individual's special aptitude that is above average of a normal aptitude and the special aptitude can be categorized into functional, expressive or athletic (Hoffmann and Wulff, 2015). In relation to talent that are linked to physical activity, talent in sports is described as the ability in sports skill that is more than the normal standard and those skills are not yet developed or polished (Williams & Franks, 1998). Pinder et al., (2013) stated that individuals with talents in sports will exhibit specific characteristics which could lead to achievement in future performances. Therefore, it is important to carry out programs related to identifying potential talent to find young talented athletes as coatings in the future.

The identification of talent in sports traditionally had been associated with individual sports that have discrete physical and physiological requirements, such as cycling, running, rowing, and etc. However, research in team sports such as basketball (Hoare & Hunt, 1999a and Hoare & Hunt, 1999b), men's soccer (Hoare, 1999a), netball (Hoare, 1997) and women's soccer (Hoare, 2000), have successfully isolated the contribution of selected anthropometric and physiological attributes to sport performance.

Sports talent identification begins in the early 60's in Russia and a few other western countries (Vaeyens et al., 2008). In the late 1960s and early 1970s, most East European countries realized the weakness of the traditional talent identification programs and attempted to develop methods of identification which could be underpinned by scientific theory and evidence (Bompa, 1999). Bulgaria was one of the countries that had developed methods of identification and the results of the methods were astounding as eighty percent of Bulgarian medalists in the 1976 Olympic Games were resulted from the talent identification process. Similar results were demonstrated by Romania and East German athletes in the 1972, 1976 and 1980 Olympics (Bompa, 1994).

Bompa (1994) also stated that the effectiveness of the implementation of sports talent identifying program was also proven through the victory of small countries such as Romania in getting medals in the Olympics and this showed that small countries can be on par with bigger countries. During that time, a group of scientists and rowing specialist in Romania, in 1976 had scientifically selected 100 young girls to form a rowing team. The initial 100 girls were selected from 27,000 teenagers. By 1978, the group had been reduced to 25 persons and most of them were participating in the Moscow Olympics. The result was 1 gold, 2 silver and 2 bronze medals. Another group selected in the late 1970s produced 5 gold and 1 silver medal during the 1984 Olympic Games in Los Angeles and 9 medals at the Seoul Olympic Games. The best achievement in Sydney Olympic Games, Romania contingent won 11 gold, 6 silver and 9 bronze medals (www.olympic.org).

To-date, sports talent identifying program is widely conducted in Malaysia. Multiple ministries and parties are involved in making this program a success. The National Sports Council, the National Sports Institute, the Ministry of Youth and Sports along with the Ministry of Education are working together in executing this program to aim for excellent sports performances at an international level. Therefore, teachers and coaches in schools, clubs and sports associations can make use of the program in order to attain excellent sports performances at any scales; interschool, interstate, national or international competition.

1.1 Background of the Study

Due to systematic and scientific sports talent identifying programs, many countries had done well in the sports arena. Countries such as Russia (Malina, 2010), Australia (Green, 2007 and Tomkinson et al., 2003), Japan (Houlihan & Green, 2007), South Korea (Ko et al, 2003), Germany (Kozel, 1996) and China (Wu, 1992) excelled in sports as a result from such programs. Nonetheless, documented results showed that these countries had been implementing this program for quite a while before achieving its goal.

Malaysia had begun searching for talents in sports thoroughly when Kuala Lumpur was announced as the host for the Commonwealth Games in 1998. Following the selection, actions were taken to ensure that Malaysia would not only be the host for the prestigious sports event, but also succeed and performed in the participated sports. The success of the sports talent search program was proven from the outstanding achievements in the 1998 Commonwealth Games. As the western countries achieved successful results through sports talent identifying program, Malaysia had introduced the same program for children and young athletes. This confirms that small countries can be on the same level with the big nations in the sports arena through this systematic and planned program.

This program has proven to contribute to Malaysia's excellent performance in the Commonwealth Games in 1998. Consequently, this has also strengthened the needs of the implementation of the talent identifying program thoroughly at all levels, states and associations. Sports talent identification should be done in schools to attain excellence in sports performance and not just merely relying on financial support, facilities and coach/teacher's expertise. This is because excellence in sports can also be accomplished through scientific and systematic sports talent identification program.

The Sports Talent Identification Program in Malaysia was gazetted by Datuk Seri Mohd Najib bin Tun Abdul Razak in 1997 (Asha et al., 2009). It was set up through the help of expertise from the National Sports Council for the training of young athletes attending the Bukit Jalil Sports School.

In 1998, the National Sports Council successfully published a book related to sports talent identification and the norms of each tests in brief. Data collected on the norms were collected from a group of children between the age of 11-14 years old and also with a group of Malaysian's elite athletes (National Sports Council of Malaysia, 1998). The items that were tested are height, arm's length, sitting height, weight, measurements of skin folds, weight throwing, vertical jump, 40m sprint,

hexagon agility test and shuttle running endurance test or 800m running. However, these tests are still too general and do not include all the components of physical fitness that is the basis of motor skills tests.

This program became less active after Malaysia showed an excellent performance in the Commonwealth Games in 1998. Hence, through the meeting of the Cabinet Committee for Sports Development in 2004, it was decided that the National Sports Institute (ISN) was responsible to expand the system and program-related activities in identifying sports talents in Malaysia. The execution of the sports talents identifying programs and the development of young athletes was based on the implementation of the principles and practices of the appropriate Sports Science (Asha et al., 2009).

In addition, *Program Tunas Gemilang* was put into operation. This program was suggested by former Minister of Youth and Sports, Dato' Azalina Othman Said (National Sports Council of Malaysia, 2007). This program was a collaboration between the National Sports Institute of Malaysia and State Assembly Community Sports Club throughout Malaysia. The purpose of this program was to ensure the participation of all Community Sports Clubs in sports talent identifying programs and also playing a role in developing sports-related activities at the fundamental level. At the beginning of 2005, the implementation of the program and mass sports activities had been expanded and it covered all parliament areas and state constituencies.

Malaysia also had expanded the implementation of its sports talent identifying program for people with disabilities. Starting from 2007, talent identifying tests was performed with these groups to prepare our country for the participation in the Paralympics Games in the regional (ASEAN) and international level. Consequently, athletes with disabilities showed good performances during the 4th Paralympics Games in Korat, Thailand in 2007. At that moment, 180 athletes from Malaysia finished in third place with 83 Gold, 74 Silver and 46 Bronze medals from 222 events participated. The continued excellence in the Paralympics Games,

Rio 2016 with Malaysian contingent won three gold and one bronze medal (www.paralympic.org, 2016).

The sports talent identification program remains a priority. The support from the Minister of Youth and Sports towards this program is strengthening with the collaboration of two ministries; Ministry of Youth and Sports and Ministry of Education in implementing the program (ISN, 2009).

The Ministry of Youth and Sports through the National Sports Council had developed curriculums that are related to the talent identifying program. There were a variety of programs included in the curriculums. Those programs were *Program Tunas Gemilang*, Athletes Foundation Program, General Talent Identifying Test Program, Specific Talent Identifying Test Program and Multi Lateral Program. All of these programs aimed to identify talents among children throughout the nation by using a set of general and specific talent identifying tests according to the age group of 7-9 years old, 10-12 years old and 13-15 years old (ISN, 2009).

The National Sports Institute (2009) had outlined the implementation methods of talent identifying program by sorting out the activities according to phases of tests, assessments and development programs. These phases contained a general and specific talent identifying test manuals, general and specific talent identifying course for the examiner, developing standards and norms of the test performance. It also included the following strategies:

1. Implementations of the general and specific talent identifying test
2. Analysis of test results, evaluation and decisions
3. Organization of talent development camps, development of training center, implementations of research and development activities
4. Establishment of national panels for the talent identifying and development program
5. Appointment of instructors all over the states

Malaysia should implement a comprehensive and systematic talent identification program. Sports professionals also agreed that the sports talent identification program is one of the programs that would lead to successful elite sports (Hoare, 1998). The process of sports talent identifying program had changed from an unstructured process such as talent selected based on results of tournaments to a more structured and systematic process.

Besides this, the Malaysian Government is very committed and has spent a large amount of budget for sports development. Sports development requires a comprehensive eco-system including infrastructure, administration and coaching, talent building from the early stages as well as the managing the welfare of athletes. Therefore, a total of 239 million Ringgit is allocated for excellence in sports including building and upgrading sports complexes, creating a pilot program of talent identification in primary schools and implement a Future Professional Coach program to hone the skills of potential coaches for selected sports (Ministry of Finance, 2014).

1.2 Problem Statement

Malaysia's involvement in the international sporting arena has been proven even before gaining its independence. Malaysia has participated in the Olympic Games since 1956, Asian Games since 1954, Commonwealth Games since 1950 and Sea Games since 1959. Malaysian athletes have won various medals in all the tournaments back then. To-date, Malaysia has yet to win a single gold medal at the Olympic Games despite winning silver and bronze medals before in Barcelona 1992 Olympic Games, Atlanta 1996, Beijing 2008 and London 2012 in badminton. In Rio 2016, Malaysia contingent won four silver medals and one bronze medal (Olympic Council of Malaysia, 2016). Therefore, now is the best time to seriously conduct a TID program in Malaysia in order to identify new talents that can help in realizing Malaysia's dream of getting a first gold medal in the Olympics Games.

In recent years, we can be proud of the achievements attained internationally and it is proven through the success and excellence gained by our own local champions, Datuk Nicol Ann David in squash (WISPA World Ranking, 2015) and Datuk Lee Chong Wei in badminton (BWF World Ranking, 2016). Both of them are holding the World No. 1 title in their own sports respectively. However, their best performance is still not quite encouraging because until now Malaysia still has not won a gold medal at the Olympic Games. Thus, in order to win a gold medal in the future, a lot of work needs to be done. Various preparations and athlete developments need to be analyzed, re-checked and restructured as soon as possible. Malaysia can not keep putting a burden on Datuk Lee Chong Wei to win a medal in Olympic because his increasing age would affect his performance (ISN, 2016). Therefore, among the steps that should be taken is by developing a new normative data for the specific sport to ensure accuracy in the TID program which will be implemented to seek new talents in youth particularly, to match them into the right sport activities.

Generally, ISN is one of the responsible authorities that carries out research related to sport sciences and also responsible in executing of the talent finding program to search for future athletes. Previously, the TID program focused on the anthropometric measurement, physical abilities and mental toughness assessment for early detection (ISN, 2009). However, it is also crucial to include other attributes in the TID program which include physiological, psychological and sociological components (Höner et al., 2015; Gabbett et al., 2007; Gabbett & Georgiff, 2005). These aspects are fairly important in enhancing the efforts of identifying the potential TID participants, with the intention that they can become elite athletes in the future (Falk et al., 2004). In addition, Hoffmann and Wulff (2015) stresses out that accurate assessment at the TID program will provide long-term positive impact on the development potential of young athletes. Therefore, in addition to the focus on physical, additional attributes such as physiological, psychological and sociological needs to be emphasized. Each has a specific characteristic and test depending on each type of sport.

Nevertheless, there is a limitation for ISN to conduct the specific planned program effectively due to the shortage of staffs and officers. Besides that, the

limitation faced by the ISN is not just the lengthy period taken to conduct the program, but also the higher implementation cost of the tour throughout the country. Therefore, using or inventing a system that can help to increase the efficiency of the process of the sport talent identification program is a need. TID technology is one of the ways that can help in smoothing the process of the sport talent identification program.

From the development aspect of the TID technology, Malaysia is still lagging behind compared to other established countries that had achieved good reputations internationally in sports. Those countries developed a technological system which has the purpose of identifying talents in various types of sport activities. The system also produces a convenient way of processing and analyzing the data. This shortens the time required for the implementation/execution of the TID program. For instance, Australia is using E-TID as the TID program software while Croatia uses The Expert System for Sports Talent Detection. Alternatively, Namibia is working with the Proactive TID and Slovenia is currently using the Sports Measurement Management System (Rogulj et al., 2006). However, these developed system only focused on the physical attribute such as physical abilities, morphological and functional test. However, these systems developed only focused on the physical attributes such as physical abilities, morphological and functional test. In addition, these systems are developed based on the suitability of the local population and normative data referred to not focus on the particular age of the target group.

Therefore, the researcher has now come out with the suggestion to develop a new normative data for specific sports based on the physical and physiological attributes. Whereas, the psychological and sociological attributes also be used as an indicator to the evaluation process. Then, the Sports Talent Identification Decision Support System (STIDSS) will be developed to make the determination based on the analysis of these characteristics and finally matches young people to their suitable sports based on the performance of their physical and physiological attributes and also can find out the level of mental toughness and the level of parental support.

1.3 Importance of the Study

This research is crucial in aiding and simplifying the execution and management of TID in Malaysia in terms of data keeping and analyzing the results of the tests and determination of the individual's talent towards the appropriate sports. At present, there is no practical and efficient data process system used in simplifying the analysis process for the collected raw data (ISN, 2012). The data collection is focused only on the anthropometric measurement and the motor skill abilities which are done separately through physiological and psychological tests according to certain phase. With the development of Sports Talent Identification Decision Support System (STIDSS), the process of evaluating the talent of an individual can be analyzed and interpreted objectively based on physical, physiological, psychological and sociological basic attributes.

Besides that, STIDSS also serves to reduce time consuming and the execution cost of the TID program in this country. With STIDSS in practice, ISN and the Ministry of Education under Sports, Arts and Co-curriculum Division especially the TID's unit will be able to identify and develop Malaysia's future sporting talent. Simultaneously, the application of STIDSS will enable teachers to operate TID in schools and get instant data processing and all data processed will store in the database.

STIDSS is a secure and systematic system where database application is included in this system. Only authorize individuals can access the data in the database to prevent misuse of the data. Using the database, the data are stored in one place where all the data can easily be filtered according to users need. This STIDSS also can be upgraded depending on changes in technology and based on the user's feedback from time to time. Lastly, this system is in line with all schools in this country. As a result, only the most talented individuals were selected scientifically and directed to the appropriate sport.

1.4 Objectives of the Study

The aim of this study is to develop an interactive computer software known as the Sports Talent Identification Decision Support System (STIDSS). Through the development of the software, young and new talented teenagers can be easily identified based on their performance of physical, physiological, psychological and sociological assessments.

In order to achieve the above aim, the following objectives have been identified:

- i) To investigate an anthropometric characteristic and develop specific normative data for general physical fitness characteristics of young athletes for ball sports, racket sports and target sports category.
- ii) To develop the specific normative data for maximum oxygen uptake demand of young athletes for ball sports, racket sports and target sports.
- iii) To analyze the level of mental toughness of Malaysian junior elite athletes in ball sports, racket sports and target sports.
- iv) To identify the levels of parental support among Malaysian junior elite athletes.
- v) To develop the STIDSS.
- vi) To evaluate the effectiveness of the STIDSS.

1.5 Research Questions

The purpose of the study is to develop the Sports Talent Identification Decision Support System (STIDSS). The study concerns the following research questions:

- a) What is the anthropometric characteristics of young athletes for ball games, racket sports and target sports?
- b) What are the specific normative data of general physical fitness for ball sports, racket sports and target sports?
- c) What are the specific normative data for estimated vo2max uptake for ball sports, racket sports and target sports?
- d) What is the level of mental toughness among Malaysian junior elite athletes?
- e) Is there any significant differences between ball sports, racket sports and target sports based on mental toughness sub-constructs; reboundability, pressure, concentration, confidence and motivation?
- f) What is the level of parental support among Malaysian junior elite athletes?
- g) What is the usability of the STIDSS?
- h) What is the accuracy of the STIDSS based on the physical and physiological evaluation?

1.6 Scope of the Study

This study focuses on developing a Sports Talent Identification Decision Support System (STIDSS) to help the process of evaluating the talent of an individual and the system can be analyzed and interpreted objectively based on physical, physiological, psychological and sociological attributes. In addition, this study only involved Malaysian and state sport schools children and focused on 3 categories of sport which are ball sports, racket sports and target sports. This study was started by identifying those basic attributes, followed by developing the system, testing the system and lastly examines the effectiveness of the system.

1.7 Limitation of the Study

All research conducted has limitations in order to avoid unreachable objectives. In this research, four limitations have been set. Firstly, this research only involves stage of detection and identification in TID phases. Second, nine sports that are selected were football, rugby, netball, hockey, badminton, squash, tennis, archery and ten pin bowling. Third, the age of subject selection should be 13 years old and they are young potential athletes that could become national elite athletes. Lastly, the testing component involves physical attributes that include anthropometry, a general motor skill component of physical fitness and flexibility. Physiological attributes cover on estimated vo2max intake, psychological attributes focus on mental toughness and finally sociological attributes looked into parental support.

1.8 Operational Definitions

Below are the operational definitions that will be used in this study. The definitions stated below are also functioned to differentiate the operational definitions in this study with other definitions that may be used in other studies.

1.8.1 STIDSS

Sports Talent Identification Decision Support System (STIDSS) is a new system for sports talent identification and was developed in this study.

1.8.2 Ball sports

Ball sports or ball games, or any form of the game or sport which feature a ball as part of the play. In this study, ball sports refer to football (soccer), rugby, netball, and hockey.

1.8.3 Racket sports

A racket or racquet is a sport consisting of a handled frame with an open hoop across which a network of strings or catgut is stretched tightly. It is used for striking a ball in games. In this study, racket sports refer to squash, tennis and badminton.

1.8.4 Target sports

Also as known as precision and accuracy sports. Target sports whose objective is to hit a target of various shapes and sizes (such as a pocket, hole, jack or bowling pin) using various means (such as a bow, firearm, billiard cue, ball or club). In this study, target sports refer to archery and ten pin bowling.

1.8.5 TID

TID refers to Talent Identification. It is the process of identifying sports talent which is a method of pursuing excellence in sports by using a scientific method through a few phases of tests and selections. There are four main phases in the process of identifying sports talent which are detection, identification, selection and development.

1.8.6 ISN

The National Sports Institute of Malaysia (ISN) role is supporting the comprehensive sports science development process in Malaysia. The Institute is equipped with the latest technology including the Sports Medical Clinic, medical laboratory, radiology unit, physiotherapy, injury rehabilitation gymnasium, conditioning gymnasium, biomechanics hall, training hall, physiological laboratory, nutrition facilities, sports technology and sports massage and sauna.

1.10 Summary

This chapter had discussed on the background of the study, problem statements, the important of the study, research objective and research questions, the scope and limitation of the study and operational definition. The next chapter will look into the literature review of previous research that relates to this study.

sports for every test battery that were used to measure physical abilities whereas estimated vo2max uptake was used to serve as a guide in assessing the junior athletes performance.

Recommended future research can include a wider variety of categories of sports such as athletics, combat sports and so on to allow this system to have a wide selection of sports. Also consider a few more added tests to the test battery based on specific sports requirements based on the nature of the sport itself. Further, it can be expanded to various age groups to get more young talents. Thus, with this addition, the criteria of specific normative data can be issued according to the type of sport or sports category. To strengthen the implementation of the TID program in Malaysia, researchers could include the next phase in TID which is talent selection and talent development. In terms of system development, this system needs to be improved in terms of usability in which is in line with the speed of the revolution in technology to provide a more efficient system.

REFERENCES

- A.Schmidt, R. (2010). *Motor Control and Learning-5th Edition*. United States: Human Kinetics.
- Abbott, A., Button, C., Pepping, G. J., & Collins, D. (2005). Unnatural selection: talent identification and development in sport. *Nonlinear dynamics, psychology, and life sciences*, 9(1), 61-88.
- Abbott, A. & Collins, D. (2004). Eliminating the dichotomy between theory and practice in talent and development: considering the role of psychology. *Journal of Sports Sciences*. 22, 395-408.
- Ackland, T. R. (2009). *Applied Anatomy and Biomechanics in Sport*. United States: Human Kinetics.
- Ahmad Hashim (2004). *Pengukuran Kecergasan Motor*. Tanjong Malim, Perak, Malaysia: Quantum Books.
- Aiken, L.R. & Groth-Marnat, G. (2006). *Psychological testing and assessment*. 12th Ed. Boston, MA: Pearson Education Group, Inc.
- Ajay Kumar Pandey, D. K. (2015). Relationship between explosive strength and agility of Football male players. *International Journal of Applied Research* , 303-305.
- Allender, S. (2006). Understanding participation in sport and physical activity among children and adults: a review of qualitative studies. *HEALTH EDUCATION RESEARCH*, 36.
- American College of Sports Medicine. (2014). *ACSM's Health-Related Physical Fitness Assessment Manual*. China: Chris Johnson.
- Amit Bandyopadhyay (2013). Validity of 20 meter multi-stage shuttle run test for estimation of maximum oxygen uptake in female university students. *Indian J physiol Pharmacol*. 57(1):77-83.

- Amusa, L.O. (2002). Talent Identification and sport development. *The Paralympic Movement: Sport Science and Physical Education Bulletin*: 35-50.
- Anderson, J. C., Funk, J. B., Elliott, R. & Smith, P. H. (2003). Parental support and pressure and children's extracurricular activities: Relationships with amount of involvement and affective experience of participation. *Applied Developmental Psychology*, 24, 241-257. Retrieved December 5, 2005 from Science Direct database.
- Andrew Mills, J. B. (2012). Identifying factors perceived to influence the development of elite youth football academy player. *Journal of Sport Science*, 119-120.
- Aranha, V. P., Joshi, R., Samuel, A. J., & Sharma, K. (2015). Catch the moving ruler and estimate reaction time in children. *Indian Journal of Medical and Health Sciences*, 2(2), 23-6.
- Arnots, R. B. and C.L. Gaines (1986). *Sports talent: Discovery your natural athletic talents and excel in the sports of your choice*. New York, Penguin.
- Asha, H., Halijah, I., Zainal, A. Z., Hayrol, S. (2009). *Manual Kecergasan Fizikal & Kenalpasti Bakat*. Skudai. Nasmak Sdn. Bhd.
- Australian Sports Commission (1998). *The National Talent Identification and Development Program: Instructional manual*. Australian Sports Commission, Belconnen, A. C. T. Australia.
- Baballa, J. F. (2011). Effect of 8-weeks circuit training programme on physiological and performance characteristics of university racket game players. *Journal of Asian Scientific Research*. 1(4): 143-149.
- Badminton World Federation. (Februari, 2016). Ranking. <http://www.bwfbadminton.org/>
- Baker, J. (2012). *Talent Identification and Development in Sport: International Perspectives*. New York: Routledge.
- Bar-Or, O. (1996). *The child and adolescent athlete*. Oxford: Blackwell Science.
- Barrett R. S. & J. M. Manning (2004). Rowing: Relationships Between Rigging Set-up, Anthropometry, Physical Capacity. Kinematics and Rowing Performance Rowing, *Sports Biomechanics*, 3(2): 221-235,
- Bassett, D. J. (2000). Limiting factors for maximum oxygen uptake and determinants of endurance performance. *Medicine and Science in Sport and Exercise*, 70-84.

- Battinelli, Thomas (2007). *Physique, fitness, and performance*. USA: Taylor & Francis Group LLC. p. 27. ISBN 0-8493-9197-0. Retrieved 7/8/2010.
- Bean, C., & Forneris, T. (2016). Examining the Importance of Intentionally Structuring the Youth Sport Context to Facilitate Positive Youth Development. *Journal of Applied Sport Psychology*, 1-16
- Becker, D. A., & Yannotta, L. (2013). Modeling a library website redesign process: Developing a user-centered website through usability testing. *Information Technology and Libraries (Online)*, 32(1), 6.
- Beets, M. W., Cardinal, B. J., & Alderman, B. L. (2010). Parental social support and the physical activity-related behaviors of youth: a review. *Health Education & Behavior*.
- Bergh U, S. B. (1999). The relationship between body mass and oxygen uptake during running in humans. *Med Sci Sports Exercise*, 205-11.
- Bloomfield, J., Polman, R., & O'Donoghue, P. (2007). Physical demands of different positions in FA Premier League soccer. *Journal of Sports Science and Medicine*, 6(1), 63-70.
- Bois, J., Sarrazin, P., Southon, J., & Boiché, J. (2009). Psychological characteristics and their relation to performance in professional golfers. *The Sport Psychologist*, 23, 252-270.
- Bompa, T.O. (1999). *Periodization: theory and methodology of training*. Champaign: Human Kinetics.
- Bompa, T.O. (1994). *Theory and methodology of training, 4th Ed*. Champaign: Human Kinetics.
- Bouchard, C. A. (1999). Familial aggregation for VO₂max response to exercise training. *Journal of Applied Physiology*, 1003-1008.
- Bradberry, D. R. (2010). *Strength, Flexibility, Functional Movement, And Injury In Collegiate Men Football Players*. uga.
- Brian J. Gordon and Jesus Dapena. (2006). Contributions of joint rotations to racquet speed in the tennis serve. *Journal of Sports Sciences*, 24 (1): 31-49
- Brown, A. & Green, T. (2006). *The Essentials of Instructional Design: Connecting Fundamental Principals with Process and Practice*. Prentice Hall.
- Brown. (2001). *Sports talent How to identify and develop outstanding athletes*. Champaign, IL, Human Kinetics.

- Brown. (2015). *Training for Speed, Agility, and Quickness, 3E*. United States: Human Kinetics.
- Bull, S. J., Albinson, J. G., & Shambrook, C. J. (1996). *The mental game plan: Getting psyched for sport*. Sports Dynamics.
- Bull, S. J., Shambrook, C. J., James, W., & Brooks, J. E. (2005). Towards an understanding of mental toughness in elite English cricketers. *Journal of Applied Sport Psychology*, 17, 209-227.
- Burgess, D. J., & Naughton, G. A. (2010). Talent development in adolescent team sports: a review. *International journal of sports physiology and performance*, 5(1), 103-116.
- Burns, Roberts B. (2000) Introduction to research methods. London: Sage Publication.
- Campos, F. A. D., Daros, L. B., Mastrascusa, V., Dourado, A. C., Stanganelli, L. C. R., & Campos, F. A. D. (2009). Anthropometric profile and motor performance of junior badminton players. *CEP*, 5596, 000.
- Castagna, C., Impellizzeri, F. M., Belardinelli, R., Abt, G., COUTTS, A., CHAMARI, K., & D'OTTAVIO, S. T. E. F. A. N. O. (2006). Cardiorespiratory responses to Yo-yo Intermittent Endurance Test in nonelite youth soccer players. *The Journal of Strength & Conditioning Research*, 20(2), 326-330.
- Castro-Piñero, J., Artero, E. G., España-Romero, V., Ortega, F. B., Sjöström, M., Suni, J., & Ruiz, J. R. (2009). Criterion-related validity of field-based fitness tests in youth: a systematic review. *British journal of sports medicine*.
- Cattell, R. B. (1957). Personality and motivation structure and measurement.
- Cetin, C., Karatosun, H., Baydar, M. L., & Cosarcac, K. (2005). A regression equation to predict true maximal oxygen consumption of taekwondo athletes using a field test. *Saudi medical journal*, 26(5), 848-850.
- Chatterjee, P., Banerjee, A. K., Das, P., & Debnath, P. (2008). Validity of 20 meter multi stage shuttle run test for prediction of maximum oxygen uptake in Indian female university students.
- Chin, N. S., Khoo, S., & Low, W. Y. (2009). Sex, age group and locality differences in adolescent athletes' beliefs, values and goal orientation in track and field. *Journal of Exercise Science & Fitness*, 7(2), 112-121.

- Christie, C. a. (2009). Impact of training status on maximal oxygen uptake criteria attainment during running. *South African Journal of Sports Medicine.*, 19-22.
- Chua Yan Piaw (2006). Kaedah dan Statistik Penyelidikan Buku . Kaedah Penyelidikan. Kuala Lumpur : Mc Graw Hill
- Chua Yan Piaw (2014). Kaedah dan Statistik Penyelidikan Buku . Kaedah Penyelidikan. Edisi Kedua. Kuala Lumpur : Mc Graw Hill
- Cinthuja, P. (2015). Physical fitness factors of school badminton players in Kandy district. *European Journal of Sports and Exercise Science*, 14-25.
- Claude Sarrazin, C. A. (Volume 5, Issue 4, December 2010). Simulation study of a decision-making model of squash competition, phase two: Testing the model through the use of computer simulation. *Human Movement Science*, Pages 373– 391.
- Clough, P. J., Earle, K., & Sewell, D. (2002) Mental toughness: The concept and its measurement. In I.Cockerill (Ed.), *Solutions in sport psychology* (pp. 32-43). London: Thomson Publishing.
- Coakley, J. (2003). *Sports in Society: Issues and Controversies, 5th editions*. Boston, MA: McGraw-Hill.
- Cohen, L., Manion, L., & Morrison, K. (2011). Planning educational research. *Research methods in education*. New York: Routledge Editors.
- Cohen, R.J. & Swerdlik, M.E. (2002). *Psychological testing and assessment: An introduction to test and measurement*. Ed. ke-5. Boston: Mcgraw-Hill.
- Conger, S. (2011). Software Development Life Cycles and Methodologies: Fixing the Old and Adopting the New. *International Journal of Information Technologies and Systems Approach (IJITSA)*, 4(1), 1-22.
- Cook, J. L., Kiss, Z. S., Khan, K. M., Purdam, C. R., & Webster, K. E. (2004). Anthropometry, physical performance, and ultrasound patellar tendon abnormality in elite junior basketball players: a cross-sectional study. *British journal of sports medicine*, 38(2), 206-209.
- Cooper, S. B. (2005). The repeatability and criterion validity of the 20 m multistage fitness test as a predictor of maximal oxygen uptake in active young men. *British Journal of Sports Medicine*, 19-26.
- Cooper, S. M., Baker, J. S., Eaton, Z. E., & Matthews, N. (2004). A simple multistage field test for the prediction of anaerobic capacity

- Connaughton, D., Hanton, S., Jones, G., & Wadey, R. (2008). Mental toughness research: key issues in this area. *International Journal of Sport Psychology*, 39(3), 192-204.
- Connaughton, D., Wadey, R., Hanton, S., and John, G. (2008). The Development and Maintenance of Mental Toughness: Perceptions of Elite Performers. *Journal of Sports Sciences*. 26. P. 83-95
- Côté, J., & Gilbert, W. (2009). An integrative definition of coaching effectiveness and expertise. *International Journal of Sports Science & Coaching*, 4(3), 307-323.
- Cox, R. H., & Liu, Z. (1993). Psychological skills: A cross-cultural investigation. *International Journal of Sport Psychology*.
- Creswell, John W (2009). *Research design : qualitative, quantitative, and mixed methods approaches* 3rd ed. London :SAGE Publications.
- Crust, L. (2007). Mental Toughness in Sport: A review. *International Journal of Sport and Exercise Psychology*, 5(3). P. 83-85.
- Crust, L., & Azadi, K. (2010). Mental toughness and athletes' use of psychological strategies. *European Journal of Sport Science*, 10(1), 43-51.
- Crust, L., & Clough, P. J. (2005). Relationship between mental toughness and physical endurance. *Perceptual & Motor Skills*, 100, 192-194.
- Csikszentmihalyi, M., & Robinson, R. E. (2014). Culture, time, and the development of talent. In *The Systems Model of Creativity* (pp. 27-46). Springer Netherlands.
- Daros, L. B., Osiecki, R., Dourado, A. C., Stanganelli, L. C. R., Fornaziero, A. M., & Osiecki, A. C. (2012). Maximum aerobic power test for soccer players. *J Exerc Physiol*, 15(2), 80.
- David W. C. (2010). Talent Development from a Positive Psychology Perspective. *Educational Research Journal*. Vol. 25, No. 1, Hong Kong Educational Research Association 2010.
- Davids, K., Lees, A. & Burtwitz, L. (2000). Understanding and measuring coordination and control in kicking skills in soccer: implications for talent identification and skill acquisition. *Journal of Sports Sciences (JSS)* 18(9), 703 – 714.

- Davies, R. C., Rowlands, A. V., & Eston, R. G. (2008). The prediction of maximal oxygen uptake from submaximal ratings of perceived exertion elicited during the multistage fitness test. *British journal of sports medicine*, 42(12), 1006-1010.
- Davis, H., & Zaichkowsky, L. (1998). Explanatory style among elite ice hockey athletes. *Perceptual and Motor Skills*, 87, 1075-1080.
- Donald Ary, Lucy Cheser Jacobs & Asghar Razavieh (2002). Introduction to research in Education. 6th edition. Wadsworth, USA.
- Dopsaj, M. (2000). EXTENT OF FLEXIBILITY AMONG ATHLETES IN DIFFERENT SPORTS GAMES - SOCCER, VOLLEYBALL, BASKETBALL AND HANDBALL. *The scientific journal FACTA UNIVERSITATIS*.
- Drinkwater, E. J. (2012). Fitness and Anthropometric Testing in Basketball Players. In *Handbook of Anthropometry* (pp. 1837-1856). Springer New York.
- Duda, J. L. (1989). Goal perspectives, participation and persistence in sport. *International Journal of Sport Psychology* 20: 42-56.
- Durand-Bush, N. and J. H. Salmela (2001). *The development of talent in sport*. In R. N. Singer, H. A. Hausenblas and C. M. Janelle. *Handbook of Sport Psychology* New York, John Wiley & Sons, Inc.:269-289.
- Duthie, G., Pyne, D., & Hooper, S. (2003). Applied physiology and game analysis of rugby union. *Sports medicine*, 33(13), 973-991.
- Dweck, C. S. (2000). *Self-theories: Their role in motivation, personality, and development*. Psychology Press.
- Eccles, J. S., & Harold, R. D. (1991). Gender differences in sport involvement: Applying the Eccles' expectancy-value model. *Journal of applied sport psychology*, 3(1), 7-35.
- Eckner, J. T., Richardson, J. K., Kim, H., Joshi, M. S., Oh, Y. K., & Ashton-Miller, J. A. (2015). Reliability and criterion validity of a novel clinical test of simple and complex reaction time in athletes. *Perceptual and motor skills*, 120(3), 841-859.
- Eckstein, R., Moss, D.M, Delaney, K.J. (2010). Sports Sociology's Still Untapped Potential. *Sociological Forum* 25 (3): 500-518.

- Edwards, A. M., Macfadyen, A. M., & Clark, N. (2003). Test performance indicators from a single soccer specific fitness test differentiate between highly trained and recreationally active soccer players. *Journal of Sports Medicine and Physical Fitness*, 43(1), 14.
- El-Hamid, M. G. (2012). Effect of Some Coordination Abilities Exercises on the Muscular Power and Record Level of Young Athletes in the Youth National Project. *World Journal of Sport Sciences* , vol : 6, p. 3.
- Elferink-Gemser, M., Visscher, C., Lemmink, K., & Mulder, T. (2004). Relation between multidimensional performance characteristics and level of performance in talented youth field hockey players. *Journal of Sports Sciences*, 22(11-12), 1053-1063.
- Elphinston, J. (2008). *Stability, Sport, and Performance Movement: Great Technique Without Injury*. Chester: Lotus Publishing.
en.wikipedia.org/wiki/Height_in_sports.
- Ertan, H. (2009). Muscular activation patterns of the bow arm in recurve archery. *Journal of Science and Medicine in Sport*, 12(3), 357-360.
- Falk, B, Lidor, R, Lander, Y & Lang, B. (2004). Talent Identification and Early Development of Elite Water-Polo Players: a 2-year follow up study. *Journal of Sports Sciences*. 22:347-355.
- FAN, K. B., & LI, Y. S. (2008). Evaluation of the Fitness of Outstanding Male Archery Athletes in China [J]. *Journal of Tianjin University of Sport*, 4, 018.
- Fagan, J. C., Mandernach, M. A., Nelson, C. S., Paulo, J. R., & Saunders, G. (2012). Usability test results for a discovery tool in an academic library.
- Faude, O., Meyer, T., Fries, M., & Kindermann, W. (2008). 1 Physiological testing in badminton. *Science and Racket Sports IV*, 5.
- Finkelstein1, S. (2005). Power in Top Management Teams: Dimensions, Measurement, and Validation. *Academy of Management*, vol. 35 no. 3 505-538.
- Fisher, R.J. and Borms, J. (1990). *The Search for Sporting Excellence*. Schorndorf: Verlag Karl Hofman.
- Flouris, A. D., Metsios, G., and Koutedakis, Y. (2005). Enhancing the efficacy of the 20 m multi-stage shuttle run test. *British journal of Sports Medicine*, vol 39: 166-170.

- Fua, W.-J. (2009). *The characteristics of plantar pressure in typical footwork of badminton*. Usa: Taylor & Francis.
- Gabbett, T. J. (2002). Physiological characteristics of junior and senior rugby league players. *British Journal of Sports Medicine*, 36(5), 334-339.
- Gabbett, T., Georgeiff, B., & Domrow, N. (2007). The use of physiological, anthropometric and skill data to predict selection in a talent identification junior volleyball squad. *Journal Sports Sciences*, 25, (12), 1337-1344.
- Gabbett, T., Georgeiff, B. (2007). Physiological characteristics of elite junior volleyball players over a competitive season. Strength and Conditioning Coach, *Journal Sports Sciences*: 13, 2-7.
- Gall, J.P., Gall, M.D. dan Borg, W.R. (2005). *Applying educational research a practical guide*. Boston: Allyn and Bacon.
- Galli, N. & Vealey, R. (2008). "Bouncing back" from adversity: Athletes' experiences of resilience. *The Sports Psychologist*, (22):316-335.
- Gavin, S., Christine, V., Daniel, C., Matthew, T. and D. M. Stasinopoulos. (2012). Centile curve and normative values for the twenty meter shuttle-run test in English schoolchildren. *Journal of Sports Sciences*. 30(7): 679-687.
- Gay, L.R dan Airasian, P (2003). *Educational research competencies for analysis and application*. New Jersey: Prentice Hall.
- Ghasemi, A., Yaghoubian, A., and Momeni, M. (2012). Mental Toughness and Success Levels Among Elite Fencers. *Advances in Environmental Biology*, 6(9). P. 2536- 2540.
- Gibson, A. (1998). *Mental toughness*. New York. Vantage Press.
- Girard, O., Chevalier, R., Leveque, F., Micallef, J. P., & Millet, G. P. (2006). Specific incremental field test for aerobic fitness in tennis. *British journal of sports medicine*, 40(9), 791-796.
- Goldberg, A. S. (1998). *Sports slump busting: 10 steps to mental toughness and peak performance*. Llumina Press.
- Golby, J., Sheard, M., & Lavallee, D. (2003). A cognitive-behavioural analysis of mental toughness in national rugby league teams. *Perceptual and Motor Skills*, 96, 455-462.

- Gore, C. J., Tanner, R. K., Fuller, K. L., & Stanef, F. (2013). Determination of maximal oxygen consumption (VO₂max). *Physiological Tests for Elite Athletes*, eds RK Tanner and CJ Gore (Champaign, IL: Human Kinetics), 103-122.
- Gould, D., & Carson, S. (2008). Life skills development through sport: Current status and future directions. *International review of sport and exercise psychology*, 1(1), 58-78.
- Gould, D., Hodge, K., Peterson, K., & Petlichkoff, L. (1987). Psychological foundations of coaching: Similarities and differences among intercollegiate wrestling coaches. *The Sport Psychologist*, 1(4), 293-308.
- Gould, D., Wilson, C. G., Tuffey, S., & Lochbaum, M. (1993). Stress and the young athlete: The child's perspective. *Pediatric Exercise Science*, 5, 286-286.
- Green, M. (2007). Olympic glory or grassroots development?: Sport policy priorities in Australia, Canada and the United Kingdom, 1960–2006. *The international journal of the history of sport*, 24(7), 921-953.
- Grice, T. (2003). *The development of KidTest 2002 update: A talent identification inventory for predicting success in sport for children*. Applied Research in Coaching and Athletics Manual 2003. US, American Press. 18.
- Grigoris G. Malousaris, Nikolaos K. Bergeles, Karolina G. Barzouka, Ioannis A. Bayios, George P. Nassis and Maria D. Koskolou. (2008). Somatotype, size and body composition of competitive female volleyball players. *Journal of Science and Medicine in Sport*. 11, 337-334.
- Gucciardi, D. F., Gordon, S., and Dimmock, J. A. (2009). Evaluation of Mental Toughness Training Program for Youth-aged Australian Footballers: A Quantitative Analysis . *Journal of Applied Sport Psychology*, 21. P. 307-232.
- Gulbin, J. (2001). From novice to national champion. *Athlete Development Journal Sports Sciences*: 24(1).
- Gupta, S. (2013). A CRITICAL ANALYSIS OF MENTAL TOUGHNESS AND WILL TO WIN BETWEEN THROWERS AND JUMPERS: A PSYCHOLOGICAL PROBE. *International Journal of Behavioural Social and Movement Sciences*, 2(2), 162-168.
- Gurmeet Singh, Rana Devender Kumar, Singh Kuldeep and Kaur Guneet Inder Jit. (2013). A Study of Mental Toughness Among Team Game Players. *International Journal of Sports Sciences and Fitness*, Volume 3(2).

- H.Felder. (2014). TRAINING EFFECTS OF PLYOMETRIC TRAINING ON JUMP PARAMETERS IN D- AND D/C-SQUAD BADMINTON PLAYERS. *Journal of Sports Research*, 22-23.
- Haff, G. G., & Triplett, N. T. (Eds.). (2015). *Essentials of Strength Training and Conditioning 4th Edition*. Human kinetics.
- Hahn, A. (1991). The concepts of talent identification in Australia. *The 18th ACHPER National Biennial Conference*, Perth, Australia Council for Health, Physical Education and Recreation Inc.
- Han, J. (2015). The Role of Ankle Proprioception for Balance Control in relation to Sports Performance and Injury. *BioMed Research International*.
- Harre, D. (1990). Principles of Sports Training. *Sportverlag*.
- Hasan M., Roel V., Stijn M., Marc M., Johan L., Matthieu L. & Renaat P. (2009). Anthropometric and performance measures for the development of a talent detection and identification model in youth handball. *Journal of Sports Sciences*, 27:3, 257-266.
- Hasballa, A. M. (2010). Variance as a Base for Training Coordinative Abilities and its Effect on Developing Some Defensive Moves for Handball Beginners. *World Journal of Sport Sciences 3* , 100-109.
- Helsen, W.F., Hodges, N.J., Van Winckel, J. & Starkes, J.L. (2000). The roles of talent, physical precocity and practice in the development of soccer expertise. *Journal of Sport Sciences*, 18: 727-736.
- Hoare, D.G. (1997). Talent Identification for Junior netball players. *Sports Coach*, 21(3), 32-33.
- Hoare, D.G. & Hunt, P. (1999a). The junior basketball talent identification project: part 1- anthropometric (physical) & physiological profiles. *X's and O's*, 6(1), 16-17.
- Hoare, D.G. & Hunt, P. (1999b). The junior basketball talent identification project: part 2- predicting player performance from test results. *X's and O's*, 6(2), 16-18.
- Hoare, D.G. & Warr, C.R. (2000). Talent Identification and Women's Soccer: An Australian Experience. *Journal of Sports Science*. 18: 751-758.
- Hoffmann, A., & Wulff, J. (2015). 7 Talent identification and development in Germany. *Managing Elite Sport Systems: Research and Practice*, 3, 107.

- Hoffman, J. R. (2008). The Applied Physiology of American Football. *International Journal of Sports Physiology and Performance*, 387-392.
- Höner, O., Schultz, F., Schreiner, R., & Votteler, A. (2015). 27 Prognostic validity of motor diagnostics in the German talent identification and development program. *International Research in Science and Soccer II*, 267.
- Houlihan, B., & Green, M. (Eds.). (2007). *Comparative elite sport development*. Routledge.
- Hrysomallis, C. (2007). Relationship between balance ability, training and sports injury risk. *Sports Medicine*, 547–556.
- Hui, L. I. U. (2000). Sports Biomechanical Principles of Power Serve Technique in Tennis [J]. *JOURNAL OF BEIJING UNIVERSITY OF PHYSICAL EDVCATION*, 2, 012.
- Hughes, M. D. (2010). The use of performance indicators in performance analysis. *Journal Of Sport Science*, pages 739-754.
- Hung, T. M., Tang, W. T., & Shiang, T. Y. (2009). A case study of integrated sport sciences for an olympic archer. *Journal of Medical and Biological Engineering*, 29(4), 164-171.
- Institut Sukan Negara (2009). Talent identification program. <http://www.isn.gov.my>
- Jarver, J. (1981). Procedure of talent identification in the U.S.S.R. *Modern Athlete and Coach*. 20: 3-6.
- Johannes C. S. Chun. (2007). *Identifying highly talented athletes: Conception and design of an expert system*. Munich, GRIN Publishing GmbH. Sport - Kinematics and Training Theory.
- Jonatan R. Ruiz, Gustavo S., Norton O., J. C. Ribeiro, Jose F. Oliveira and Jorge M. (2009). Criterion-related validity of the 20-m shuttle run test in youths aged 13-19 years. *Journal of Sports Sciences*. 27(9): 899-906.
- Jones, G. (2002). What is this thing called mental toughness? An investigation of elite sport performers. *Journal of applied sport psychology*, 14(3), 205-218.
- Jones, G. & Swain, A. (1995). Predispositions to experience debilitating and facilitative anxiety in elite and non-elite performers. *The sports Psychologist*. 9: 201-211.
- Kementerian Pelajaran Malaysia (2009). Program Kenalpastian Bakat Sukan. <http://www.moe.gov/bsukan/>

- Khurana, G. and Gupta, S. (2012). Study & Comparison of Software Development Life Cycle Models. *International Journal of Research in Engineering & Applied Science*. 2(2): 1513-1521.
- Kibler, W. B., Press, J., & Sciascia, A. (2006). The role of core stability in athletic function. *Sports medicine*, 36(3), 189-198.
- Kilding, A.E. (2006) Measuring and predicting maximal aerobic power in international-level intermittent sport athletes. *The Journal of Sports Medicine and Physical Fitness*, 46 (3), p. 366-72.
- Kim, H. B., Kim, S. H., & So, W. Y. (2015). The Relative Importance of Performance Factors in Korean Archery. *The Journal of Strength & Conditioning Research*, 29(5), 1211-1219.
- Ko, B. G., Gu, H. M., Park, D. H., Back, J. H., Yun, S. W., Lee, M. C., ... & Shin, S. Y. (2003). The Construction of Sports Talent Identification Models. *International Journal of Applied Sports Sciences*, 15(2).
- Koz, S. M. (2006). The Physical and Physiological Properties of Football Players from a Turkish Professional First-Division Football League. *Sports Journal*.
- Kozel, J. (1996). Talent identification and development in Germany. *Coaching Focus*: 5-6.
- Kuan, G., & Roy, J. (2007). Goal profiles, mental toughness and its influence on performance outcomes among Wushu athletes. *Journal of Sports Science and Medicine*, 6(2), 28-33.
- Kumar. (2010). A Study of Anaerobic Power and Capacity of Football Players. *Journal of Exercise Science and Physiotherapy*, Vol. 10. 2:97-103, 2014.
- Kumar, D. R. (2011). AN EFFECT OF MENTAL TOUGHNESS ON DIFFERENT LEVEL OF PARTICIPATION IN SOCCER PLAYERS. *The Shield*, 100-1119.
- Kumar, S., Singh, N. S., & Mitra, S. (2016). Comparison of mental toughness between male and female volleyball players of 12th south Asian games. *IJAR*, 2(6), 268- 270.
- Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educ psychol meas*.

- Le Gall, F., Carling, C., Williams, M., & Reilly, T. (2010). Anthropometric and fitness characteristics of international, professional and amateur male graduate soccer players from an elite youth academy. *Journal of Science and Medicine in Sport*, 13(1), 90-95.
- Lee, K., Shin, D. S., Han, M., & Lee, E. (1994). Developing the norm of Korean table tennis players' mental toughness. *Korean Journal of Sport Science*, 6, 103-120.
- Lees, A. (2003). Science and the major racket sports: a review. *Journal of Sports Sciences*, 707-732.
- Leger, L.A. and Lambert, J. (1982) A maximal multistage 20m shuttle run test to predict VO₂ max. *European Journal of Applied Physiology*, 49 (1), p. 1-5.
- Liston, K. (2011). Sports and Leisure. *Sociological review* 59(SUPPL. 1): 160-180.
- Loehr, J. E. (1982). *Athletic excellence: Mental toughness training for sports*. New York: Plume.
- Loehr, J. E. (1986). *Mental toughness training for sport: Achieving athletic excellence*. Lexington, MA: Stephen Greene.
- Loko, J. (1994). Talent selection procedures. *Modern Athlete and Coach* 32(1): 19-21.
- Lourenco, T. F., Martins, L. E. B., Tessutti, L. S., Brenzikofer, R., & Macedo, D. V. (2011). Reproducibility of an incremental treadmill VO₂max test with gas exchange analysis for runners. *The Journal of Strength & Conditioning Research*, 25(7), 1994-1999.
- MacNamara, Á., Button, A., & Collins, D. (2010). The role of psychological characteristics in facilitating the pathway to elite performance. Part 1: Identifying mental skills and behaviours. *The Sport Psychologist*, 24(1), 52-73.
- Mahar, M. T., Guerieri, A. M., Hanna, M. S., & Kemble, C. D. (2011). Estimation of aerobic fitness from 20-m multistage shuttle run test performance. *American journal of preventive medicine*, 41(4), S117-S123.
- Malina, R. M. (2010). Early sport specialization: roots, effectiveness, risks. *Current sports medicine reports*, 9(6), 364-371.
- Malina, R. M., (1994). Physical Growth & Biological Maturation of Young Athletes. *Exercise and Sports Science Review*, 22:389-434.

- Marques, M. C., Van den Tillaar, R., Gabbett, T. J., Reis, V. M., & González Badillo, J. J. (2009). Physical fitness qualities of professional volleyball players: determination of positional differences. *The Journal of Strength & Conditioning Research*, 23(4), 1106-1111.
- Marsh, C. E. (2012). Evaluation of the American College of Sports Medicine submaximal treadmill running test for predicting VO₂max. *The Journal of Strength & Conditioning Research*, 26(2), 548-554.
- Maud, P. J., & Foster, C. (2006). *Physiological assessment of human fitness*. Human Kinetics.
- Mayorga-Vega, D., Aguilar-Soto, P., & Viciano, J. (2015). Criterion-related validity of the 20-m shuttle run test for estimating cardiorespiratory fitness: A meta-analysis. *Journal of sports science & medicine*, 14(3), 536.
- Mayorga-Vega, D., Merino-Marban, R., & Viciano, J. (2014). Criterion-related validity of sit-and-reach tests for estimating hamstring and lumbar extensibility: A meta- analysis. *Journal of sports science & medicine*, 13(1), 1.
- McCrae, R. R., Costa Jr, P. T., Terracciano, A., Parker, W. D., Mills, C. J., De Fruyt, F., & Mervielde, I. (2002). Personality trait development from age 12 to age 18: Longitudinal, cross-sectional and cross-cultural analyses. *Journal of personality and social psychology*, 83(6), 1456.
- McGuine TA, K. J. (2006). The effect of a balance training program on the risk of ankle. *Am J Sports Med*, 1103-1111.
- McHugh MP, T. T. (2007). The effectiveness of a balance training intervention in reducing the incidence of noncontact ankle sprains in high school football players. *Am J Sports Med*, 1289-94.
- McLeod, T. C. (2008). The Effectiveness of Balance Training Programs on Reducing the Incidence of Ankle Sprains in Adolescent Athletes. *Journal of Sport Rehabilitation* , 316-323.
- McMillan, J. (2008). *Educational Research Fundamental for the consumer*. Boston:Pearson Allyn and Bacon
- McPherson, S. L. (1994). The Development of Sport Expertise - Mapping the Tactical Domain. *Quest*, 46, 223-240.

- Meylan, C., Cronin, J., Oliver, J. and Hughes, M. (2010). Talent identification in soccer: The role of maturity status on physical, physiological and technical characteristics. *International Journal of Sports Science and Coaching*. Volume 5, Issue 4, 1 December 2010, Pages 571-592.
- Middleton, S. C., Marsh, H. W., Martin, A. J., Richards, G. E., & Perry, C. (2004a). Discovering mental toughness: A qualitative study of mental toughness in elite athletes. Self Research Centre Biannual Conference, Berlin. Available from http://self.uws.edu.au/Conferences/2004_Middleton_Marsh_Martin_Richards_Perryb.pdf
- Miguel, M. M., David, V., Elena, H. H., Fátima, O. S., Michael, S., Manuel, D. F. and Francisco, B. O. (2014) Anthropometric, body composition and somatotype characteristics of elite female volleyball players from the highest Spanish league, *Journal of Sports Sciences*, 32:2, 137-148,
- Mikael Fogelholm. (1994). Effect of body weight reduction on sports performance. *Sports Medicine*. 18(4): 249-267.
- Mills, A., Butt, J., Maynard, I., & Harwood, C. (2012). Identifying factors perceived to influence the development of elite youth football academy players. *Journal of sports sciences*, 30(15), 1593-1604.
- Ministry of Finance (November, 2014). The 2014 Budget. <http://www.treasury.gov.my/pdf/bajet/.../ub14.pdf>
- Mohd. Majid Konting (2005). *Kaedah Penyelidikan Pendidikan*. Kuala Lumpur. Dewan Bahasa dan Pustaka.
- Mohamad Najib Abdul Ghafar (2011). *Pembinaan Analisis Ujian Bilik Darjah*. Edisi kedua. Penerbit UTM. Universiti Teknologi Malaysia.
- Mohamed, H., Vaeyens, R., Matthys, S., Multael, M., Lefevre, J., Lenoir, M., & Philippaerts, R. (2009). Anthropometric and performance measures for the development of a talent detection and identification model in youth handball. *Journal of Sports Sciences*, 27(3), 257-266.
- Mohan, T. (2003). *Linking promise to the podium Talent Identification and Development (TID) in New Zealand: A report to SPARC's board from the TID taskforce*, New Zealand Academy of Sport.
- Molenda, M. (2003). In search of the elusive ADDIE model. *Performance Improvement*, 42(5), 35-36.

- Morris, L., Sallybanks, J., Willis, K., & Makkai, T. (2004). Sport, physical activity and antisocial behavior in youth. *Youth Studies Australia*, 23, 47-52.
- Morrow Jr, J. R., Mood, D., Disch, J., & Kang, M. (2015). *Measurement and Evaluation in Human Performance*, 5E. Human Kinetics.
- Morris, T. (2010). Psychological characteristics and talent identification in soccer. *Journal of Sports Sciences*, 201-215.
- Naruhiro, H. N. (2008). Does performance on hang power clean differentiate performance of jumping, sprinting,. *Journal of Strength and Conditioning Research and changing of direction?*, 412-418.
- Nassis, G. P., Geladas, N. D., Soldatos, Y., Sotiropoulos, A., Bekris, V., & Souglis, A. (2010). Relationship between the 20-m multistage shuttle run test and 2 soccer-specific field tests for the assessment of aerobic fitness in adult semi-professional soccer players. *The Journal of Strength & Conditioning Research*, 24(10), 2693-2697.
- National Sports Council of Malaysia, (November, 1998). Talent identification program. <http://www.nsc.gov.my/>
- National Sports Council of Malaysia, (October, 2007). Talent identification program <http://www.nsc.gov.my/>
- Neuman, W.L.(2003). Social research methods: Qualitative and quantitative approaches. Ed.ke-5. Boston: Allyn & Bacon.
- Nobrega, A. P. (2005). Interaction between resistance training and flexibility training in healthy young adults. *Journal of Strength and Conditioning Research* , 842-846.
- Ooi, C. H., Tan, A., Ahmad, A., Kwong, K. W., Sompong, R., Mohd Ghazali, K. A., & Thompson, M. W. (2009). Physiological characteristics of elite and sub-elite badminton players. *Journal of sports sciences*, 27(14), 1591-1599.
- Olufemi A., Martin M., Comfort M., Kayode O., Jonathan A. & Isiaka O. (2010). Sport Talent Identification and Development in Nigeria: A Preliminary Investigation. *International Journal of Coaching Science*. 4(2): 3-13.
- Olympic Council of Malaysia (2011). Medal tally. <http://www.olympic.org.my/web/>
- Pajares, F. (2003). Self-efficacy beliefs, motivation, and achievement in writing: A review of the literature. *Reading & Writing Quarterly*, 19(2), 139-158.

- Pajares, F., & Schunk, D. H. (2002). Self and self-belief in psychology and education: A historical perspective. *Improving academic achievement: Impact of psychological factors on education*, 3-21.
- Paradis, G. P., Zacharogiannis, E., Mandila, D., Smirtiotou, A., Argeitaki, P., & Cooke, C. B. (2014). Multi-stage 20-m shuttle run fitness test, maximal oxygen uptake and velocity at maximal oxygen uptake. *Journal of human kinetics*, 41(1), 81-87.
- Patrick, H., Ryan, A. M., Alfeld-Liro, C., Fredricks, J. A., Hruda, L. Z., & Eccles, J. S. (1999). Adolescents' commitment to developing talent: The role of peers in continuing motivation for sports and the arts. *Journal of Youth and Adolescence*, 28(6), 741-763.
- Partridge, J. A. (2011). Current directions in social influence: Parents and peers. *Revista iberoamericana de psicología del ejercicio y el deporte*, 6(2), 251-268.
- Paul, M., Kumar Biswas, S., & Singh Sandhu, J. (2011). ROLE OF SPORTS VISION AND EYE HAND COORDINATION TRAINING IN PERFORMANCE OF TABLE TENNIS PLAYERS. *Brazilian Journal of Biomotricity*, 106-116 .
- Peltola, E. (1992). Talent Identification. *New Studies in Athletics*, 7 (3): 7-12.
- Pfleeger, S.L., Atlee, J.M. (2006). *Software engineering: theory and practice*, 3rd ed. Prentice Hall, Upper Saddle River.
- Phillips, E., Davids, K., Renshaw, I., & Portus, M. (2010). Expert performance in sport and the dynamics of talent development. *Sports Medicine*, 40(4), 271-283.
- Piaget, J.(1951). *Play, Dreams & Limitations in Childhood*. London:Routledge and Kegan Paul. IN: Smith, P.K., Cowie, H. & Blades, M. (2005). *Understanding Children's Development*. Blackwell Publishing. Printed in UK. Chapters 12 & 13.
- Piasecki, B. (2013). *Doing More with Teams: The New Way to Winning*. John Wiley & Sons.
- Pienaar, A.E., Spamer, M.J. & Steyn, H.S. (1998). Identifying and developing rugby talent among 10-year old boys: A practical model. *Journal of Sport Sciences*, 16(8), 691-699.

- Pilianidis, T., Marigli, H., Douda, H., Mantzouranis, N., Smilios, I., & Tokmakidis, S. (2008). Reliability and validity of a modified field test for the evaluation of aerobic performance. *Kineziologija*, 39(2), 117-123.
- Pinder, R. A., Renshaw, I., & Davids, K. (2013). The role of representative design in talent development: a comment on “Talent identification and promotion programmes of Olympic athletes”. *Journal of sports sciences*, 31(8), 803-806.
- Radwan, D. S. (2014). The impact of development of the special coordination abilities on the general skill ability for table tennis juniors under 12 years old. *International Journal of Science Culture and Sport*, 109-111.
- Rana, M. S. (2009). Assessment of mental toughness among high and low achievers Indian wrestlers: a comparative study. *The Shield-Research Journal of Physical Education & Sports Science*, 4.
- Razman, R., Cheong, J. P., Wan Abas, W. A. B., & Abu Osman, N. A. (2012). Anthropometric and strength characteristics of tenpin bowlers with different playing abilities. *Biology of Sport*, 29(1), 33.
- Rebello, A., Brito, J., Maia, J., Coelho-e-Silva, M. J., Figueiredo, A. J., Bangsbo, J., ... & Seabra, A. (2013). Anthropometric characteristics, physical fitness and technical performance of under-19 soccer players by competitive level and field position. *International journal of sports medicine*, 34(04), 312-317.
- Regnier, G., Salmela, J. & Russell, S.J. (1993). *Talent detection and development in sports*. In R.N Singer, M. Murphy & L.K Tennant (Eds.), *Handbook on research on sports psychology* :190-313.
- Reiser, R.A., & Dempsey, J.A. (Eds.) (2002). *Trends and issues in instructional design and technology*. Upper Saddle River , New Jersey : Merrill/Prentice Hall.
- [Reilly, T.](#), [Williams, A. M.](#), [Nevill, A.](#) & [Franks, A.](#) (2000). A multidisciplinary approach to talent identification in soccer. *Journal of Sport Sciences*, 18(9):695-702.
- Riordan, J. (1987). Talent Spotting in Eastern Europe. *Track Technique*: 3214-3220.
- Robert G., et.al. (2013). The Relationship between Dynamic Stability and Multidirectional Speed. *Journal of Strength & Conditioning Research*, 55-70.
- Robert M. Malina, e. (2008). *Growth, Maturation, and Physical Activity*. United States: Human Kinetics.

- Rogulj, N., Papic, V., & Plestina, V. (2006). Development of the Expert System for Sport Talents Detection. *Proceedings of the 7th WSEAS International Conference on Automation & Information*, Cartat, Croatia, June 13-15 (pp7-10).
- Royce, W. W. (1970). Managing the development of large software system: Concepts & Techniques. *Technical Papers of Western Electronic Show and Conventional (WESCON)*, Los Angeles, USA.
- Ruiz, J. R., Ramirez-Lechuga, J., Ortega, F. B., Castro-Pinero, J., Benitez, J. M., Arauzo-Azofra, A., & Zabala, M. (2008). Artificial neural network-based equation for estimating VO₂max from the 20m shuttle run test in adolescents. *Artificial intelligence in medicine*, 44(3), 233-245.
- Russell J. . Martindalea,et,al. (2005). *Talent Development: A Guide for Practice and Research Within Sport*. New York: Routledge, Volume 57, Issue 4, 2005.
- S.Majumdar, A. (2011). The Science of Speed: Determinants of Performance in the 100 m Sprint. *International Journal of Sports Science & Coaching* .
- Salmela, J.H. and Regnier, G. (1983). A Model for Sport Talent Detection. *Science Periodicals on Research and Technology in Sports*. Ottawa. Coaching Association of Canada.
- Sánchez-Muñoz, C., Zabala, M., & Williams, K. (2012). Anthropometric variables and its usage to characterise elite youth athletes. In *Handbook of Anthropometry* (pp. 1865-1888). Springer New York.
- Scanlan, T. K., Simons, J. P., Carpenter, P. J., Schmidt, G. W., & Keeler, B. (1993). The Sport Commitment Model: Measurement development for the youth-sport domain. *Journal of Sport & Exercise Psychology*, 15(1).
- Schunk, D. H., & Pajares, F. (2009). Self-efficacy theory. *Handbook of motivation at school*, 35-53.
- Schwab, S. (2012). The Impact of a Sports Vision Training Program in Youth Field Hockey Players. *J Sports Sci Med.* , 624–631.
- Sekulic, D., Spasic, M., Mirkov, D., Cavar, M. and Sattler, T. (2013). Gender-Specific Influences of Balance, Speed, and Power on Agility Performance. *Journal of Strength & Conditioning Research*. 27 (3): 802–811.
- Shailendra Kumar Yadav, S. K. (2015). Agility of high and low achievers male hockey players. *International Journal of Physical Education, Sports and Health*, 23-24.

- Shankar, P. F. (2007). Epidemiology of High School and Collegiate Football Injuries in the United States. *The American Journal of Sports Medicine*, 1295-1303.
- Shariff, Z. (2012). *Successful service delivery of mass sports programs in Malaysia* (Doctoral dissertation, Victoria University).
- Sheppard, J. M., Young, W. B., Doyle, T. L. A., Sheppard, T. A., & Newton, R. U. (2006). An evaluation of a new test of reactive agility and its relationship to sprint speed and change of direction speed. *Journal of Science and Medicine in Sport*, 9(4), 342-349.
- Shin, D., Kim, S., & Lee, K. (1993). A comparison of psychological factors between top level and average players. *Journal of Sport Science*, 4(1), 65-93.
- Siedentop, D. (2011). *Complete Guide to Sport Education*. United States: Hman Kinetics.
- Simonton, D. K. (1999). Talents and its development: An emergenic and epigenetic model. *Psychological Review* 106(3):435-457.
- Singh, A. S. (2013). Comparitive Study Of Mental Toughness Between The Players of Tae-kwon -Do And Cricket. *Indian Streams Research Journal*, 230-289.
- Singh, J., Dureja, G., & Singh, S. (2012). A cross sectional analysis of mental toughness and will to win among elite football players. *Brazilian Journal of Biomotricity*, 6(4).
- Smith, R. E. (2014). PERFORMANCE ANXIETY, COGNITIVE INTERFERENCE, AND CONCENTRATION ENHANCEMENT STRATEGIES IN SPORTS. *Cognitive interference: Theories, methods, and findings*, 261.
- Singh, R., & Kumar, R. (2011). AN EFFECT OF MENTAL TOUGHNESS ON DIFFERENT LEVEL OF PARTICIPATION IN SOCCER PLAYERS. *The Shield-Research Journal of Physical Education & Sports Science.*, 6.
- Smith, R.E. & Christsen, D.S. (1995). Psychological skills as predictors of performance and survival in professional basketball. *Journal of Sport and Exercise Psychology*. 17:399-315.
- Smith, P.K., Cowie, H. & Blades, M. (2005). *Understanding Children's Development*. Blackwell Publishing. Printed in UK. Chapters 12 & 13.
- Sommerville, I. (2004). *Software Engineering, 7th ed*. London. Pearson Education Ltd.

- Spamer, E. J. (2009). Talent identification and development in youth rugby players: A research review *South African Journal for Research in Sport, Physical Education and Recreation*, 31, (2), 109-118.
- Sporis, G., Jukic, I., Ostojic, S. M., & Milanovic, D. (2009). Fitness profiling in soccer: physical and physiologic characteristics of elite players. *The Journal of Strength & Conditioning Research*, 23(7), 1947-1953.
- Stephens, D.E., & Bredemier, B.J.L. (1996). Moral atmosphere and judgments about aggression in girls' soccer: Relationships among moral and motivational variables. *Journal of Sport & Exercise Psychology*. 18, 158-173.
- Stockbrugger, B. A., & Haennel, R. G. (2001). Validity and reliability of a medicine ball explosive power test. *The Journal of strength & conditioning research*, 15(4), 431-438.
- Stølen, T. (2005). Physiology of Soccer. *Sports Med* 2005, 501-536.
- Svensson, M., & Drust, B. (2005). Testing soccer players. *Journal of Sports Sciences*, 23(6), 601-618.
- Tan, B., Aziz, A. R., & Chuan, T. K. (2000). Correlations between physiological parameters and performance in elite ten-pin bowlers. *Journal of science and medicine in sport*, 3(2), 176-185.
- Thomas, R.W. & Beavis, N. (1985). *Talent Identification in Sport*. Report on behalf of Otago University and community sports trust for the New Zealand foundation Inc, Wellington, New Zealand. Pages 1-196.
- Tomkinson, G. R., Olds, T. S., & Gulbin, J. (2003). Secular trends in physical performance of Australian children: evidence from the Talent Search program. *Journal of sports medicine and physical fitness*, 43(1), 90.
- Tranckle, P., & Cushion, C. J. (2006). Rethinking giftedness and talent in sport. *Quest*, 58, 265-282.
- Tuffy, S. (2002). Racquet Sport: Training Shoulder Speed & Agility Drills. *Performance Training Journal*, 40-52.
- Unit Perancang Ekonomi. (2006). *Rancangan Malaysia ke-9 (2006-2010)*, 24, 501-508. Putrajaya. Jabatan Perdana Menteri.
- Vaeyens, R., Coehlo e Silva, M., Visscher, C., Philippaerts, R. M., & Williams, A. M. (2013). Identifying young players. *Science and soccer: Developing elite performers*, 3, 289-306.

- Vaeyens, R., Lenoir, M., Williams, A. M., & Philippaerts, R. M. (2008). Talent identification and development programmes in sports – Current model and future directions. *Sports Medicine*, 38, 703-714.
- Vallance, J.K.H., Dunn, J.G.H., & Dunn, J L.C. (2006). Perfectionism, anger, and situation criticality in competitive youth ice hockey. *Journal of Sport & Exercise Psychology*. 28, 383-406.
- Vanrossum, J. H. A., & Gagne, F. (2005). Talent development in sport. In Dixon, M. A.; Moon, S.M. *The Handbook of Secondary of Gifted Education*. Waco Prufrock Press, 281-316.
- Watson, A. W. S. (2014). *Physical fitness and athletic performance*. Routledge.
- Wheeler, S. (2012). The significance of family culture for sports participation. *International Review for the Sociology of Sport*, 47(2), 235-252.
- Wiersma, W. & Jurs, S.G. (2005). *Research Methods in Education: An introduction*. 8th ed. United States: Pearson.
- Williams, A. M. and A. Franks (1998). Talent identification in soccer. *Sports, Exercise and Injury*. 4:159-165.
- Williams, A. M. and T. Reilly (2000). Talent identification and development in soccer. *Journal of Sports Science* 18:657-667.
- Williams, M. & Davids, K. (1995). Declarative Knowledge in Sport - A By-Product of Experience Or A Characteristic of Expertise. *Journal of Sport & Exercise Psychology*, 17, 259-275.
- Withers, R. G. (2000). Determination of Maximal Oxygen Consumption (VO₂ max) or Maximal Aerobic Power. In: Gore, C.J., ed. *Physiological Tests for Elite Athletes*. *Australian Sports Commission*, 114–127.
- Women's International Squash Players Association. (March, 2015). Ranking. <http://www.wispa.net/>
- Woodman, T., & Hardy, L. (2003). The relative impact of cognitive anxiety and self-confidence upon sport performance: A meta-analysis. *Journal of sports sciences*, 21(6), 443-457.
- International Olympic Committee. (September, 2016) Medal tally. www.olympic.org
- International Paralympic Committee. (September, 2016) Medal tally. www.paralympic.org/results :
- Wu, C. H. (1992). Talent identification in China. *New Studies in Athletics* 7: 37-39.

- Yin, R.K. (2006). *Case Study Research: Design and Methods, 3rd ed.* Applied Social Research Methods Series, vol. 5. Prentice Hall, Englewood Cliffs.
- Witzig, Richard (2006). *The Global Art of Soccer.* USA: CusiBoy Publishing. p. 500. ISBN 0-9776688-0-0. Retrieved 7/8/2010.

PDF | Talent identification, orientation within wide variety of sports and events, and further selection is a complex multidimensional process. Purpose of the study was to scrutinize the systems of Talent Identification and Development available worldwide in order to suggest how...Â Well-adjusted system of Talent Identification, on the contrary is regarded as the first step to become an international athlete (Peltola, 1992). Talent identification as such, correct place Figure 1.2 Perceived potential of talent identification procedures to contribute to international success and mass participation (adapted from Strategy Unit, 2002, p.83) . 5. Figure 2.1 Relative importance of psychological, motor and biometric factors for talent identification and performance in Wrestling (adapted from Kunst & Florescu, 1971). 43. Figure 4.1 Histograms and normal distribution curves for raw scores on the physical tasks.