THE PHYSICAL FITNESS PROFILE OF HONG KONG ELITE WOMEN'S BASKETBALL TEAM PLAYERS (UNDER16)

BY

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We hereby recommend that the Honours Project by Miss Iu Tsz Yan entitled “The Physical Fitness Profile of Hong Kong Elite Women’s Basketball Team Players (Under 16)” be accepted in partial fulfillment of the requirements for the Bachelor of Arts Honours Degree in Physical Education and Recreation Management.

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ABSTRACT

In recent years, female basketball players are progressively increasing, research dealing with the performance capacity of elite Asian basketball player is still lacking. In such situation, studies of physiological characteristics of Hong Kong elite female basketball players (Under 16) are definitely insufficient. In this study, we would like to evaluate the physical fitness profiles of Hong Kong elite female basketball players (Under 16).12 players from the Hong Kong elite female basketball team, aged 14-16, were invited to participate in the study. The following means and standard deviations were obtained: height 169.42±3.82cm; weight 59.98±8.32kg; body fat 23.78±4.69%; shoulder width 34.83±3.64cm; chest 87.83±5.32cm; waist 71.75±6.47cm; hip 93.25±6.65cm; thigh 45.0±3.19cm; calf 36.33±2.90cm; flexibility 33.83±10.13cm; Left and right hand strength 28.17±3.13kg and 29.67±4.60kg respectively; leg power (vertical jump) 47.25±4.14cm; VO2max 51.03±3.84 ml/kg/min. These data were used to compare with other female and male

basketball players and also other sports players. The Hong Kong female elite basketball players did quite well in flexibility, agility, handgrip and leg power test. Yet, they did a bit poor in the Yo-Yo Intermittent recovery test, so it was suggested to have more training on cardiovascular fitness and at the same time the other physical fitness and the technique can also be improved in order to achieve a better performance .

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Introduction

Basketball is undoubtedly one of the most widely played games throughout the world, it is becoming increasingly popular in many countries and is played worldwide by more than 450 million people.(Schiltz et al. 2009) Besides men's game, women's game is also increasing in popularity. In Hong Kong, similar trend of women's basketball also happened. More and more females participated in basketball games, since the Hong Kong Amateur Basketball Association was founded on 1912. In the early stage, only nine sport clubs with men's team were affiliated with the association. A few years later, the sport becomes more popular due to constant visits by U.S.navy teams and teams from China. The standard was steadily raised when women basketball activities were promoted in 1930. It generally was enlarging local basketball programs. In 1936, basketball was included in Olympic Games as a result the popularity of this sport was greatly increased in Hong Kong. Furthermore, in recent years the association provided lots

of training programs, elite training programs, and local competitions for Hong Kong female basketball players in order to develop this sport. Hong Kong elite girl's basketball team (Under 16) also has the opportunities to represented Hong Kong to visit other countries in Asia to compete in many national competitions.

Previously, many coaches may think that physical fitness is not too important when comparing with skills, but Smith and Thomas (1991) indicated that successful performance in international basketball competition requires an appreciation of the physical demands of the sport and the capacities of the team to respond to those demands. Although the female basketball players are progressively increasing in recent years, research dealing with the performance capacity of elite Asian basketball player is still lacking. In such situation, studies of physiological characteristics of Hong Kong elite girl's basketball players (Under 16) are definitely insufficient. In this study, we would like to evaluate the physical fitness profiles of Hong Kong elite

girl’s basketball players (Under 16).

Statement of the Problem

The purpose of the study was to evaluate the physical fitness profiles of the Hong Kong elite girl’s basketball players (Under 16). The physical fitness profile includes the characteristics of the players in anthropometry, body composition, muscular fitness, cardiorespiratory fitness, agility and flexibility.

Definition of Terms

For a better understanding of this study, the terms that would be used commonly were defined as follow:

Hong Kong elite women’s basketball team players (Under 16)

In this paper, Hong Kong elite women’s basketball team players (Under 16)are defined as the top female basketball players in Hong Kong who represent the Hong Kong youth woman’s basketball team to participate in both national and local female Grade-A and B competitions.

Anthropometry

It is the measurement of body size and proportions. The measurements are body weight, height, circumferences, skin fold thickness and bony widths and lengths (Heyward,2002).

Cardiorespiratory Fitness

It is the ability of a person to perform dynamic exercise involving large muscle groups at moderate-to- high intensity for prolonged periods (Heyward, 1998).

Maximum Oxygen Uptake (VO2max)

Maximum Oxygen Uptake (VO2max) is defined as the maximal amount of oxygen that can be consumed per minute during maximal exercise (Noble, 1986). The VO2 max, or rate of oxygen uptake during maximal aerobic exercise, reflects the capacity of the heart, lungs, and blood to transport oxygen to the working muscles and the utilization of oxygen by the muscles during exercise. (Heyward, 1998)

Flexibility

It is the ability to move joints fluidly through complete range of motion without injury (Heyward, 1991).

Agility

Agility is the ability to rapidly and accurately change the position of the body in space. (Hastad, Lacy, 1998)

Body Composition

Body composition was a component of physical fitness which refers to the absolute and relative amounts of muscle, bone and fat tissues composing body mass (Heyward, 1998).

Muscular strength

It is defined as the ability of a muscle group to develop maximal contractile force against a resistance in a single contraction. (Heyward, 1998)

Vertical jump test

The vertical jump test was proposed to evaluate lower limb explosive power of athletes competing in various disciplines. (Chamari, et al. 2008)

Bioelectric Impedance Analysis (BIA)

BIA is a device used as determining body composition which included percentage body and fat free mass of the body. A specific amount of electrical current is transmitted through

the body, and the device calculates the resistance (impedance) of the body. As fat is a poor conductor of electricity, the resistance is directly related to the amount of fat in the body. The resistance is also related to the length (height) and cross-sectional area (weight) of the conductor (body). These data are required in predicting percentage body fat and fat free mass. (Anshel, Freedson, Hamill, Haywood,Horvat & Plowman 1991).

Delimitation

The followings are the delimitations included as part of the study:

1. The subjects of the study were delimited to the elite women basketball players from
   the Hong Kong woman basketball team (Under 16) who
   participated in both national and local female grade-A and
   B competitions.
2. The subjects of the study were delimited to the women team players aged between 14- 16 years old.
3. There are totally 12 subjects involved in this study.

4. All subjects will be taken the test in Dr. Stephen Hui Research Centre for Physical Recreation and Wellness and Wai Heng Sport Center located in Hong Kong Baptist University and Kowloon Tsai Park.

5. The time spent for testing each subjects was approximately one and a half hour.

Limitations

The following limitations were included in the study:

1. The data of tests were collected in different dates and time.

2. The study could not control the underlying variables such as injuries, sickness or tiredness.

3. The effort of the subjects in performing the tests was uncontrollable which might influence the results of the study.

4. Study findings were applicable only to the subjects included in this study.

5. The study could not control the subject’s daily life

behavior, such as smoking and drinking.

Significance of study

The significance of the study was to establish the physical fitness profile of the Hong Kong elite women's basketball team players (under16) in order to provide information for the coaches. Relevant information on the physiological characteristics of Hong Kong elite women's basketball players (under16)are important, useful and can be utilized by the coaches when planning a daily practice or a long term training. It can greatly help coaches to have better planning and increase the control over the player's physical workloads in order to plan a more quality training programs for the players so that they can improve their performance effectively, in addition, it can also help to reduce the injury rate of the players.

Chapter 2

Review of Literatures

The present study was to determine physical fitness profiles of Hong Kong elite female basketball players (under 16). The review of literatures was mainly divided into four sections: (a) physiological demands of a basketball player (b) anthropometry (c) cardiorespiratory fitness, (d) gender difference in basketball players and (e) a summary were included in the last section.

Physiological Demands of a Basketball Player

Basketball is a sport with many complex demands that require a combination of fitness, skills, team tactics and strategies, and motivational aspects. However key areas that are likely to play an important role in a basketball player's success are muscular strength, fitness and body size. (Drinkwater, 2006) The performance of the basketball players depended on different kinds of physiological characteristics. Since during the forty minutes game, players have to keep moving which contain aerobic and endurance content,

furthermore, they have to perform some explosive burst of activities such as jumping, sprinting, changing pace, turning, maintaining balance etc. Therefore, to become a successful elite basketball player there must be many factors to support it. Drinkwater, Pyne, McKenna (2008) stated that team sport performance is dependent upon a diverse range of qualities including size, fitness, sport-specific skills, team tactics, and psychological attributes. The game of basketball has evolved to have a high priority on body size and physical fitness. A player's size had becoming an important component on the position in the team, while the high-intensity, intermittent nature of the physical demands requires players to have a high level of fitness. Ziv, Lidor (2009) stated that height, weight, somatotype, relative size, aerobic profile, strength, anaerobic power, agility and speed were the general sub-components investigated in the physiological profiles of basketball players. Furthermore, the ability to jump higher, run faster, and demonstrate greater agility is skills that a successful basketball player must possess.

(Greene, McGuine, Leverson and Best ,1998)

Anthropometry

Anthropometry measurement included age, weight, height, specific segment lengths, skeletal breadths, limb circumferences and skinfold thickness (Malina, 1988). However, in this study, only age, height and weight and body composition of the basketball player would be investigated.

Age, height and weight are intricately related to performance in a specific sporting activity. Physical characteristics and body composition have been known to be fundamental to excellence in athletic performance (Mathur and Salokun, 1985). Hoare (2000) indicated that differences in anthropometric characteristics were present across some playing positions for both males and females. Moreover, best players always differed to rest players on a number of anthropometric and physiological variables for both males and females too

Height and Weight

Every event determines an optimal combination of height and

weight. In some events differences are obvious to a novice; basketball players are tall, gymnasts are short, endurance runners are lean. (Khosle, McBroom., 1985) In the basketball game, differences in physical attributes exist among playing positions and skill levels. There are clear differences in absolute size were found between guards, forwards and centers, but in terms of proportionality the latter two groups exhibited some similarities, particularly for measures of relative size in upper body dimensions. (Ackland, Schreiner, Kerr, 1997). In the study of Ostojic, Mazic ,Dikic(2006), it showed that centers were taller and heavier than guards and forwards, whereas forwards had significantly higher height and weight than guards . In another study on physiological differences in professional basketball players as a function of playing position and level of play, (Sallet, Perrier ,Ferret, Vitelli and Baverel,2005) stated that centers were significantly taller and heavier than forwards and guards.Furthermore,Ziv and Lidor (2009) also indicated that guards tend to be lighter, shorter and more

mesomorphic than centres. In another study by Bale (1991), centres had the largest measures of physique and body composition followed by the forwards and then the guards. The centres were much taller, had longer limb lengths, hip widths and were more muscular. In a later study, Carter, Ackland, Kerr, Stapff (2005) found that guards were taller and more ectomorphic, forwards were taller, with lower mesomorphy and higher ectomorphy, and centers did not differ.

Body composition

Body composition was another component of the anthropometry. It makes an important contribution to an individual's level of physical fitness. Gutin, Trinidad, Norton (1978) stated that performance, particularly in activities that require one to carry one's body weight over distance, will be facilitated by a large proportion of active tissue (muscle)in relation to a small proportion of inactive tissue (fat). However, in basketball game, there are different players who playing different positions, so they would have different body structure. Bale (1991) indicated that centers

had the largest measures of physique and body composition followed by the forwards and then the guards. In another study, Ostojic, Mazic ,Dikic. (2006) pointed out that centers had more body fat as compared with forwards and guards. Besides, Soh and Soh found that the centre and defence players had meso-endomorphic bodies, but the attack players endomosomorphic bodies. Moreover, the defences were the fattest, followed by the centre and attack players. Female American basketball players have a body fat content of 10 to 16 % while the Malaysian players in this study 10 % to 26 %. In the later study, Ziv and Lidor (2009) found that having a mesomorphic body type along with lower absolute weight can prove useful to guards, who often need to defend against the quickest players of the opposing team and to rapidly transfer the ball from defense to offence while attacking the quickest defenders of the opposite team. The lighter, shorter mesomorphic physique of guards is suitable to the speed and agility required of them. Although female guards were found to be more mesomorphic than centers, centers

still showed a higher FFM. When looking at the players' physique, it is suggested that physical characteristics be considered as a whole, since looking at only one aspect of the players' physique can be misleading.

Muscular Fitness

Leg power

The ability to jump higher, run faster, and demonstrate greater agility is skills that a successful basketball player must possess. (Greene, McGuine, Leverson and Best ,1998)And vertical jump is the most prevalent test used to assess anaerobic power in female and male players, since vertical jumps are among the most prevalent acts performed by basketball players in both defense such as blocking and rebounding, and offence such as shooting and rebounding.Ziv and Lidor (2009) stated that male and female players of higher skill levels tend to have higher vertical jump values. Also, differences in skill levels were found to be related to vertical jump capability. So, good jumping ability is

associated with achieving success in basketball.

Cardiorespiratory fitness

Cardiorespiratory fitness was a measure of maximum aerobic performance (Jones & Helms, 1993). Cardiorespiratory fitness reflected the cardiac and pulmonary function during exercise. A good cardiorespiratory fitness allowed players to perform better in the game. Good cardiorespiratory fitness is important to support basketball players to play as long as possible in the game as a basketball match is officially lasted for 40 minutes. Heyward (1998) stated that direct VO_{2max} measurement was considered as the most valid measure of functional capacity of the cardiorespiratory system by reflecting the rate of oxygen uptake maximal aerobic exercise. In the study of Ziv and Lidor (2009), they found that maximum aerobic capacity ($V\ O_{2max}$) values of female and male players are 44.0–54.0 and 50–60 ml/kg/min, respectively.

In the study of Cormery , Marcil , Bouvard and Rule (2008), they had compared a number of physiological variables as

measured during the two different periods -before the changes made by FIBA and after the realization of these changes. They found out and reported that these changes were associated with an increased V02 max in guards, but no significant changes in V02max in forwards and centers. Although it was suggested that the rule modifications were associated with physiological changes in the players (especially in guards), causation could not be established from this study, since other factors could have influenced the increased VO2max in guards, among them better training and conditioning programmes, and increased level of competitiveness in the top-level leagues.

Gender difference in basketball players

Indeed, the game of basketball had established itself as one of the most popular sport throughout the world. (Ziv and Lidor, 2009) Since the adoption of Title IX in 1972, the number of women competing in sports involving physical contact, pivoting, jumping, and sprinting has increased dramatically.

Coupled with this growth has been an increased awareness of performance and physiologic characteristics of female basketball players and of the sex differences that exist between them and their male counterparts. (Greene, McGuine, Leverson and Best ,1998)

Also, the popularity of women's basketball grew steadily around the world for decades because of the changing attitudes and the media coverage of women‘s sport, more women are interested in playing basketball game. However, there are some differences between the men’s basketball game and women’s basketball game. Men’s game is always with more power and faster speed than women’s, so men’s game are always much more exciting and attract more spectators. According to Drinkwater (1984), he stated that there seems to be at least three basic physiologic differences between men and women that affect the capacity for aerobic power. Women usually have a higher percentage of body fat, a smaller oxygen- carrying capacity, and a smaller muscle fiber area than men do. Also, from a review of studies on body composition in athletes by Wilmore (1983),

he stated that male’s basketball player weight is around 84to 109kg and their percent body fat would be 7 %to 11% whereas women basketball player’s weight is 63-64 kg with 21% to 27 % body fat. Moreover, a recent study on the neuromuscular performance of male and female athletes by Huston and Wojtys (1996), they stated that female subjects had significantly less strength in their quadriceps and hamstrings and significantly slower time to peak torque for knee flexion than the male. Furthermore, male players also showed higher values in isometric leg extension and trunk flexion and extension and male players took less time to produce maximal force compared with female players. (Häkkinen,1991). So male’s players can perform difficult action like jump shoot, slam dunk, second time layup easily by their preference condition. In addition, Greene, McGuine, Leverson and Best(1998)revealed that the males were able to jump significantly higher and run the 22.86-m (25-yard) shuttle run and 1 8.29-m (20-yard) sprint significantly faster than the female subjects. (Greene, McGuine, Leverson and Best ,1998)

Summary

From the above literature of review, we may understand that the success of a basketball player was determined by different factors. Physiological characteristics, anthropometry, cardiorespiratory fitness played an important role in the success of a player. There are a strong relationship exists between body composition, aerobic fitness, anaerobic power, and positional roles in elite basketball. In addition, height, weight and body composition might provide advantages in some playing positions. Cardiorespiratory fitness was a crucial factor affecting the performance of the basketball players. The better the cardiorespiratory fitness, the better the performance the players could be made and the longer the time that they could sustain their high level of performances.

Chapter 3

Methods

Subjects

There were twelve subjects participating in the test. All the subjects were Hong Kong elite women's basketball players, aged 14-16, were invited to participate in the study. They were the top youth female basketball players in Hong Kong who represent the Hong Kong woman basketball team to participate in both national and local female Grade-A and B competitions, and they were volunteered for the study. Participants were informed of the details such as the purpose and benefits of the study and they all provided written informed consent and physical activities readiness questionnaire (PAR-Q) before the test.

Procedures

In this study, there were five physical fitness components that used to assess the subjects. In each component, there were tests and measurement and they would be divided into lab test and field tests. There were eight parts of tests and

measurements, (1) body height and weight, (2) percentage body fat measure by using BIA device, (4) sit and reach test, (5)hand grip strength testing, (6) measuring shoulder width, circumference of chest, waist, thigh and calf, the length of leg and arm, (7) maximum oxygen uptake (VO2max) measurement of 1 mile jogging test (8) Yo-Yo intermittent Recovery Test. All lab tests were held in Dr. Stephen Hui Research Center of Physical Recreation and Wellness and the field test was held in the Joint Sports Centre and Wai Heng Sport Center at Hong Kong Baptist University.

For the lab test, the subjects would be taken the anthropometry components test first, then body composition would be measure by the BIA device, after that the flexibility, hand grip strength testing, vertical jump test measurement would be performed. Furthermore, for the field test, the 1 mile jogging test would be also taken at Joint Sport Center which located in Baptist University within the day. On the other hand, The Yo-Yo Intermittent Recovery Test and the side-steeping agility test (field test) were conducted in an indoor multi-

purpose hall in Wai Heng Sports Center which also located in Baptist University. And these two field tests were taken in another day.

Body height and weight measurement

The body height of the basketball players were measured by wall mounted stadiometer. The body weight of the basketball players were measured by (TANITA Body Composition analyzer TBF-410).

Percentage Body Fat measure by using BIA device

Percentage body fat was measured by a (TANITA Body Composition analyzer TBF-410). The subjects were told to take off their shoes and socks .Then tester has to input the subject’s sex, age and height to the machine. Normal mode was chosen and 0.5kg was deducted for the weight of their clothing. Subjects stood on the foot pad on the machine with bare foot and eyes looking forward. The results were printed out after the measurement.

Shoulder Width and Circumference of Chest, Waist, hip, Thigh and Calf Measurement

Shoulder Width Measurement.

Subjects were required to stand in an upright position with their clothes off, eyes looking forward and arms hanging at their sides. Testers stood behind the subjects and apply tape snugly over maximum bulges of the deltoid muscles, inferior to acromion processes, then record measurement at end of normal expiration. The width was read to the 0.1cm. (Callaway et al., 1988)

Chest Circumference

Subjects stood erect with feet at shoulder width and clothes off. Tester then applies a tape snugly around the torso at level of the fourth costo-sternal joints. Subjects slightly abducted their arm during the measurement. The measurement was made in a horizontal plane, and record measurement would at the end of a normal expiration (Callaway et al., 1988).

Waist Circumference

Subjects were asked to put off their clothes prior to the

measurement. Tape was placed around subjects’ waist in horizontal plane at level of narrowest part of the torso. An assistant is needed to position tape behind the client. Take measurement at end of normal expiration. (Callaway et al., 1988).

Thigh Circumference

Subjects were asked to flex the knee to 90 degrees (right foot on bench), then tester apply tape at the same level of the thigh skinfold measurement which was the midway between the midpoint of the inguinal crease and the proximal border of the patella. It was recorded to the nearest 0.1cm (Callaway et al., 1988).

Calf Circumference

Subjects were suggested to stand upright, and tape was placed horizontally around the maximum girth of calf .It was recorded to the nearest 0.1cm (Callaway et al., 1988).

Sit and Reach Test

The subjects were given 5 minutes to do some stretching

exercises before the test began. Subjects were required to take off their shoes. Then they have to sit in front of the modified sit and reach box (Acuflex I, Novel Products Inc. Addison,IL, U.S.) with legs extended, feet shoulder- width apart. The arms are extended forward with one hand on top of the other and finger pads on top of fingernails. The subjects reaches directly forward, palms down, along the measuring scale and they held the position for 3 seconds once they came to the farthest point. Three trials were conducted for both legs and the best score was used as the results.

Hand Grip Strength Test

A hand grip dynamometer (Takei Scientific Instruments Co.,Ltd, Japan) was used in the test. The dynamometer must first be adjusted to fit the subject’s handgrip size. Then the subject was in a standing position, and holds the dynamometer out to the size and squeezes the grip with their maximum strength for 3 seconds and without moving their arm. They were required to breathe out and keep their arms straight, when they squeezed the dynamometer. The subjects were tested

with both of their left and right hand alternatively. And there are total three trials for both hands. The best score was used as the subject's performance. (Heyward, 1984)

Vertical jump

The vertical jump test is measured by Vertec (Sports Imports Inc, Columbus, OH), the most common apparatus for measuring vertical jump. The subjects were asked to have 5 to 10 minutes warm up and light jogging, including one practice attempt before the test begin. The tests were then administered in random order for all subjects. The subjects then stands with both feet together and flat on the ground and the dominant arm near the device. Then take the standing height of the subject with one arm fully extended upward, then have the subject jump-up and touch the highest possible vane. The difference in distance between the standing reach height and the jump height is the score. Three jump trials are given with the best trial used. It was recorded in inches (in) to the closest 0.5 in, and then converts to centimeters to the closest 1cm. (Adams & Beam, 2008)

Yo-Yo Intermittent Recovery test

There were two kinds of Yo-Yo tests. The Yo-Yo Intermittent Recovery Test was one of the Yo-Yo tests which proposed by Bangsbo that to evaluate an individual's ability to recover after repeatedly perform intense exercise. Before the test start, the subjects were given 5 to 10 minutes to warm up and listen once to the radio type. When the test begin, the subject need to keep shuttle running for and back between the 20 meters markers at given speeds, controlled by a cassette tape. The test lasted for between 5 and 20 minutes, there was a 10 seconds pause between each exercise period (5-15 seconds).Performance in the Yo-Yo IR tests for young athletes increases with rising age. The Yo-Yo IR tests have shown to be a more sensitive measure of changes in performance than maximum oxygen uptake. The Yo-Yo IR tests provide a simple and valid way to obtain important information of an individual's capacity to perform repeated intense exercise and to examine changes in performance.(Bangsbo, Laia and Krustrup, 2008)

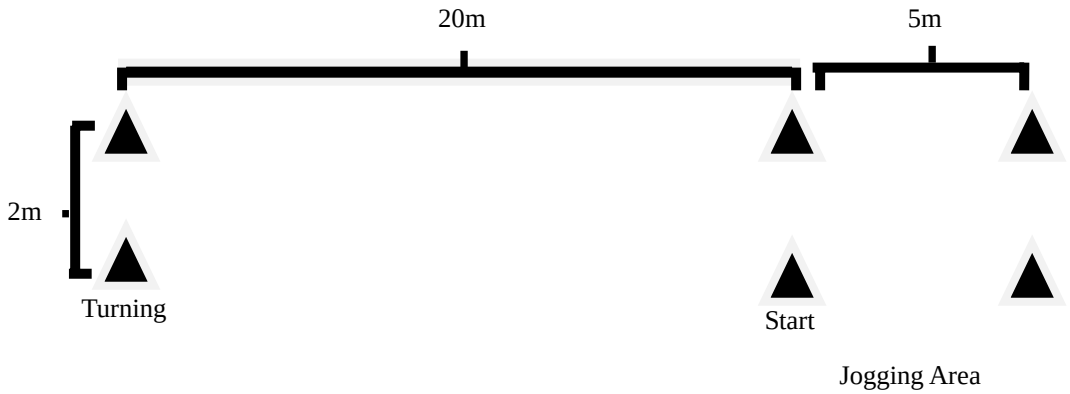

Figure 1. The setting of the Yo-Yo Intermittent Recovery Test

Agility Test

Side- stepping (state of North Carolina, 1977)

Two parallel lines are marked on the floor 12 feet apart. The subject assumes a starting position with one foot touching one of the lines. On the command “Go”, the subject moves sideward with a side-step (sliding) toward the other line. Once the lead foot has crossed the other line, the subject repeats the action back to the starting line and continues back and forth until time is called. The subject must face the same direction throughout the test and the feet must not cross. And the test last for 30 seconds

One mile jogging test

The subjects were given 5 minutes to do some stretching exercises before the test began. Before the test, instruct the subjects to select a comfortable, moderate jogging pace

and to measure their post exercise heart rate immediately following the test. The elapsed time for 1 mile should be at least 8 minutes for males and 9 minutes for females, and the post exercise heart rate should not exceed 180 bpm.

Method of Analysis

In this pilot study, the collected data were entered to were entered to the” Statistic Package of Social Science 14.0 for windows” (SPSS14.0) software. Means and standard deviations of each testing items were calculated.

Chapter 4

ANALYSIS OF DATA

The main purpose of this study was to attempt the physical fitness profile of Hong Kong elite women's basketball team players (Under16). This chapter was divided into two main sessions, which were results and discussions. In each session, it was generally divided into six physical fitness aspects; they were (a) anthropometry, (b) body composition, (c) flexibility and grip strength, (e) cardiovascular fitness and (f) leg power and agility.

Results

Twelve female Hong Kong elite basketball players who are under 16 were invited to take part in the study. The purpose of the study was to evaluate the physical fitness profiles of the Hong Kong elite basketball players. All the subjects were participated in some lab tests , one mile jogging test, agility test and the Yo-Yo Intermittent Recovery Test within two weeks.

Anthropometry

The physical characteristics of the subjects were summarized in Table 1. The age of the subjects was ranged from 14 to 16 years old with a mean of 15.5 years old and a standard deviation of 0.67 years. The weight of the subjects was ranged from 43.6 to 78.2kg with a mean weight of 59.98 kg and a standard deviation of 8.32kg. The height of the subjects was ranged from 159 to 175cm with a mean height of 169.42cm and a standard deviation of 3.82cm. The shoulder width of the subjects was ranged from 30 to 41 cm with a mean width of 34.83cm and a standard deviation of 3.64 cm. The chest circumference of the subjects was ranged from 77 to 99 cm with a mean of 87.83 cm and a standard deviation of 5.32 cm. The waist circumference of the subjects was ranged from 63 to 88 cm with a mean of 71.75 cm and a standard deviation of 6.47 cm. The hip circumference of the subjects was ranged from 82 to 105 cm with a mean of 93.25cm and a standard deviation of 6.65 cm. The thigh circumference of the subjects was ranged from 39 to 50 cm with a mean of 45 cm and a standard deviation of 3.19

cm. The calf circumference of the subjects was ranged from 31 to 41 cm with a mean of 36.33 cm and a standard deviation of 2.9 cm.

Table 1. *Physical Characteristics of Hong Kong female elite basketball players (N = 12)*

Variables	Minimum	Maximum	Mean ±SD
Age (yrs)	14	16	15.5 ± 0.67
Height (cm)	159	175	169.42 ± 3.82
Weight (kg)	43.6	78.2	59.98 ± 8.34
Shoulder width (cm)	30	41	34.83 ± 3.64
Circumference (cm)			
- Chest	77	99	87.83 ± 5.32
- Waist	63	88	71.75 ± 6.47
- Hip	82	105	93.25 ± 6.65
- Thigh	39	50	45.00 ± 3.19
- Calf	31	41	36.33± 2.90

Body Composition

The measurement of body composition of the subjects were using BIA device, and the mean and standard deviation of the subjects were presented in Table 2. The percent body fat of the subjects using BIA measurement was ranged from 16.8 to 31.5 %. The mean and standard deviation of the percent body

fat using BIA measurement were 23.78 and 4.69%, respectively. The fat mass of the subjects was ranged from 7.3 to 24.6 kg with a mean of 14.63 kg and a standard deviation of 4.64 kg. The fat free mass of the subjects was ranged from 36.3 to 53.6 kg with a mean of 45.22 kg and a standard deviation of 4.08 kg.

Table 2. *The body composition data of Hong Kong female elite basketball players (N = 12)*

Variables	Minimum	Maximum	Mean±SD
Body Fat (%)	16.8	31.5	23.78 ± 4.69
Fat mass (kg)	7.3	24.6	14.63 ± 4.64
Fat Free Mass (kg)	36.3	53.6	45.22 ± 4.08

Flexibility and grip strength

The results of handgrip strength test and the flexibility test for both sides was shown in Table 3. The handgrip strength for the left hand of the subjects ranged from 23 to 34kg with a mean of 28.17 kg and standard deviation 3.13 kg. For the right hand handgrip strength, it ranged from 23 to 37 kg with

a mean of- 29.67kg and standard deviation 4.6 kg. The flexibility of the subjects ranged from 17 to 48 cm with a mean of 33.83 cm and standard deviation of 10.13cm.

Table3. *Flexibility and Handgrip Strength of Hong Kong elite female basketball players (N=12)*

Variables	Minimum	Maximum	Mean ±SD
Handgrip L (kg)	23	34	28.17 ± 3.13
Handgrip R (kg)	23	37	29.67 ± 4.60
Sit and Reach (cm)	17	48	33.83 ± 10.13

Cardiovascular fitness

Maximum Oxygen Uptake (VO2max)

In Table 4, it showed that the basketball players had a minimum of 45.23ml/kg/min and a maximum of 56.41ml/kg/min in the VO2max test. The mean and standard deviation was 51.03 ± 3.84 ml/kg/min.

Table 4. Cardiorespiratory Fitness of Hong Kong female elite

basketball players (N = 12)

Variable	Minimum	Maximum	Mean ± SD
VO2max(ml/kg/min)	45.23	56.41	51.03 ± 3.84

Yo-Yo Intermittent Recovery Test

The total distances of the participants covered in the Yo-Yo Intermittent Recovery Test were ranged from 280 m to 1200 m. The mean and standard deviation of the distances were 680 ± 290.96 m.

Table 5. *The total distance covered in the Yo-Yo Intermittent Recovery Test of Hong Kong female elite basketball players (N = 12)*

Variable	Minimum	Maximum	Mean ±SD
Yo-Yo Distance (meters)	280	1200	680 ± 290.96

Leg Power

The mean and standard deviation of the subjects in the measurements of leg power of the subjects were presented in

Table 6. For the leg power test (vertical jump), the minimum jump height was 43 cm while the maximum was 56 cm. The mean was 47.25 cm and the standard deviation was 4.14 cm.

Table 6. *The leg power of Hong Kong female elite basketball players (N = 12)*

Variable	Minimum	Maximum	Mean ±SD
Vertical jump (cm)	43	56	47.25±4.14

Agility

In Table 7, it showed the total number of lines that the participants had touched. The range of the side- stepping test was ranged from 15 to 21times. The mean and the standard deviation of the number of times were 18.17 ± 1.53.

Table 7. *The total number of lines scored in the Side- Stepping Test of Hong Kong female elite basketball players (N = 12)*

Variable	Minimum	Maximum	Mean ±SD
Number of lines	15	21	18.17 ± 1.53

Discussion

Since, there were limited data about the physical fitness characteristics of young female elite basketball players in Hong Kong. Therefore, this study was to evaluate the physical fitness profiles of Hong Kong elite female basketball players who ages 14- 16. Accordingly, it aimed at helping the development in female basketball. The following discussion would divide into five parts: they are (a) anthropometry, (b) body composition, (c) flexibility and grip strength (d) cardiorespiratory fitness and (e) leg power and agility.

Anthropometry

The anthropometric measurement data of the Hong Kong elite female basketball player (under16) is all shown in table 1. In a study about the anthropometric and performance measures for high school basketball players, the mean age of the female basketball players is 16.02±1.16 years, and their mean height and weight of those basketball players are 61.4 ± 8.68 kg and 1.66 ± 7.42 m respectively which was similar to Hong Kong female basketball player in our study. (Greene, McGuine, Leverson

and Best ,1998) In another study which about the differences in neuromuscular strategies between landing and cutting tasks in female basketball and soccer athletes, the mean age of the female basketball players is 15.1± 1.7 years, and the mean height and weight of their player are 165.3± 7.9 cm and 61.8± 9.3 kg which were almost the same as our study.(Cowley, Ford , Myer, Kernozek and Hewett,2006)

However, on another two studies one is about the Anthropometric, body composition and somatotype differences of Greek elite female basketball, volleyball and handball players (Bayios et al. 2006) and the other is about the physiological demands of competitive basketball (Narazaki et al.2008). The mean height and weight of their basketball players are 174.7± 7.8 cm, 71.5 ± 10.1kg and 174.2 ± 9.0, 66.9 ± 58kg respectively. In our present study, the mean height (169.42 ± 3.82cm) and the mean weight (59.98 ± 8.32 kg) of the Hong Kong elite female basketball players were relatively shorter and lighter than the foreign elite basketball players .On the other hand, Ziv and Lidor (2009) stated that

differences in physical attributes exist among playing positions and skill levels. The characteristics in female or male basketball players, it is observed that differences in height and weight among players playing different positions (e,g, guards, forwards and centers). For example centers were always heavier and taller than guards. The tall and heavy build of centers is useful in their physical low-post battles. The guard, forward and center's height and weight measurement data are shown in table 8, 9 and 10. The mean height and weight of the centers are comparatively higher than the forward and guard.

Table 8. *The height and weight of the guards of Hong Kong female elite basketball players (N = 4)*

Variable	Minimum	Maximum	Mean ±SD
Height (cm)	159	171	167.25 ± 5.56
Weight (kg)	43.6	62.76	57.5 ± 9.30

Table 9. *The height and weight of the forwards of Hong Kong female elite basketball players (N = 6)*

Variable	Minimum	Maximum	Mean ±SD

Height (cm)	168	171	169.33 ± 1.03
Weight (kg)	50.5	62.6	58.08 ± 4.78

Table 10.*The height and weight of the centers of Hong Kong female elite basketball players (N = 2)*

Variable	Minimum	Maximum	Mean ± SD
Height (cm)	173	175	174 ± 1.41
Weight (kg)	63.1	78.2	70.65 ± 10.67

In another study which is the comparison of physical and physiological variables for female college basketball players. The mean height and weight of the guard is 169.55 ± 3.86cm and 62.15 ± 5.03 kg, compare with the guard in Hong Kong they are slightly taller and heavier than the foreign player. And for the mean height and weight of forward are 179.56 ± 3.71 cm and 73.61 ± 6.55kg which is much taller and heavier than the forward in Hong Kong. Lastly is the mean height and weight of the centers in foreign countries. They are 188.09 ± 5.46 cm and 79.99 ± 7.29 respectively; by comparing with the centers player in Hong Kong elite female basketball team they are obviously taller and much heavier. LaMonte et. al. (1999) As basketball game is a kind of contact sport, the players should be stronger, bigger and taller than other people. However,

according to the measurement data, the Hong Kong elite female basketball players were comparatively shorter, lighter than the others.

Body composition

The result of the Hong Kong elite female basketball player's body composition measurement was shown in table 2. A study on body composition in athletes by Wilson (1983), the general range of the female basketball player's percentage body fat was 21%- 27%. In the present study, the average percent body fat of the Hong Kong elite female basketball player was 23.78 ±4.69% and the FFM is 45.22±4.08. One of the studies about the Anthropometric, body composition and somatotype differences of Greek elite female basketball, volleyball and handball players (Bayios et al. 2006), the mean of the percent body fat and the FFM were 24.3±3.6% and 53.6 ±6.8 kg respectively which is higher than the Hong Kong elite basketball player. Moreover, in another study on anthropometric measurements and body composition of selected national athletes (Wan, Ismail & Zawiak, 1996), the mean

percent body fat was 25.6 ±4.7% which is also higher than the female basketball player in Hong Kong. Yet, one of the other studies which about the Anthropometric body composition and performance variables of young elite female basketball players.(Bale, 1991) Their measurement had divided the player position into guard, forward and center to evaluate. In table 11, 12 and 13, the percent body fat and FFM of the guards, forward and center are shown. By compare with the study, their mean percentage body and FFM were 17.9 ± 1.1% and 47.5 ± 4.9kg, the percent body fat of the guards in Hong Kong was higher than the foreign guard players; however the FFM of the guards in Hong Kong was relatively lower than them. For the forward players, the mean of the percent body in Hong Kong was higher than the foreign player (17.9± 2.3%) and the mean of the FFM in Hong Kong was lower than the foreign player (52.4 ± 3.2 kg). For the center, the mean of the percent body fat of elite female basketball players in Hong Kong is much higher than the foreigner (18.3± 2.3 %) and lower in FFM (58.1 ±4.7 kg). The percent body fat of foreign players is relatively lower

when comparing with the Hong Kong female basketball player, oppositely the FFM of the foreign players is higher than the Hong Kong player. Since the foreign players training load maybe comparatively higher than those in Hong Kong and all the subjects are in secondary school so their growth are not stable yet, therefore the percent body fat of female elite basketball player in Hong Kong is relatively higher than the foreign female basketball players.

Table 11. *The percent body fat and FFM of the guards of Hong Kong female elite basketball players (N = 4)*

Variable	Minimum	Maximum	Mean ± SD
%Body fat	16.8	26.9	22.86 ± 4.59
FFM (kg)	36.3	47.8	44 ± 5.21

Table 12. *The percent body fat and FFM of the forwards of Hong Kong female elite basketball players (N = 6)*

Variable	Minimum	Maximum	Mean ±SD
%Body fat	17.8	29.4	23.02 ±4.75
FFM (kg)	41.1	45.6	44.20 ±1.61

Table 13.*The percent body fat and FFM of the centers of Hong Kong female elite basketball players (N = 2)*

Variable	Minimum	Maximum	Mean ± SD

%Body fat	24.2	31.5	27.85 ±5.16
FFM (kg)	47.8	53.6	50.7 ±4.10

Flexibility and grip strength

In the present study, the range of the flexibility is 17 to 48 cm and the mean of the flexibility of the Hong Kong elite female basketball players was 33.83 ± 10.13cm which is all showing in table 3. In general, most of the players's flexibility is above average and satisfactory. In a study on physiological profile of Hong Kong elite soccer players,(Chin, Lo, Li, So, 1992)the flexibility of the soccer players is 31.0±7.0 cm which is similar to the Hong Kong elite basketball players. Moreover, the flexibility results of different positions are different. Guards have the highest flexibility, their mean is 40.5± 5.07cm, and forward their mean is 32.17±10.7cm, yet center got the worst result with the mean 25.5±12.02cm by compare with the other two. This poor flexibility indicated tight hamstrings which may be due to the design of training and the specific stretching. (Chin et al., 1992)Besides, in the handgrip test, the mean of the right

and left handgrip were 29.67±3.13 and 28.17±3.13kg respectively which were presented in table 3. According to the norms of static strength for women , for the left and right grip ,> 37kg and >41 kg was stated as excellent, 34-36kg and 38-40kg was stated as good , 22-33kg and 25-37kg was stated as average , 18-21kg and 22-24kg was stated as poor and <18 and <22kg will be stated as very poor. The left and right handgrip result of the Hong Kong elite female basketball players was both in average. Furthermore, there is no difference among players playing different positions in left and right dynamic hand grip strength. Forwards, guards and centers of the Hong Kong elite female basketball team have the similar result. (Ziv and Lidor, 2009)

Cardiovascular fitness

The mean and standard deviation of the maximum oxygen uptake (VO2max) of the Hong Kong elite female basketball players was 51.03 ± 3.84 ml/kg/min. According to Gal and Ronnie (2009), they stated that the maximum aerobic capacity (VO2max) of female basketball players should be ranging from 44.0 to

54.0 ml/kg/min. In a study on national male sepak takraw players, the mean VO 2 max relative is 53.5 ± 5.5 ml/kg/min. (Jawis, Singin, Singin and Yassin, 2005). In another study on the professional elite male basketball players (Cormery, Marcil and Bonvard,2008),their study divided the players according to their position and their result of the mean VO 2 max for the guards is 54.0 ml/kg/min, which is higher than the guards in Hong Kong elite female basketball team with 51.9 ml/kg/min. And the mean VO 2 max of the national male forwards is 45.5 ml/kg/min and the mean of male centers is 41.7 ml/kg/min while the VO2 max mean value of Hong Kong elite female forwards and centers is 52.71 ml/kg/min and 49.27 ml/kg/min respectively which is much higher than the national male forward and centers.

In the present study, the mean value of VO $_2$ max of the subjects was satisfactory. It is inside the range of the norm and also by compare with the other countries players, their mean of VO2 max are relatively higher. Hong Kong elite female basketball team had adequate aerobic training throughout the

whole training sessions since basketball game is last for 40 minutes, sometimes it even last for longer in some final matches, because the time will be stopped during the game including the penalty shoot or time out.

Yo-Yo Intermittent Recovery Test

The mean and standard deviation of the distances that the Hong Kong elite female basketball players covered were 680 ± 290.96 m. In a review article written by Bangsbo, Laia and Krustrup (2008), the title was “The Yo-Yo intermittent recovery test: a useful tool for evaluation of physical performance in intermittent sports”. Studies have also shown that the Yo-Yo intermittent recovery test is more sensitivity when compared to VO2-max test in detecting seasonal changes in fitness status and in discriminating players’ performances at various age groups, competitive levels, between different playing positions and after periods of changes in training. Moreover, the Yo-Yo intermittent recovery test is useful for evaluating continuous sports such as soccer, handball, basketball, netball and running etc. Data from the Yo-Yo

intermittent recovery level 1 (IR1) tests, it showing the mean distance of the national female soccer players with different level, for top-class ,the mean is 1600m; elite players , the mean is 1360m and for the sub-elite players, their mean is 1160m. In addition, in the female young elite-badminton players who are age 21 years, their mean is 1200 m; and age 17 years which is 1080 m. Also, in a group of state-level female hockey players who are under 21, their mean distance is 840 m. The national female soccer, badminton and hockey players, their mean distance is much more than the Hong Kong elite female basketball players. It is almost a half distance less than the national players.

Leg power and Agility

The mean leg power and agility of the Hong Kong elite female basketball players were 47.25 ±4.14 cm and 18.17±1.53 lines respectively. According to Gal and Ronnie (2009), they stated that female players of higher skill levels tend to have higher vertical jump values, the more skilled female players are faster and more agile than the less skilled players, and

guards tend to perform more high-intensity movements during game play compared with forwards and centers. A normative data for various squads collected between 1993 and 1996 (David, 1999), the mean leg power of the female junior was 46.2±5.6cm. In another study of the anthropometric and performance measures for high school female basketball player's .The mean ± SD vertical jump height was 46.36 ± 5.59 cm. (Greene et al., 1998)In our study, the result was quite similar to the other research. And our subjects were doing very well in the vertical jump test and also the side stepping test, since being a successful basketball player should have the ability to jump higher, run faster, and demonstrate greater agility. Moreover, stronger leg muscles and better agility can also help to prevent injury during the games, so it is highly encourage the basketball players to have more leg strength and power exercise training.

Recommendation

Based on my findings, the cardiovascular fitness and isometric strength seems to be weaker among all physiological components. They perform poor in the Yo-Yo intermittent Recovery test which indicated that their ability to recover after repeatedly perform intense exercise is weak. Therefore, they are suggested to work out in fitness room in order to build up their body muscle to support their movement during the game, they can hold on the chin up bar or hold a push-up position for a period of time. Moreover, shuttle run and 9 minutes run can be also work within the training to improve their cardiovascular fitness. Besides, flexibility is also very important to the players which can help to enhance performance, maintain balance and prevent injuries and as the female players still have a room to improve, so more stretching exercises before and after the practice is highly encourage.

Chapter 5

SUMMARY AND CONCLUSION

This study aimed to evaluate the physical fitness profile of the female elite basketball player in Hong Kong. The tests included ten testing components, 1. body height and weight measurement, 2. percentage body fat measure by using BIA device, 3. measurement of shoulder width and circumference of chest, waist, hip, thigh and calf, 4. hand grip strength test, 6. sit and reach test, 7.vertical jump test by using vertec, 8. one mile jogging test, 9. agility side-stepping test, 10. Yo- Yo intermittent recovery test.

Summary of Results

This study showed that the Hong Kong elite female basketball team players were generally younger, shorter and lighter than the other elite female basketball players in other foreign countries. Moreover, our guards were slightly taller and heavier than the foreign guard players. The female forward and center players in Hong Kong were shorter and lighter than those in foreign countries. The Hong Kong elite

female basketball players were thinner when comparing with the foreign players our subjects had lower percent body fat. The flexibility of the Hong Kong elite female basketball players was not bad, especially the guard players, they got the highest flexibility while the centers got the worst flexibility. The handgrip result of the female elite basketball players in Hong Kong was only average, which means that their muscular strength need to be improved. Besides, the mean vertical jump height of the Hong Kong elite female basketball players was similar to the national level. They were also got a good cardiovascular fitness when comparing with the female and male players in other countries. Similarly, they also performed a good agility in the side-stepping test. However, the mean distance in Yo-YO intermittent recovery test were not as good as other female elite athletes

Conclusions

Despite the female basketball is not as famous and popular as the male basketball however this study provided information about the physical fitness profile of the elite female

basketball players in Hong Kong. This information is helpful and useful for the well- development of the female basketball in Hong Kong. Moreover, it can also work as a reference or a record of selecting and training the players to be a higher level player with a new or modify effective training program in order to enhancing the future development of basketball in Hong Kong. Comparing with the previous study, the data of the present study showed that the Hong Kong elite female basketball players tended to be lighter, shorter and thinner than the other foreign athletes. The body shape of the Asian is always smaller than the westerner. Besides, the flexibility, muscle strength, leg power and the agility of the Hong Kong female basketball players were average to above average, which means that they still have a room to improve their level of fitness in order to enhance better performance and to reduce to risk of getting injury. Besides, the female basketball players perform a bit poor in the Yo-Yo intermittent recovery test. Cardiovascular fitness is very important to very aerobic sport athletes. As the previous studies mentioned, basketball

game p layers cover about 4500–5000 m during a 40 minutes game with a variety of multidirectional movements such as running, shuffling and dribbling at variable velocities and jumping(Metin, Yildiz, Bayraktar , Yucesir, Kasap and Cakar, 2010), therefore, better cardiorespiratory fitness was necessary to improve all physiological aspects of the players. Being a successful basketball player, not only skills are needed but also the physical fitness including the health-related fitness and sport- related fitness. Therefore, if the team wants to show their improvement or to perform a higher level of skills in order to reach the international level, a better training program is needed for the players. In addition, coaches should also provide specific training to different position players and training should be included both physical fitness and also technical and technique training.

Recommendations for Further Study

The recommendations for further study are shown as follow:

1. The sample size should be enlarged in order to obtain more

representatives.

2. Pre-season is the best time to undergo the investigation. This study was conducted during season. Injuries and exhaustions are the two major factors affecting the players' performance in the test. Carrying out the test during preseason can reduce the influences by those two factors.

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APPENDIX A

Informed Consent for physical Fitness Testing

(English Version)

The purpose of the fitness testing is to evaluate physiological profile including cardiorespiratory fitness, body composition, flexibility and muscular fitness.

I understand that I am responsible for monitoring my own condition throughout the tests, and should any unusual symptoms occur, I will cease my participation and inform the instructor.

In signing this consent from, I: _____, (Name of Participant), affirm that I have read this form in its entirety and that I understand the description of the testing procedures and the risks and discomforts, and having had an opportunity to ask questions that have been answered to my satisfaction.

_____ _____

Signature of Participant Date

_____ _____

Tests Investigator Date

APPENDIX A

Informed Consent for Fitness Testing
(Chinese Version)

閣下正被邀請參與一個關於香港籃球運動員的研究，其研究目的是收集運動員身體素質的資料。其資料可能將會有助於日後設計運動員鍛鍊計劃。

研究包括以下測試：

最高攝氧量(一公里跑)
二十米來回跑
皮下脂肪
手握力
柔軟度
肌肉力量及耐力量測試
敏捷度(側身拼步)

量度:
- 肩寬
- 胸圍
- 腰圍
- 大腿粗幼度
- 小腿粗幼度

風險評估

當進行最高攝氧量測試時，可能會潛在不適和危險。當參加者在研究期間有任何不適，應立即通知有關研究人員。如需要額外藥物治療，有關費用將由參加者負責。若進行研究中參加者有任何受傷，將不會獲得任何金錢上的賠償。

參予條款

參加者是義務參與是項研究，若參加者於中途退出，將不需承擔任何懲罰。當參加者進行研究期間，要求退出，亦不需負上任何責任或損失。如果參加者中途退出，其數據將交回他本人或可要求銷毀。

*本人_____已細閱及明白上述內容，並同意參加是次研究。

_____ _____
(實驗對象簽署) (日期)

_____ _____
(研究人員簽署) (日期)

APPENDIX A

Informed Consent for Physical Fitness Testing
(Chinese Version)

2010-2011 體能測試內容及家長同意書

確認回條及家長同意書

致：各受試者
本人是香港浸會大學體育系三年級學生。正就有關畢業論文進行體能測試，其體測內容包括：

1. 最大攝氧量的直接測驗法: 一公里跑測試
受試者在運動場跑道上進行一公里跑，對心血管疾病的人而言，衰竭運動具有潛在危險的可能性。

2. 二十米來回跑測試
受試者進行20 米來回跑運動，直到全身力竭。對心血管疾病的人而言，衰竭運動具有潛在危險的可能性。

3. 肌肉力量及耐力量測試
測量受試者髖關節的柔韌度、以及大腿群肌的肌力。受試者可能會出現運動後延遲性肌肉酸痛。

(1) 意向回覆：(*請在合適空格加上”X”／ 請刪除不適用者)
☐ 本人 / 參加者已細閱以上內容詳情，確認接受邀請，參加此計劃的全部項目。本人清楚明白此計劃的高度要求，並承諾會竭盡全力，爭取進步。
☐ 本人 / 參加者不接受邀請參加體能測試，其原因是：
_____

(2) 個人資料：
姓名：(中文)_____ (英文)_____
出生日期:_____ 性別:_____ 身份証號碼:_____
身高： _____cm 體重： _____kg
聯絡電話：(日)_____ (夜)_____
電郵：_____
就讀學校／工作機構:_____

(3) 參加者責任聲明：

本人_____身體健康狀況良好，適宜參加上述的測試，本人並未有任何疾病，而不適合參與此體能測試。

如有疑問，會向醫生尋求指示。在訓練或比賽期間發生意外而導致任何事故，本人願承擔全部責任，主辦或協機構並不需要負上任何法律責任。此外，本人亦明白必須遵守上述計劃的一切規則及教練 / 指導員之安排。

確認日期：_____ 參加者簽名：_____

※ 註：未滿十八的參加者必須由家長簽署同意參加有關測試

家長/監護人姓名：_____ 家長/監護人簽名：_____

與參加者之關係：_____ 日期：_____

- 本人聲明：申請人所提供之資料只會用作報名記錄及聯絡用途。所有個人資料，除獲測試員授權職員外，將不會提供予其他人士。若要求更改或索取已申報的個人資料，請與測試員聯絡。

APPENDIX B

Physical Activity Readiness Questionnaire (PAR-Q)
(Chinese Version)

體能活動適應能力問卷與你

（一份適用於 15 至 69 歲人士的問卷）

經常進行體能活動不但有益身心，而且樂趣無窮，因此，愈來愈多人開始每天多做運動。對大部分人來說，多做運動是很安全的。不過，有些人則應在增加運動量前，先行徵詢醫生的意見。

如果你計劃增加運動量，請先回答下列 7 條問題。如果你介乎 15 至 69 歲之間，這份體能活動適應能力問卷會告訴你應否在開始前諮詢醫生。如果你超過 69 歲及沒有經常運動，請徵詢醫生的意見。

普通常識是回答這些問題的最佳指引。請仔細閱讀下列問題，然後誠實回答：
請答「是」或「否」

是	否	
☐	☐	1. 醫生曾否說過你的心臟有問題，以及只可進行醫生建議的體能活動？
☐	☐	2. 你進行體能活動時會否感到胸口痛？
☐	☐	3. 過去一個月內，你曾否在沒有進行體能活動時也感到胸口痛？
☐	☐	4. 你曾否因感到暈眩而失去平衡，或曾否失去知覺？
☐	☐	5. 你的骨骼或關節(例如脊骨、膝蓋或髖關節)是否有毛病，且會因改變體能活動而惡化？
☐	☐	6. 醫生現時是否有開血壓或心臟藥物（例如 water pills）給你服用？
☐	☐	7. 是否有其他理由令你不應進行體能活動？

*如果在上述問卷中有一個或以上「是」的答案，即表示參加者的身體狀況可能不適合參加有關活動。

本人 _____(姓名)已閱悉、明白並填妥本問卷。本人的問題亦已得到圓滿解答。

_____ _____

(實驗對象簽署) (日期)

APPENDIX B

Physical Activity Readiness Questionnaire (PAR-Q)
(English Version)

PAR-Q is designed to help you. For most people physical activity should not pose any problem or hazard. PAR-Q has been designed to identify the small number of adults for whom physical activity might be inappropriate or those who should have medical advice concerning the type of activity most suitable for them. Common sense is your best guide when you answer these questions. Please read the following questions carefully and answer each one honestly: check YES or NO.

Yes	No	Question
		1. Has your doctor even said that you have a heart condition and that you should only do physical activity recommended by a doctor?
		2. Do you feel pain in your chest when you do physical activity?
		3. In the past month, have you had chest pain when you were not doing physical activity?
		4. Do you lose your balance because of dizziness or do you ever lose consciousness?
		5. Do you have a bone or joint problem that could be made worse by a change in your physical activity?
		6. Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?
		7. Do you know of any other reason why you should not do physical activity?

*If you answer “yes” to one or more questions in the “PAR-Q & YOU”, your physical condition may not be suitable for taking part in the activity concerned.

I,_____ (Name of Participant), have read, understood and completed this questionnaire. Any questions I had were answered to my full satisfaction.

_____ _____

(Signature of participant) (Date)

APPENDIX C

Data Collection Form (A)

Name: _____ (Chi) Date of Birth:_____

_____ (Eng) Age: _____

Weight: _____kg_ Height: _____cm_

Experience of basketball:

0-2 / 3-4 / 5-6 / 7-8 / 9-10 / 11 or above years

Position: _____

Times of training: _____days/ week _____minutes / day

Anthropometry

Shoulder width: _____

Circumference:

Chest: _____

Waist: _____

Hip: _____

Thigh: _____

Calf: _____

Body Composition

Percentage body Fat: _____%

Fat mass: _____kg

Fat Free mass: _____kg

Flexibility

Sit and reach test:

Trial 1 _____

Trial 2 _____

Trial 3 _____

Muscular Fitness

Hand grip test:

	Right	Left
Trial 1	_____	_____
Trial 2	_____	_____
Trial 3	_____	_____

Leg power test: (vertical jump)

Trial1 _____

Trial2 _____

Trial 3 _____

Cardiovascular Fitness

VO2 max from 1 mile jog test

Weight:_____

Time: _____

Heart rate (bpm):_____

Estimated oxygen uptake :_____ml/kg/min

APPENDIX D

Data Collection Form (B)

TEST SCHEME: YO-YO INTERMITTENT RECOVERY TEST – LEVEL 1

Date:_____ Name:_____

Speed level:_____ Intervals:_____

5	1							
	(40)							
9	1							
	(80)							
11	1	2						
	(120)	(160)						
12	1	2	3					
	(200)	(240)	(280)					
13	1	2	3	4				
	(320)	(360)	(400)	(440)				
14	1	2	3	4	5	6	7	8
	(480)	(520)	(560)	(600)	(640)	(680)	(720)	(760)
15	1	2	3	4	5	6	7	8
	(800)	(840)	(880)	(920)	(960)	(1000)	(1040)	(1080)
16	1	2	3	4	5	6	7	8
	(1120)	(1160)	(1200)	(1240)	(1280)	(1320)	(1360)	(1400)
17	1	2	3	4	5	6	7	8
	(1440)	(1480)	(1520)	(1560)	(1600)	(1640)	(1680)	(1720)
18	1	2	3	4	5	6	7	8
	(1760)	(1800)	(1840)	(1880)	(1920)	(1960)	(2000)	(2040)
19	1	2	3	4	5	6	7	8
	(2080)	(2120)	(2160)	(2200)	(2240)	(2280)	(2320)	(2360)
20	1	2	3	4	5	6	7	8
	(2400)	(2440)	(2480)	(2520)	(2560)	(2600)	(2640)	(2680)
21	1	2	3	4	5	6	7	8
	(2720)	(2760)	(2800)	(2840)	(2880)	(2920)	(2960)	(3000)
22	1	2	3	4	5	6	7	8
	(3040)	(3080)	(3120)	(3160)	(3200)	(3240)	(3280)	(3320)
23	1	2	3	4	5	6	7	8
	(3360)	(3400)	(3440)	(3480)	(3520)	(3560)	(3600)	(3640)

APPENDIX D

Data Collection Form (C)

RESULT SCHEME: YO-YO INTERMITTENT RECOVERY TEST

Date:_____ Level:_____

Surface condition: _____ Weather:_____

No.	Name	Speed level Intervals	Total distance	Comment
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				