Anthropometric and physiological profiles of sepak takraw players

M N Jawis, R Singh, H J Singh, M N Yassin

Methods: Anthropometric and physiological profiles of national sepak takraw players were determined. Thirty-nine male, sepak takraw players on state and national teams, were divided into three age categories of under 15 (U15), under 18 (U18), and under 23 (U23) years of age. Height, weight, percent body fat (%bf), maximum oxygen consumption ($V_{O2max}$), range of motion (ROM), back and leg strength, and heart rate, for the estimation of oxygen consumption during matches, were recorded. Statistical analysis was performed using one way ANOVA for independent measurements and data are presented as mean ± standard deviation.

Results: The U23 players were significantly taller and heavier with significantly better ROM of the neck, trunk, and ankle joints and back and leg strength than the U15 players. No significant difference was found in %bf between the three age categories. Mean maximum heart rate during exercise was significantly higher in the U15 group when compared to the U18 and U23 groups ($p < 0.05$). Mean $V_{O2max}$ was similar between the three groups. Estimated oxygen consumption during matches was 69.1%, 68.5%, and 56.4% of $V_{O2max}$ in the killer, tekong, and the feeder groups, respectively.

Conclusions: The mean height, body weight, and cardiopulmonary capacities of the players were within the Malaysian population norms, but were somewhat lower than those of players of other court games from other countries. %bf was also lower in these players. This study provides the much needed anthropometric and physiological data of sepak takraw players for further development of this sport.

Abbreviations: %bf, percent body fat; HR$_{max}$, maximum heart rate; $O_2P_{max}$, maximum oxygen pulse; ROM, range of motion; SD, standard deviation; $V_{O2max}$, maximum oxygen consumption.
period was allowed between jumps to minimise the effect of fatigue. Standing long jump power was obtained by multiplying the distance jumped by body mass. The scores of all three jumps were recorded and best of the three jumps was taken as the measure of the jump.

Range of motion

The Leighton flexometer (Spokane, WA), a weighted 360° goniometer, was used to assess static range of motion (ROM) of the right side of the neck, trunk, and ankle as described previously.7 The neck ROM (flexion and extension) was measured with the subject in a supine position with the head and neck projecting over the end of a bench, with the shoulders touching the edge of the bench and arms at the side. The flexometer was attached to the right side of the head and over the ear. The subject was first instructed to raise and flex the head forwards to a position as near to the chest and then to extend the head backwards as far as possible. These positions were held for 3 s each time and the angle was recorded to the nearest degree.

For the assessment of trunk ROM (rotation), the subject lay in a supine position on a bench with the knees together and raised above the hips with the legs held parallel to the bench and body. The flexometer was fastened around the middle of the thighs. With the shoulders held down, the subject was asked to move the knees sideways as far as possible, first to the left and then to the right. The ROM was recorded to the nearest degree.

The ROM of the ankle (flexion and extension) was obtained with the subject sitting on the bench with knees straight and the legs projecting over the end of the bench with the flexometer fastened to the inside of the right foot first. The subject was instructed to first extend the right foot downwards as far possible and then to flex the right foot upwards towards the knee as far as possible. The ROM was recorded to the nearest degree. For the inversion and eversion ROM of the ankle, the flexometer was fastened to the front of the shoe at the ankle. The subject sat at the end of the bench with the knees hanging over the bench. With lower legs secured in position by the assessor’s free hand, the subject was asked to first twist the foot inwards as far as possible and then to turn the foot outwards as far as possible. The ROM was then recorded to the nearest degree.

Determination of maximum oxygen consumption (VO2max)

Maximum oxygen uptake was determined using an incremental treadmill running test to exhaustion (Model 18–60, Quinton, Seattle, WA, USA) following prior familiarisation with the test procedures. Following a 5 min warm up, subjects ran at a predetermined speed for VO2max testing, which was maintained throughout the test. The gradient was increased by 2.5%, from the initial 3.5% gradient, every 3 min until volitional exhaustion.8 Metabolic and respiratory measurements were carried out using a pre-calibrated metabolic chart recorder (SensorMedic 2900, Yorba Linda, CA, USA). Heart rates were recorded using a telemetry heart rate monitor (Polar, Kempele, Finland). Maximum oxygen pulse (O2Pmax) was determined by dividing maximum oxygen uptake in ml min−1 with maximum heart rate obtained during the VO2max test.

Determination of VO2 during a match

Oxygen consumption during a competitive game in an indoor stadium was estimated from the heart rates of players in each of the three positions (feeder, killer, and tekong) of a U23 team during four consecutive matches over a period of
4 days, that is, each player’s heart rate was recorded four times on 4 consecutive days. For this, each player was fitted with a heart rate transmitter and receiver (Polar) during the competitive game. Heart rates were recorded every minute in each individual during the game. After each game the data were downloaded onto a personal computer for analysis. Heart rates during each match were averaged and \( \text{Vo}_2 \) was estimated from the respective heart rate versus oxygen consumption curves which were obtained in the laboratory a few days earlier as described by Bangsbo. Duration of the matches (best of three sets of 21 points) varied between 45 and 70 min.

**Statistical analysis**

One way analysis of variance (ANOVA) for independent measurements was used to compare the differences in all measured parameters. A Tukey post hoc test was used to locate the significant differences. A \( p \leq 0.05 \) was considered to indicate statistical significance for all measurements. All data are presented as mean ± standard deviation (SD).

**RESULTS**

As expected, the U23 and U18 players were significantly taller than the U15 players (\( p \leq 0.001 \); table 1). Similarly, the U23 players were significantly heavier than the U15 players (\( p \leq 0.05 \)). No significant differences were evident between the three groups as regards %bf.

Mean neck and trunk ROMs of the U18 and U23 players were significantly greater than those of the U15 players (\( p < 0.05 \) and \( p < 0.01 \), respectively; table 2). Mean ankle flexion/extension ROM of the U15 players was significantly smaller than that of the U23 players (\( p < 0.05 \)). Mean ankle inversion/eversion ROM of the U18 players was significantly greater than that of the U15 players (\( p < 0.05 \)).

Back and leg strength of the U18 and U23 players was significantly greater than that of the U15 players (\( p < 0.05 \) and \( p < 0.001 \), respectively; table 2). Leg strength was significantly greater in the U18 and U23 players when compared to that of the U15 players (\( p < 0.05 \) and \( p < 0.01 \), respectively). Similarly, mean leg power (kg \( \text{m}^2 \)) in the U18 and U23 players was significantly greater than that in the U15 players (\( p < 0.05 \) and \( p < 0.001 \), respectively).

Maximum heart rate (HR\(_{\text{max}}\)) was significantly higher in the U15 players than in the other two age groups (\( p < 0.05 \); table 2). Absolute \( \text{Vo}_{2\text{max}} \) of the U18 and U23 players was significantly higher than that of the U15 players (\( p < 0.01 \)), whereas relative \( \text{Vo}_{2\text{max}} \) was similar in all three age categories. However, \( \text{O}_2\text{P}_{\text{max}} \) was significantly lower (\( p < 0.001 \)) in the U15 players than in the other two age groups.

No significant differences were evident between the mean heart rate of players in the three playing positions during the matches (table 3). However, oxygen consumption was somewhat lower in the feeder group compared to the tekong and the killer groups, but the difference was not statistically significant. When expressed as % of \( \text{Vo}_{2\text{max}} \), average oxygen consumption ranged between 50% and 70% of the \( \text{Vo}_{2\text{max}} \) in players in the three playing positions.

**DISCUSSION**

Mean heights of the U23, U18, and U15 groups were found to be within the Malaysian population norms for their respective age categories. We do not have data from Malaysian players of other but similar court games and comparison is therefore difficult. But when compared to players of court games from other countries, it was found that the height of the Malaysian sepak takraw players was lower than that reported in Indian and Chinese badminton players and English squash players. The exact significance of height to performance in sepak takraw remains unclear, as there is no information in the literature correlating height with performance in this sport. While there may be a minimum height requirement in sepak takraw, it is unlikely that a greater than average height bestows any extra advantage to a player.

Having the correct body weight and body composition is important for athletes. Optimal body size and composition characteristics vary from sport to sport depending on the physical demands of the sport. The body weights of all the

---

**Table 1** Anthropometric measurements expressed as mean ± SD for the three age categories

<table>
<thead>
<tr>
<th>Variables</th>
<th>U15 (n = 12)</th>
<th>U18 (n = 15)</th>
<th>U23 (n = 12)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>13.8 ± 0.8***</td>
<td>16.7 ± 1.0†††</td>
<td>20.4 ± 1.3</td>
</tr>
<tr>
<td>Height (m)</td>
<td>1.61 ± 0.07**</td>
<td>1.69 ± 0.04</td>
<td>1.69 ± 0.07</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>49.7 ± 7.3†‡</td>
<td>58.7 ± 10.3</td>
<td>61.9 ± 10.6</td>
</tr>
<tr>
<td>Body fat (%)</td>
<td>7.6 ± 2.4</td>
<td>8.7 ± 5.1</td>
<td>10.2 ± 4.8</td>
</tr>
</tbody>
</table>

*\( p < 0.01 \), **\( p < 0.001 \), significantly different from the U18 and U23 measurements, respectively.
† \( p < 0.05 \), †† \( p < 0.001 \), significantly different from the U23 measurement.

---

**Table 2** Range of motion (ROM) and strength characteristics (mean ± SD) of the players in the three age categories

<table>
<thead>
<tr>
<th>Variables</th>
<th>Age categories</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>U15 (n = 12)</td>
</tr>
<tr>
<td>Neck ROM (deg)</td>
<td></td>
</tr>
<tr>
<td>Flexion/extension</td>
<td>129.0 ± 12.9</td>
</tr>
<tr>
<td>Trunk ROM (deg)</td>
<td>125.1 ± 17.1</td>
</tr>
<tr>
<td>Rotation</td>
<td></td>
</tr>
<tr>
<td>Ankle ROM (deg)</td>
<td>68.0 ± 7.2</td>
</tr>
<tr>
<td>Flexion/extension</td>
<td>58.7 ± 8.7</td>
</tr>
<tr>
<td>Inversion/eversion</td>
<td>108.8 ± 18.8</td>
</tr>
<tr>
<td>Back and leg</td>
<td></td>
</tr>
<tr>
<td>strength (kg)</td>
<td>201.5 ± 13.8</td>
</tr>
<tr>
<td>Standing long jump (cm)</td>
<td>100.2 ± 16.6</td>
</tr>
</tbody>
</table>

*\( p < 0.05 \), **\( p < 0.01 \), ***\( p < 0.001 \), significantly different from U15
subjects who participated in the study were very lean with mean %bf increased with increasing age category, the differences and the genetic make up of the individuals. Although these differences is uncertain but may reflect racial differences. The reason for this is unclear, but it may be related to training and the requirements of the game. As sepak takraw is a game of lower work intensity compared to badminton, squash, tennis, and even basketball, it is therefore not surprising that sepak takraw players have a lower aerobic capacity as also reported by Aziz et al.1

Estimation of Vo2 from heart rates during competitive matches revealed workload intensities of about 70% of maximum heart rates or between 50 and 72% of Vo2max (table 3). The 70% maximum heart rate recorded during competitive matches was slightly lower than that reported by Aziz et al.1 The reason for this is unclear, but it may be related to the environment as their games were held outdoors whereas the matches in this study were held in an air conditioned indoor stadium. Oxygen consumption ranged between 28 and 43 ml kg⁻¹ min⁻¹ during competitive matches. Although mean Vo2 was lower in the feeder group, there was no significant difference between the players in the three playing positions. This may be due to the small number of subjects per group. These values are lower than those reported for badminton14,15 players, where oxygen consumption rates of between 45 and 52 ml kg⁻¹ min⁻¹ or between 75 and 86% of Vo2max have been observed. The difference in the oxygen consumption during the game and the lower Vo2max of the sepak takraw players confirms the lower work intensity of this sport.

In conclusion, these data appear to be the first of their kind obtained from sepak takraw players in Malaysia and provide a useful database against which talented groups may be compared for talent detection, identification, and development programmes.

ACKNOWLEDGEMENTS
The authors would like to thank all the players for their invaluable participation and cooperation. The authors also wish to thank Willy Pieter for statistical advice.

Authors’ affiliations
M N Jawis, R Singh, H J Singh, M N Yassin, Universiti Sains Malaysia, Kota Bharu, Malaysia

This study was supported by a short term research grant from Universiti Sains Malaysia (304/PFSP/6131229)

Competing interests: none declared
The players described in this article consented to the publication of their details and photographs

REFERENCES
What is already known on this topic

Except for one report which analyses the temporal characteristics of sepak takraw, there are no other published data on a sport which is increasing in popularity.

What this study adds

This study provides much needed anthropometric and physiological information for the future development of sepak takraw.

The paper will prove useful in providing coaches and trainers with information on the physical and physiological demands of sepak takraw, a sport suitable for the average Asian since the height requirement is 164–175 cm. The metabolic and cardiorespiratory demands of the sport are moderate and great motor ability and strength are not required, but players need to be very flexible and agile. The players should receive optimal cardiorespiratory fitness and strength training to minimise the chances of injury.

G L Khanna
Sports Authority of India, New Delhi, India;
glkhanna56@hotmail.com
Anthropometric and physiological profiles of sepak takraw players

M N Jawis, R Singh, H J Singh and M N Yassin

doi: 10.1136/bjsm.2004.016915

Updated information and services can be found at:
http://bjsm.bmj.com/content/39/11/825

These include:

References
This article cites 14 articles, 4 of which you can access for free at:
http://bjsm.bmj.com/content/39/11/825#BIBL

Email alerting service
Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

Notes

To request permissions go to:
http://group.bmj.com/group/rights-licensing/permissions

To order reprints go to:
http://journals.bmj.com/cgi/reprintform

To subscribe to BMJ go to:
http://group.bmj.com/subscribe/