University of Canberra

A COMPARISON OF FIELD AND LABORATORY TESTING OF SPORTS SPECIFIC FITNESS FOR FEMALE FIELD HOCKEY PLAYERS

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ABSTRACT

There are many methods to measure the physical fitness of athletes, including tests that can be applied in the field or in the laboratory. Much of the recent research with regard to fitness of team sport players has been undertaken using laboratory testing to measure aerobic power, anaerobic power and capacity, strength and flexibility. Field tests are an alternative method to measure the fitness of players without the expense, time and expertise required for the laboratory testing, especially in developing countries.

The purpose of this study is to establish procedures for the application of contemporary sports science practice for Indonesian female field hockey players, including determination of the precision of field tests of the physical and performance characteristics of field hockey players in Indonesia; determination of the physical and performance characteristics of Indonesian female field hockey players; identification of the performance demands and distance covered during competitive field hockey at the national level in Indonesia; comparison of the physical and performance characteristics of national level female field hockey players in Indonesia with those of club level players in Australia; and determination of the relationships between field and laboratory tests of physiological performance capacity for field hockey.

This study was conducted on 26 Indonesian and 11 Australian female field hockey players. The mean values for age, height, mass, BMI and skinfold thickness of the Indonesian players were 22.0±3.4 years, 156.3±4.9cm, 51.2±6.2kg, 20.9±2.0kg·m^{-2}, and 99.4±17.9mm, respectively. The mean values for VO_2max (20m srt), VJ, leg power, SBJ, sit and reach, and 40m sprint were 38.7±3.2ml·kg^{-1}·min^{-1}, 39.3±4.3cm, 70.7±1.0kg·m·sec^{-1}, 183.3±17.0cm, +14.7±5.7cm, 6.99±0.39s, respectively.

The mean HR values at the end of the first and second half of a game of field hockey were 171.0±8.7bpm and 161.3±18.2bpm, respectively. The mean values for blood lactate concentration at the end of the first and second half of play were 5.3±1.2mmol·L^{-1} and 5.1±1.7mmol·L^{-1}, respectively. The mean total distance covered by the players during the complete game was 2841.8±432.2m. The mean time spent walking and at more than walking pace (jogging, running and sprinting) during the game were 46:08min and 24:18min, respectively. The mean values for temperature and humidity were 38.2±4.1°C and 57.5±9.8%, respectively.

The mean values for age, height, mass, BMI and skinfold thickness of the Australian players were 24.0±3.9 years, 165.7±3.4cm, 64.8±4.1kg, 24.0±1.6kg·m^{-2}, and 77.9±17.3mm, respectively. The mean values for VO_2max (20m srt), VJ, leg power, SBJ, sit and reach, and 40m sprint were 42.1±4.7ml·kg^{-1}·min^{-1}, 37.5±4.4cm, 87.2±7.0kg·m·sec^{-1}, 174.9±18.3cm, +11.2±6.4cm, and 6.46±0.30s, respectively. The mean values for VO_2max (treadmill running), isokinetic strength, 10 sec maximal ergometer sprint test, and 5 x 6 sec repeat effort cycle ergometer test were 46.3±3.8ml·kg^{-1}·min^{-1}, 88.2±10.6N·m (left hamstring), 58.1±13.8N·m (right hamstring), 152.9±27.0N·m (left quadriceps), 152.6±19.2N·m (right quadriceps), 58.6±6.9% (left hamstring/quadriceps ratio), 57.9±5.3% (right hamstring/quadriceps ratio), 103.7±10.8J·kg^{-1} (total work), 12.5±1.0W·kg^{-1} (peak power), 261.2±25.6J·kg^{-1} (total work), 9.3±5.4% (work decrement) and 5.7±3.8% (power decrement),

respectively. The mean values for temperature and humidity were 11.8±1.8°C (outdoor), 20.5±3.3°C (indoor), 60.4±2.6% (outdoor) and 50.6±6.8% (indoor), respectively.

There were no significant differences between Indonesian and Australian players in age, VO_2max (20m SRT), VJ, SBJ, S&R, and acceleration measurements ($p>0.05$). However, there were significant differences between Indonesian and Australian players in height, mass, BMI, skinfold thickness, leg power, speed, and combined acceleration and speed measurements ($p<0.05$). The Australian players were significantly taller and heavier than the Indonesian players. The Indonesian players had higher values for the sum of 7 skinfolds than the Australian players. The Australian players had significantly higher values for leg power than the Indonesian players. The Australian players were significantly faster than the Indonesian players.

Among the Australian players there was a significant difference between the VO_2max value during treadmill running and the VO_2max estimated from the 20m srt ($t=0.003$, $p<0.05$). There was a significant correlation between the VO_2max value during treadmill running and the VO_2max estimated from the 20m srt ($r=0.66$, $p<0.05$). The correlations between the leg power (estimated from the vertical jump test) and the isokinetic power of the quadriceps muscle group was not significant ($p>0.05$). The correlation between the running speed (estimated from the combined acceleration and speed score from the 40m sprint test) and the peak power from the 10s maximal ergometer sprint test ($r=-0.55$) was not significant ($p>0.05$).

In conclusion, the present study found that the Indonesian female field hockey players (at the national level) were comparable to the Australian female field hockey players (at the club level) in some physical and performance test results. However, they were also different on other physical and performance characteristic measurements, with the Indonesian players generally have lower values, for other performance measurements.

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ABBREVIATIONS

Selected abbreviations used throughout the text

b·m^{-1}: breaths per minute

bpm: beats per minute

cm: centimetre/centimetres

°C: temperature in degrees centigrade

F_EO_2: fractions of oxygen in expired air

F_ECO_2: fractions of carbon dioxide in expired air

HR: heart rate/heart rates

J: joule/joules

J·kg^{-1}: joules per kilogram

kg: kilogram/kilograms

kg·m^{-2}: kilograms per metre square

kJ·min^{-1}: kilojoules per minute

km: kilometre/kilometres

kg·m·sec^{-1}: kilograms metre per second

La: lactic acid

L·min^{-1}: litres per minute

m: metre/metres

mm: millimetre/millimetres

ml·kg^{-1}·min^{-1}: millilitres per kilogram per minute

ml·min^{-1}: millilitres per minute

mmol·L^{-1}: millimoles per litre

m·s^{-1}: metres per second

N·m: Newton metres

N·m·kg^{-1}: Newton metres per kilogram

s: second/seconds

30°·sec^{-1}: 30 degrees per second

60°·sec^{-1}: 60 degrees per second

180°·sec^{-1}: 180 degree per second

20m srt: 20 metres shuttle run test

$V_EQ\ O_2$: ventilatory equivalents of oxygen

$V_EQ\ CO_2$: ventilatory equivalents of carbon dioxide

VCO_2: volume of carbon dioxide

VO_2 : volume of oxygen

VO_2max: maximum oxygen uptake

W: watts

$W \cdot kg^{-1}$: watts per kilogram