

The Effect of Eight-Week Training Programme on VO₂ Max and Body Composition

探討最大攝氧量與身體脂肪於八星期訓練後的影響

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Abstract

The purpose of the study was to determine the maximal oxygen consumption (VO₂ max) and the body fat content in Malaysian national junior netball players and the impact of an eight-week aerobic and strength-training programme on these two variables. A total of 21 netball players (mean age of 16.12±1.55 years old) from Bukit Jalil Sports School were the subjects used. The 12-minute Run was used to determine the VO₂ max while the body composition was calculated using the skinfold method. Pre-test and post-test results showed significant improvement in the VO₂ max and body fat content among the netball players. The Z value for the VO₂ max test was -3.25 (p<0.01), and for the body fat percentage test was -2.73 (p<0.01). The eight-week training programme was very effective in improving VO₂ max and reducing the body fat content for all the players, but especially for the attack.

Key Words : Aerobic capacity, body fat, netball player, aerobic training, and strength training

摘要

本文旨在探討最大攝氧量與身體脂肪組合透過八星期的訓練計劃，對身體生理方面的影響。廿一名(平均年齡為 16.12±1.55) 投球選手參與研究，評估內容包括十二分鐘跑及皮摺量度脂肪法，結果發現受試者的最大攝氧能力顯著上升，而皮下脂肪則顯著減少。

Introduction

The aims of this study were to determine the VO₂ max and body fat in Malaysian national junior netball players before and after eight weeks of aerobic and strength training. According to Bale and Hunt (1986), a good netball player should be tall and slim with a balance physique. However, Chad and Steele (1991) also included aerobic fitness as a requisite. Good aerobic fitness would allow the player to last the match at or close to her full potential with quick recovery after short bursts of intense play. Therefore, improving aerobic fitness

has been found important for playing the game. This is because with better aerobic capacity and body composition come the concomitant improvement in the other fitness components, such as agility, muscular endurance, power, and also avoidance of injury (Hooper et al. 1995; Hooper & Elliott 1993). Although the netball game has been in Malaysia for a long time, research into this game was not many and most of them were mainly in form of textbooks or coaching manual as mention by Steele (1990). Therefore, the purpose of this study was to determine the VO₂ max and body fat content in Malaysian junior netball players and to compare the results with other study. Besides

that, this study was also aims to determine the impact of an eight-week aerobic and strength-training programme on these two variables.

Methods and Procedures

Subjects

The subjects were Malaysian national junior netball players from the Bukit Jalil Sports School (N=21). The subjects' age range was between 14 to 18 years old (mean 16.12 ± 1.55 years old). Their reported height and body weight were 168.11 ± 5.31 cm and 62.72 ± 5.98 kg. They had had at least 4.00 ± 1.61 years' experience in playing netball at state level and above.

Procedure and Instrumentation

The 12-minute Run was used to determine VO_2 max, while the body composition was determined by skinfold measurement from seven locations. The locations were chest, midaxilla, subscapular, triceps, suprailiac, navel and thigh, and then calculated by the formula of Pollock et al. (1980). According

to Adams (1994) and Pollock et al. (1980), the skinfold technique for body fat measurement is suitable for athletes as they are quite muscular. Of all the methods, this has the highest correlation ($r=.85$) with Hydrostatic Weighing. At least two readings are required for each skinfold measurement (Maud & Foster, 1995). The measurement were taken starting on the right side of the body, slowly rotating round to avoid placing excessive pressure on any spot by the pinching of the instruments. Two readings were taken for each location, and the figures rounded up to the nearest mm. Only if the two readings were within one mm were they accepted. If not, a third measurement was taken and the two closest within one mm of each other were taken (Lohman et al. 1991). The readings were then averaged, rounding to the nearest mm.

Training Programme

The training was over eight weeks on every Monday, Tuesday, Thursday, and Friday morning. The other days were for rest. The physicals were in the morning, and skill (basic netball play and strategy by a coach from Bukit Jalil Sports School in the afternoon. Details of the training programme are given in Table 1.

Table 1. Type of Training Programme Description.

Day	Type of Training	Description
Monday	Weight	● Circuit weight training with weights (50-70% of actual capacity)
	Training	● Circuit weight training with weights (80-90% of actual capacity)
Tuesday	Aerobic	● Hill run (30-40 minutes)
	Training	● Long distance /cross country run (40 minutes)
Thursday	Weight	● Sprinting up a slope for 10, 20 and 30 meters
	Training	● Using body weight activities
Friday	Aerobic	● Long distance /cross country run (40 minutes)
	Training	● Speed Play (30-40 minutes)
Legend:		
● Choice of different programs in different weeks		

Statistical Analysis

The impact of the eight weeks' programme was measured using the Wilcoxon Signed Rank (or Wilcoxon Matched Pairs Signed Rank Test). This test is an alternative to the t-test for correlated samples for sample sized <30. It was used to analyze the data to a = .05 (Baumgartner et al. 2002; Pallant, 2001).

Results

The results for pre and post-training showed significant improvement in the VO₂ max and body fat content among the netball players. The Z value for VO₂ max test was -3.25 (p<0.01), and body fat percentage -2.73 (p<0.01). Both the values indicated improvement after the training (Table 2).

Table 2. Pre-test and Post-test Vo₂ Max and Body Fat Percentage according to Playing Positions.

Playing Position	VO ₂ max (ml/kg min)		Body Fat (%)	
	Pre-test	Post-test	Pre-test	Post-test
Defender	30.62±4.57	36.59±4.83	23.72±5.24	23.02±5.92
Center	33.02±5.32	37.91±6.28	21.74±4.85	20.26±3.54
Attacker	30.34±7.33	36.44±3.87	21.64±6.05	20.55±4.39
Mean	31.24±5.43	36.93±4.87	22.66±4.94	21.64±4.96

Discussion and Conclusion

The VO₂ max was reported to be improved by 5.70ml/kg min - from 31.24±5.34ml/kg min to 36.93±4.87ml/kg min. However, the improvement in VO₂ among these netball players was found to be very much depending on their initial VO₂ level. In addition, it was found that the initial VO₂ max of 31.24ml/kg min among these netball players was very low and not suitable for national or elite level. The average percentage of body fat among the netball players was reduced by 1.02% in the post-test result. The mean value of body fat percentage in the post-test was 21.64±9.46%, as compared to the pre-test of 22.66±4.94%. Both the pre-test and post-test body fat results were found to be higher as compared to elite sportswomen's norm of 10-16% (Wilmore & Costill, 1994).

Netball players of center playing position were found to have the highest VO₂ max level and lowest body fat percentage as compared to the netball defenders and attackers. A higher

VO₂ max increases the capacity for work (Helgerud et al. 2001; Martens 1997; Sharkey 1990). This would be particularly important for the center as feeders of the ball to both the attack and defence. A higher VO₂ max and lower body fat would allow them (the center) the energy for continued play and to better cover their larger playing area (Chad & Steele, 1991). The training was especially effective in improving VO₂ max and body composition for the attack.

Overall, the training conducted in this study was beneficial in improving the physical condition of the players. However, the improvements were found to be were much depending on the netball player initial VO₂ max and body fat level. Although this study was conducted during competition period, it was found that the Malaysian junior netball players had a VO₂ max and body fat level that not very suitable for their standard as a national players representation.

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