THE IMPACT OF AN EIGHT-WEEK AEROBIC AND STRENGTH-TRAINING PROGRAMME ON AGILITY AND LEG POWER OF MALAYSIAN NETBALL PLAYERS

Soh KG[1], Ruby H[2], Soh KL[3]

[1] *Department of Sports Studies, Faculty of Educational Studies, University Putra Malaysia, 43400 UPM Serdang, Selangor Darul Ehsan, Malaysia*

[2] *Department of Physiology, Faculty of Medicine, University of Malaya, 50603 Kuala Lumpur, Malaysia*

[3] *Department of Community Health, Faculty of Medicine and Health Sciences, University Putra Malaysia, 43400 UPM Serdang, Selangor Darul Ehsan, Malaysia*

ABSTRACT: The purposes of the study were: (1) to determine the agility and leg power among Malaysian national junior netball players and (2) to determine the impact of eight-week aerobic and strength-training programme on these two variables. A total of 21 netball players from Bukit Jalil Sport School were selected as the subjects in this study. The SEMO Agility Run test was used to determine the agility level while leg power was measured using the Vertical Jump test. Pre-test and post-test results showed no significant differences in the agility and leg power level among the netball players. The mean values for the agility and leg power post-test were 12.59 (SD = 0.56) seconds and 50.24 (SD = 4.90) cm respectively. The pre-test and post-test results for different playing positions recorded the highest improvement in agility and leg power among attacker, followed by centre, and defender. Thus, the training conducted in this study was found to have improved agility and leg power marginally, especially among attacker and centre netball players. *(JUMMEC 2007; 10(1): 25-28)*

KEYWORDS: Agility, leg power, netball player, aerobic training, strength-training

Introduction

The ability to jump and dart about is a very useful skill for netball. This skill would not only help the player lose her opponents, but also confer her better ability in the other aspects of play, such as catching, tapping or snatching the ball (1). In general, the performance should improve with increased agility and leg power. It was reported that better leg strength had contributed to better agility in their subjects (2). In a 3-phase study, it was found that there was an improvement in the jumping ability of Australian elite netball players after training, where the mean jumping height increased by 2 cm (3). The better jumping ability in turn improved the catching of high balls and rebounding. This is inline with the results reported by Cheng *et al* (4) who found that jumping and rebounding training improved muscle strength and this improved the jumping ability of their subjects. This study aimed to determine the agility and leg power in junior Malaysian national netball players and also to assess the impact of an eight-week aerobic and strength-training programme on them. In addition, the study aimed at differentiating the impact of the training on players in the different playing positions in the three broad areas of attack, centre and defence.

Methods and Procedures

Participants

The subjects were all the junior Malaysian national netball players (N = 24) from Bukit Jalil Sport School. Since there were three subjects suffering from serious injury during the training/treatment, only 21 subjects managed to complete all the training/treatment. The range of age of the 21 subjects was between 14 and 18 years old (mean age of 16.12, SD = 1.55 years). Their reported means of height and body weight were 168.11 (SD = 5.31) cm and 62.72 (SD = 5.98) kg, respectively. All have had at least 4.00 (SD = 1.61) years of experience playing netball at inter-state level and above. The number of attack, centre, and defence netball players were 5, 9, and 7 respectively.

Correspondence:
Dr. Soh Kim Geok
Department of Sports Studies
Faculty of Educational Studies
University Putra Malaysia, 43400 UPM
Serdang, Selangor Daruh Ehsan, Malaysia
E-mail: kim@educ.upm.edu.my or kimgeoks@yahoo.com

Procedure and Instrumentation

Agility was determined by the SEMO Agility test because the entailed exercises approximated the movements in netball play - darting about and feinting to intercept, pass or receive the ball. The test has good repeatability with an r-value of 0.88 (5). Brower Timing System (Model 22) was used to record the time for the agility test. Meanwhile, the leg power was determined by the Vertical Jump test. The test was reported to have high repeatability and objectivity with both r-values of 0.93 (5). The Digital Indication Jump Meter was the instrument used. When the touch-board is touched, the jump height is displayed on the height indicator. Both the devices were calibrated before the pre- and post-tests.

The experimental design encompassed a span of eight-week training/treatment and consisted of the pre-test and post-test approaches. Before the pre-test, the subjects' agility and leg power ability were measured. After that, they underwent an eight-week training/ treatment programme conducted every Monday, Tuesday, Thursday and Friday mornings (Table 1). At the end of the eight-week training/treatment programme, the post-test was carried out to determine whether there were significant improvements in agility and leg power among the subjects.

Every subject had to abide by the rules, one of which was that she had to be properly attired, e.g. wore a T-shirt and shorts. The uniformity of clothing was to ensure that no subject was advantaged/disadvantaged for the tests (6). The unit of measurement for the agility test was reported in seconds, while the leg power in centimetre (cm). Before the tests, two trials were allowed for the subject to be familiarised with both tests. Each subject was tested twice and the best time for agility and the best height jumped for leg power were taken. Both results were rounded up to the nearest two decimal places in seconds or centimetres. The data were analysed using the Statistical Package for the Social Sciences (SPSS) version 12 software, a widely used statistical package/tool in research.

Training Programme (Experimental Treatment)

Physical training was conducted every Monday, Tuesday, Thursday and Friday in the morning. The afternoon trainings focused on basic netball skills and strategy conducted by the netball coach of the school. Details of the training programme are given in Table 1. The other days were rest days.

Results

Agility

There was no significant improvement in agility of the netball players from the training. The mean agility at pre-test was 12.79 seconds, and while post-test's was 12.59 seconds, which was an improvement of 0.20 seconds. In terms of agility, the centre rank first for the post-test 12.45 (SD = 0.42) seconds, followed by the defence with 12.60 (SD = 0.68) seconds and the attack with 12.75 (SD = 0.51) seconds (Table 2).

Leg Power

There was no significant improvement in leg power of the netball players from the training. The mean leg power result at post-test was only improved by 0.95 cm as compared to pre-test (pre-test 49.29 cm, post-test 50.24 cm). The attack produced the highest jumps of 52.20 (SD = 5.31) cm, followed by the defence 50.60

Table 1. Training programme description

Day	Training	Description
Monday	Strength	• Circuit training with weights (50-70% of 1RM) • Circuit training with weights (80-90% of 1RM)
Tuesday	Aerobic	• Hill run (30-40 minutes at 50-70% THR) • Long distance/cross country run (40 minutes at 50-70% THR)
Thursday	Strength	• Sprinting up a slope for 10, 20 and 30 meters (10% Gradient) • Activities using body weight e.g Burpee, Star Jump, Hopping
Friday	Aerobic	• Long distance/cross country run (40 minutes at 50-70% THR) • Speed Play (30-40 minutes at 50-80% THR) • Short distance interval run (at 50-80% THR)

• Choice of different programmes in different weeks
1RM - 1 Repetition Maximum
THR - Training Heart Rate

(SD = 4.70) cm and the centre 48.00 (SD = 4.86) cm in the post-test (Table 2).

Discussion

Agility

Based on the SEMO Agility Run Norm (6), the players' overall agility was advanced intermediate (agility between 12.99-12.20 seconds). Only five players scored advanced (less than 12.19 seconds) in both the pre- and post-tests. In the post-test, two players completed the SEMO Agility Run circuit in <12 seconds as compared to none in the pre-test. The junior Malaysian netball players' mean agility run of 12.59 (SD = 0.56) seconds (post-test) was better than the Malaysian national netball players agility run norm of 12.89 (SD = 0.61) seconds (7), but was unfavourable as compared to the elite Malaysian netball players' agility run norms of 12.21 (SD = 0.44) seconds (8) (Table 3).

The training improved agility mostly in the attack (0.54 seconds), followed by the centre (0.19 seconds) and the defence (0.03 seconds). Bobo and Yarbrough (9) found that stretching exercises could improve and maintain bodily agility and, in addition, coordination. Besides stretching exercises, better agility was also associated with better leg strength (2). Improvement in these components is likely to improve the overall playing performance of netball players.

Leg Power

Only nine players improved in their leg power after the training. The mean for the post-test 50.24 (SD = 4.90) cm was better than the 47.58 (SD = 4.79) cm reported by Soh, Ruby, Mohd Nor, *et al* (7) for national netball players. However, the leg power results in this study were less than that of elite Malaysian netball players values of 51.82 (SD = 4.33) cm (8). Thus the junior Malaysian netball players were better in leg power compared to the Malaysian norms, but when compared with the elite netball player norms, the junior netball players were found to be less powerful (Table 3).

Table 2. Performance improvement from training by playing position

Playing Position	Agility (seconds)				Leg Power (cm)			
	Pre-test		Post-test		Pre-test		Post-test	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Defence	12.63	0.44	12.60	0.68	51.50	4.84	50.60	4.70
Centre	12.64	0.44	12.45	0.42	46.50	4.09	48.00	4.86
Attack	13.29	0.56	12.75	0.51	48.20	4.92	52.20	5.31
Overall	**12.79**	**0.53**	**12.59**	**0.56**	**49.29**	**4.96**	**50.24**	**4.90**

Table 3. Comparison in agility and leg power among junior, national and elite netball players in Malaysia

Test	Junior Netball Players		National Netball Players[7]		Elite Netball Players[8]	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**
Agility (sec)	12.59	0.56	12.89	0.61	12.21	0.44
Leg Power (cm)	50.24	4.90	47.58	4.79	51.82	4.33

Source:
[7] Soh KG, Ruby H, Mohd Nor' CN, *et al.* (2000)
[8] Soh KG, Ruby H, Mohd Nor' CN, *et al.* (2003)

The training improved leg power mostly in the attack (increased by 4.00 cm) and centre (increased by 1.50 cm) netball players. However, there was a decrease in leg power performance among the defence netball players (decreased by 0.90 cm). The decrease in the leg power might be due to the defence netball players having better initial leg strength ability before the start of training, as compared to the attack and centre players. According to Sharkey (10), a better leg strength would increase the jumping height. However, the ability to improve the jumping height was dependent on the athlete's initial leg strength before the training. The jumping and rebounding types of training were proven to improve muscle strength and these, in turn, improved the jumping ability (4). However, there are also other factors that could determine the progress made in training to improve jumping. These factors are such as overall strength and maximum force rate development, power-to-body mass ratio, ability to flex the muscles, and movement coordination (11).

Conclusion

The eight-week aerobic and strength-training programme was found to be inadequate to improve agility and leg power in the netball players. The junior netball players were found to be less agile as compared to the elite Malaysian netball players and reported to have only moderate agility level as compared to the SEMO Agility Run Norm (before and after training). This could be due to several factors, such as the lack of emphasis on agility in their training as their programme was more focused on overall fitness. Hence, to improve their agility and leg power, specific agility and leg power exercises would have to be incorporated. Such exercises will enhance their movements and make them more efficient, as a result of which their agility and leg power will improve (5,12,13).

Acknowledgements

The authors wish to thank the Malaysian Netball Association (MNA) for the support in this study. Gratitude is also expressed to the netball coach, Miss Choo KL, and the subjects who participated in this study. Thanks are also due to Associate Professor Zaliha Omar and staff of Faculty of Medicine, University of Malaya for their technical and material support.

References

1. Shakespear W. Netball: Step to Success. Champaign: Human Kinetics, 1997.
2. Young WB, James R, Montgomery I. Is muscle power related to running speed with changes of direction? J Sports Med Phys Fitness 2002; 42(3): 282-8.
3. Polglaze T, Lawrence S. The use of fitness testing to monitor a season's training programme. Excel 1992; 8:85-91.
4. Cheng S, Sipila S, Taaffe, *et al*. Changes in bone mass distribution induced by hormone replacement therapy and high-impact physical exercise in post-menopausal women. Bone 2002; 31(1):126-35.
5. Johnson BL, Nelson JK. Practical Measurement for Evaluation in Physical Education. 4th Ed. Edina: Burgess Publishing, 1986.
6. Tothill P, Stewart A. Estimation of thigh muscle and adipose tissue volume using magnetic resonance imaging and anthropometry. J Sports Sci 2002; 20(7):563-76.
7. Soh KG, Ruby H, Mohd Nor' CN, *et al.* Agility among Malaysian netball players. Proceeding of the Graduate Research in Education (GREduc). Universiti Putra Malaysia (UPM) 2000; 249-56.
8. Soh KG, Ruby H, Mohd Nor' CN, *et al*. Leg Power among Malaysian Netball Players. African Journal for Physical, Health Education, Recreation and Dance (AJPHPER) 2003; 9(1):32-9.
9. Bobo M, Yarbrough M. The effects of long-term aerobic dance on agility and flexibility. J Sports Med Phys Fitness 1999; 39(2):165-9.
10. Sharkey BJ. Physiology of Fitness. 3rd Ed. Illinois: Human Kinetics Books, 1990.
11. Kraemer WJ, Newton RU. Training for improved vertical jump. Gatorade Sports Science Institute 1994; 7(6):1-10.
12. Mannie K. C.O.D. Accent on Agility. Coach and Athletic Director 2002; 71(9):6-9.
13. Soh KG, Ruby H, Mohd Nor' CN, *et al*. Leg strength per body mass ratio among elite Malaysian netball players. Australian Council for Health, Physical Education and Recreation (ACHPER) Healthy Lifestyles Journal 2003; 50(2):27-9.