THE INFLUENCE OF MODIFIED EQUIPMENT IN DEVELOPING SKILLS IN BADMINTON

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Abstract

The aim of this study was to examine the effect of modified equipment on skill acquisition among novice badminton players. The participants (24 boys, 16 girls) aged between 7 – 9 years old, without any prior formal badminton experience, were randomly divided into four groups: standard racquet with standard court (SRSC), standard racquet with modified court (SRMC), modified racquet with standard court (MRSC) and modified racquet with modified court (MRMC). Children's hitting opportunities and stroke effectiveness were tabulated using videotaped and notated during a mini-competition after a five-week training program. The result showed that there was a significant difference in hitting opportunities between the groups, $F(3, 36) = 5.178$, $p < 0.05$, $\eta 2 = 0.301$. The results in terms of stroke effectiveness also showed that there were significant differences between groups $F(3, 36) = 4.178$, $p < 0.05$, $\eta 2 = 0.258$. Based on the results, the children who practiced using modified racquet with the modified court (MRMC), recorded the highest hitting opportunities and stroke effectiveness compared to the others groups. The participants who practiced using the standard equipment recorded less hitting opportunities and stroke effectiveness during the mini-competition. This study demonstrated the advantages for children playing using modified equipment with a smaller court. By manipulating the task constraints, skill acquisition can be enhanced among children.

Keywords: Modified equipment; skill acquisition; task constraints; badminton

Introduction

Skills acquisition in sports is influenced by individual, environment and task constraints (Davids, Button & Bennett, 2008). Individual constraints describe the characteristics of an individual, including physical (height and weight) and psychological (cognitive, emotional and motivational) characteristics. Environment constraints include the characteristics of the physical environment which influence the individual's movement patterns, such as temperature, light and gravity. Task constraints describe the equipment used which influence the action or task that has been given to promote skill development (Edwards, 2010). Newell (1986) stated that to produce any skilled movement, it needs the interaction between these three constraints. If any of these three constraints change, the result would also change (Haywood & Getchell, 2009). The changes in individual constraints will lead to the changes in an individual's interaction with the environment and task constraints to produce movements (Edwards, 2010). For example, a young child wants to play badminton. His coach may give him a small racquet and provide a small court for him to play. The boy may become proficient through his experience during his practice period. In this example, the individual, environment, and task have been influenced by each other.

Scaling equipment is an effective method to enhance skill acquisition and increase the joy among children when continuously participating in sport (Farrow and Reid, 2010). Manipulating the constraints, such as modifying racquets from standard to small (altering the task constraints), may assist learners to acquire the skills more efficiently especially for children. This can be one of the best ways to improve children's' skills performance in sports (Buszard, Reid, Masters & Farrow, 2016a). In fact, scaling equipment can facilitate children to produce better performance during practice and training (Arias, 2012; Arias, Argudo & Alonso, 2012; Buszard, Farrow, Reid & Masters, 2014; Buszard et al., 2016a, Elliot, 1981; Farrow & Reid, 2010; Kachel, Buszard & Reid, 2015). This method may provide children with adequate skill and allow children to find new solutions to situations in the sporting environment for them to explore a practical environment, which can facilitate the learning process (Renshaw, 2010).

In a previous study, Jackson (2011) examined the effect of scaling equipment method upon badminton serves. The results showed that children produced better badminton serves when they used scaled equipment as compared to standard equipment. In tennis, one study investigated the effects of reducing the size of the racquet and court, compression of the ball and the height of the net (Buszard et al., 2014). The combination of the smallest racquet with the ball with the least compression produced the best hitting performance for children. In basketball, children produced more dribbling and passing and enjoyed increased shot frequency and greater shot success when playing with a lighter ball (Arias, 2012; Arias et al., 2012). Farrow and Reid (2010) also found that the use of modified racquet can increase joy among children in playing tennis. In addition, a scaling environment may enhance the opportunity for children to learn many new skills during practice, and children can play in an adult's style without facing huge constraints during matches (Buszard et al., 2016a).

However, this scaling method has not been used frequently in badminton and there have been limited studies that focused on skill acquisition in badminton among children. It might be challenging for children to play badminton in a large court and using a standard racquet. The constraints that arise in badminton might affect skill acquisition among children and may cause the learning process to be slower. Therefore, the aim of this study was to investigate the effects of modified racquets on children's hitting opportunities and successful strokes after 5 weeks of practice. We hypothesized that children using modified racquets would have more hitting opportunities and successful strokes during a mini-game competition compared to children using a standard racquet and/or standard court.

Methods

Participants

Forty children (24 boys, 16 girls) with an average age of 8.5 ± 0.5 years volunteered to participate in this study. Participants were divided into 4 groups randomly, with 10 children in each group. The consent form was distributed to all guardians, to allow their children to participate in this study. The Ministry of Education (KPM) in Malaysia (KPM.600-3/2/3-eras (97)) and the Ethics Committee of Human Research in Universiti Malaysia Sabah (JKEtika 4/17 (13)) approved the study. A Shapiro-Wilk test was conducted to test the anthropometric measurement of participants. The results showed that there were no significant differences among participants.

Table 1: Anthropometric measurement of the participants

Groups	Average height (cm)	Average weight (kg)
1	129.5 ± 3.1	30.2 ± 2.1
2	128.3 ± 2.7	29.7 ± 2.7
3	129.8 ± 3.8	31.8 ± 2.2
4	127.8 ± 3.8	29.9 ± 2.7

Experimental design

Before the intervention, the participants were randomly divided into four different groups: standard racquet with standard court (SRSC), standard racquet with modified court (SRMC), modified racquet with standard court (MRSC) and modified racquet with modified court (MRMC). The new lines for the scaled court were drawn using white masking tape and the net was lowered by 80% from the actual height. The four groups playing condition are listed as follows:

- Group 1: Standard racquet, standard court (SRSC)
  Racquet length: 40.0 cm, Court dimensions: 13.4 m × 6.1 m, height net centre: 1.5 m.
- Group 2: Standard racquet, modified court (SRMC)
  Racquet length: 40.0 cm, Court dimensions: 6.1 m × 4.7 m, height net centre: 1.2 m.
- Group 3: Modified racquet, standard court (MRSC)
  Racquet length: 35.0 cm, Court dimensions: 13.4 m × 6.1 m, height net centre: 1.5 m.
- Group 4: Modified racquet, modified court (MRMC)
  Racquet length: 35.0 cm, Court dimensions: 6.1 m × 4.7 m, height net centre: 1.2 m.

Practice procedures

All groups completed the practice session for 5 weeks. Each practice session took approximately 60 minutes and they were held three times per week. During practice, children used their equipment (based on their groups) to gain the skills that they need during the match-play. A certified coach from the Badminton Association of Malaysia (BAM) conducted practice sessions for the children. Participants received a basic training program, which included basic strokes in badminton (service, forehand and backhand, lob, clear and smash). Participants were also exposed to footwork for court coverage, agility and balance activities. These skill elements would help the participants to play better badminton during match play. At the end of each training session, participants played a mini-game (3-point rally match) within their group for familiarization with the real playing condition in badminton. All groups underwent the same training program and training protocol.

Apparatus and test procedures

After 5 weeks of practice sessions, participants played in a mini-game competition. The mini-game competition involved participants playing against each other within their group. The actual game was conducted and the rules in badminton were applied. During the mini-game competition, two digital video cameras were set up 5 meters behind and on both sides of the court to record the matches. The participants were matched randomly within their groups. The participants were free to use any strokes they preferred during the game. They played 2 games of 11 points set. Hitting opportunities and successful strokes were notated post game.

Mini-game competition analysis categories

1) Hitting opportunities: The number of strokes executed by the participants regardless whether the shuttlecock was hit from inside or outside of the badminton court. The strokes where shuttlecocks hit into the net were also counted as hitting opportunities.

2) Stroke effectiveness: The number of strokes executed by participants inside of the badminton court (in the designated playing area only). The strokes where the shuttlecocks hit the net or executed outside the badminton court were not counted as successful strokes.

Results

Hitting opportunities

One-way ANOVA revealed that there was a significant difference between the groups, $F(3, 36) = 5.178$, $p < 0.05$, $\eta 2 = 0.301$. Results showed that the MRMC group recorded the most hitting opportunities compared to the other groups (See Table 2 and Fig. 1). Tukey post hoc tests revealed that there were significant differences between the SRSC and the

MRMC groups (p = .029) and the MRSC and the MRMC groups (p = .004). There were no significant differences between the SRSC and the SRMC groups (p = .678), the SRSC and MRSC groups (p = .863), the SRMC and the MRSC groups (p = .245) and the MRMC and the SRMC groups (p = .288).

Stroke Effectiveness

Analysis revealed that there was a significant difference between groups $F (3, 36) = 4.178$, $p < 0.05$, $\eta 2 = 0.258$. Fig. 1 shows the mean score of stroke effectiveness for each group where the MRSC group recorded the lowest stroke effectiveness. Tukey post hoc tests revealed significant differences between the SRSC and MRMC groups (p = .040) and the MRSC and MRMC groups (p = .011). There were no significant differences between the SRSC and SRMC groups (p = .755), SRSC and MRSC groups (p = .929), SRMC and MRSC group (p = .392) and SRMC and MRMC groups (p = .334).

Table 2: Total mean of hitting opportunities for each group

Group	N	Mean	Standard deviation	Standard Error	p
MRSC	10	14.60	3.84	1.21	0.004
SRSC	10	16.20	3.97	1.25	
SRMC	10	18.50	3.14	0.98	
MRMC	10	22.20	6.63	1.09	

Table 3: Total mean of strokes effectiveness for each group

Group	N	Mean	Standard deviation	Standard Error	p
MRSC	10	9.80	3.52	0.92	0.012
SRSC	10	10.90	3.14	0.99	
SRMC	10	12.70	2.58	0.82	
MRMC	10	15.80	4.12	1.10	

Table 4: Total mean of rallies performance for each group

Group	N	Mean	Standard deviation	Standard Error	p
MRSC	5	29.20	7.50	1.01	0.000
SRSC	5	32.40	7.50	0.91	
SRMC	5	37.00	6.20	1.21	
MRMC	5	46.20	8.10	0.83	

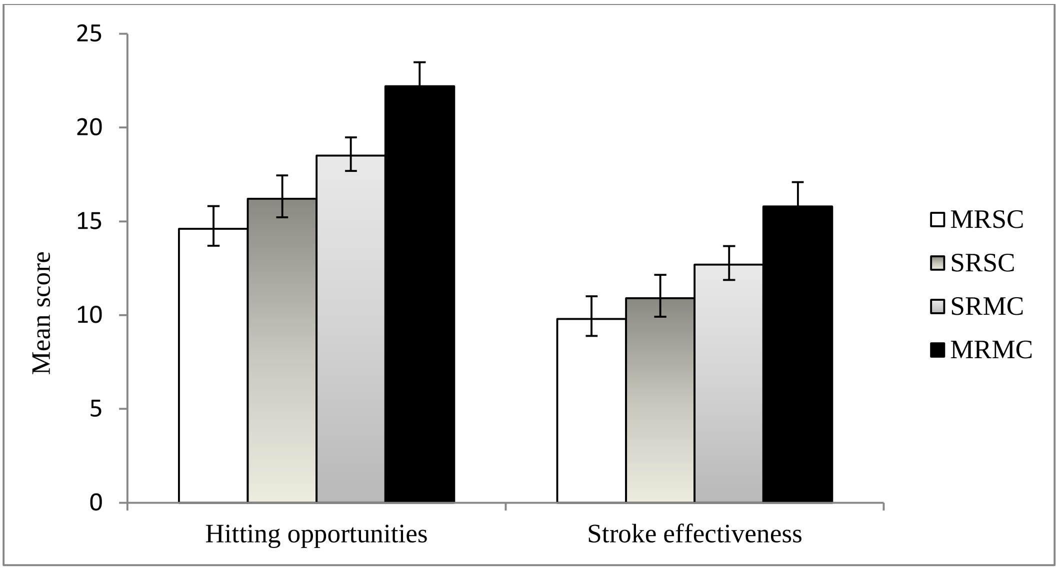

Figure 1: Hitting opportunities and stroke effectiveness for each group. Error bars represent standard deviation.

Discussion

The aim of this study was to investigate the effects of manipulating racquet length and court size on novice badminton players' skill acquisition. The results in Fig. 1 show that participants in the modified racquet with modified court (MRMC) group recorded higher mean scores in hitting opportunities and stroke effectiveness compared to other groups. The use of modified racquets had reduced the task constraints for the participants during skill execution. It showed that a shorter and lighter racquet allowed participants to use the racquet with greater ease, thereby making it easier for development of stroke-making ability (Beak, Davids and Bennett, 2000). A modified racquet is shorter than a standard racquet, enabling the participants to produce smoother swinging motion compared to a standard racquet. Furthermore, the shorter racquet allowed the participants to produce a more desirable hitting technique according to the fundamentals of overarm hitting when they were able to grip the handle easily (Burton, Greer and Wiese, 1992). This finding is also supported by a previous study in basketball (Arias, Argudo & Alonso, 2012a; Regimbal, Deller & Plumpton, 1992), in which children had a better shooting performance when they used a smaller ball compared to the adult ball.

Moreover, playing in a smaller court allowed the participants to move comfortably, making court coverage less challenging. A smaller court helped the participants to reach the shuttle more easily compared to the participants playing in a standard court. In a standard court, energy expenditure in court coverage is higher due to the smaller stature of the children, which could lead to an earlier onset of fatigue. Fewer hitting opportunities and a lower score in stroke effectiveness could be attributed to fatigue in SRSC and MRSC groups. As seen in figure 1, the MRMC recorded the highest hitting opportunities and had the highest stroke effectiveness. The MRMC group also had the highest mean for rallies (Table 3).

In a study by Buszard et al. (2016b), participants who used smaller racquets during a hitting task in tennis showed greater improvement in movement proficiency compared with participants who used larger racquets. Children with better technique could produce more successful strokes during a game and they can improve from time to time (Buszard et al., 2016b). It might be helpful for children to learn basic skills in badminton easier when manipulating the task for them. It might encourage the children to pay attention to key perceptual variables which can control their movement pattern (Davids et al., 2008). In addition, children who use a smaller and lighter racquet can focus more on their techniques and performance rather than their performance outcomes (Chow et al., 2007).

This study also showed that a smaller racquet and smaller court reduced the environmental and task constraints and facilitated skill acquisition for children. The results show that the court size was the biggest factor to influencing children's skill acquisition in badminton (see Table 1, 2 & 3). Both the groups playing in the modified court had higher means in all the parameters measured. This finding supports an earlier study that scaling the court in tennis had the biggest impact on skill acquisition among children compared to racquet size (Farrow and Reid, 2010).

Conclusion

In conclusion, the findings of the current study demonstrated that modified equipment can encourage children skill acquisition in badminton where it gives more advantages for them especially in the future. These findings may benefit children with a low memory capacity to gain skills more quickly in badminton. They can acquire the skills quicker by using modified equipment during training. These advantages include encouraging better performance, increased hitting opportunities and stroke effectiveness in badminton. Future research might examine the biomechanical differences between the use of modified racquet and standard racquet for children in badminton.

Conflicts of interest

The authors have no conflicts of interest to declare.

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