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The Effectiveness of Plyometric Training on Lower Limb Strength as A Protective Factor Against ACL Injury Among Amateur Badminton Players

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I. INTRODUCTION

Anterior cruciate ligament (ACL) injuries are common in sports that require explosive jumping, rapid directional changes, and sudden deceleration, including badminton [2]. Amateur badminton players are particularly vulnerable due to inadequate lower-limb strength and limited access to structured injury prevention programmes [3]. Poor neuromuscular control and insufficient muscular strength around the knee joint may increase the risk of non-contact ACL injuries during dynamic movements such as jumping and landing [4]. Plyometric training has been widely recognised as an effective method to improve lower-limb explosive strength, enhance neuromuscular control, and potentially reduce injury risk [1]. However, research specifically focusing on amateur badminton players remains limited [5]. Therefore, this study aimed to determine the effectiveness of a six-week plyometric training programme in improving lower-limb strength as a protective factor against ACL injury among amateur badminton players.

II. METHODS

A randomised controlled trial (RCT) pre-test and post-test design was employed. Ten amateur badminton players aged between 18 and 25 years were recruited and randomly assigned into an experimental group ($n = 5$) and a control group ($n = 5$). The experimental group underwent a structured six-week plyometric training programme, while the control group continued with routine badminton training. Lower-limb explosive strength was assessed using the Standing Long Jump (SLJ) test during pre-test and post-test sessions. Data were analysed using Jamovi statistical software. Descriptive statistics were calculated to summarise participant characteristics. Paired-samples t-tests were used to examine within-group changes, and independent sample t-tests were conducted to compare post-test differences between groups. Statistical significance was set at $p < 0.05$.

III. RESULTS AND DISCUSSION

The results indicated a statistically significant improvement in SLJ performance within the experimental group, increasing from 151 ± 32.7 cm to 169 ± 32.9 cm ($p < 0.001$). The control group also demonstrated significant improvement, increasing from 159 ± 22.8 cm to 163 ± 22.9 cm ($p < 0.001$). However, post-test comparison between groups showed no statistically significant difference ($p = 0.730$), although the experimental group recorded a higher mean score. This finding suggests that while plyometric training effectively improved lower-limb strength within the intervention group, it did not produce a significantly greater improvement compared with routine badminton training over the six-week period. The improvements observed in both groups may be attributed to the explosive nature of badminton itself, which involves repetitive jumping, lunging, and rapid directional movements that stimulate lower-limb strength development [2]. Additionally, the small sample size and short intervention duration may have limited the ability to detect significant between-group differences. Nevertheless, enhanced lower-limb strength is associated with improved knee joint stability and neuromuscular control, which are important components in ACL injury prevention [4]. Therefore, plyometric training may still be considered a beneficial conditioning strategy for amateur badminton players.

IV. CONCLUSIONS

In conclusion, a six-week plyometric training programme significantly improved lower-limb strength among amateur badminton players. However, no significant difference was observed between the experimental and control groups at post-test. Although plyometric training demonstrated positive within-group effects, routine badminton training alone may also contribute to lower-limb strength improvements. Future studies should involve larger sample sizes, longer intervention durations, and additional injury-related measures to provide stronger evidence regarding the

effectiveness of plyometric training as an ACL injury prevention strategy.

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