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The Effects of the Plyometric Exercise Training Program on Explosive Movement (Agility) on the Performance of Futsal Athletes

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ABSTRACT

This study employed quantitative research design specifically the quasi-experimental research design to compare the explosive movements of the control and experimental groups before and after intervention wherein the primary instrument was the Plyometric exercise training program adopted from Jsport Sci Med. 2006. The survey questionnaire was used that consisted of items that measure the acceptability and relevance of the training program and was rated by the athletes themselves. In data analysis, the researcher utilized the mean and standard deviation to determine the level of athletes' agility performance before and after the training program. Additionally, analysis of covariance (ANCOVA) was used to examine the mean difference in participants' post-performance as controlling for pre-performance agility. The study results showed a significant difference in agility's post-performance between the two groups as controlled by the pre-performance. It is recommended that the coaches, trainers, and athletes may integrate the plyometric exercise training program during their training further to enhance athletes' agility skill. It could serve as a guide for them to monitor the progress.

INTRODUCTION

To improve their effectiveness, efficiency, and competency in fulfilling the demands of play, athletes must first complete specific training for their chosen sport before competing in tournaments or contests. Accordingly, a number of training regimens and initiatives, such as the Plyometric Exercise Training Program, have been created to meet the needs of athletes and enhance performance. Coaches and trainers are crucial in helping athletes in professional sports get ready for the demanding demands of contemporary competitive situations.

Plyometric training is well known for its ability to enhance fundamental aspects of physical performance, including lower-body strength, sprint speed, and vertical leap height. Exercises that improve leaping ability, especially in female athletes, include jump squats and box jumps (Stojanović *et al.*, 2017; Oxfeldt *et al.*, 2019). Plyometric training has benefits for injury prevention in addition to performance enhancement. For example, Stojanović *et al.* (2017) found that athletes who play sports requiring a lot of jumping and quick direction changes had a lower incidence of knee injury. However, plyometric training is risky if done incorrectly because of its high-impact and explosive nature (Watkins *et al.*, 2021). In addition, Oxfeldt *et al.* (2019) emphasized that individual responses to plyometric training vary based on factors such as age, gender, and training background which highlight the need for individualized programs contextualized to these characteristics.

Espinosa and Sampaga (2020) discovered that following a plyometric training regimen, the majority of Filipino athletes had a notable increase in agility. Through a variety of exercises and physical activities, this training improves the strength of the lower extremities. This assertion was backed up by Diosalan (2024), who pointed out that plyometric training efficiently builds leg strength, which is essential for performing agility-based activities. The impact of plyometric activities to the development of leg strength and agility was also confirmed by Rimando *et al.* (2015).

Plyometric training dramatically enhances key physical fitness characteristics as speed and agility, according to Longakit *et al.* (2025). Similarly, Potenciando (2024) discovered a substantial link between sports motivation and engagement, indicating that plyometric exercises and other structured training regimens can improve player participation and performance. Female athletes are actively participating in futsal in the local Philippine environment. Gallardo (2025) emphasized the necessity of inclusive training programs created especially to enable female athletes to realize their full potential while highlighting the ongoing gender hurdles in sports.

Even with futsal's growing appeal and the proven value of agility and plyometric training in team sports, there is still a dearth of study on these subjects in the BARMM region. The majority of previous research has been carried out in Southeast Asia or other regions of the Philippines. This demonstrates the pressing need for regional studies that take into account the particular requirements, reactions, and agility-enhancing benefits of plyometric therapies among athletes in the BARMM region.

In order to help athletes become more proficient and successful in their sport, this study tries to ascertain the extent to which plyometric training affects agility and general performance, especially in novices.

The study assessed how well a plyometric exercise training regimen improved futsal players' explosive movement, particularly their agility. The main objective

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is to compare the performance outcomes of two groups: the experimental group, which consists of fifteen (15) athletes from Datu Paglas National High School, and the control group, which consists of fifteen (15) athletes from Tulunan National High School.

Theoretical Framework

This study is anchored in three theoretical models: Verkhoshanski's Shock Method (1968) for developing explosive strength and reactive ability, Komi's Stretch-Shortening Cycle (SSC) Theory (1979), and the Specificity Principle of Training introduced by Dr. Thomas K. Cureton in the 1940s.

Verkhoshanski's Shock Method is regarded as one of the most effective techniques for developing explosive power. This method involves overcoming external resistance after an initial preparatory force. As explained by Thibaudeau (2022), depth jumps from a height slightly above the athlete's maximum vertical jump facilitate force absorption and redirection, targeting the athlete's reactive neuromuscular capacity. These jumps can be tailored to prioritize either power or speed by varying the intensity and timing of the rebound. However, Zatsiorsky cautioned that the method may also produce negative transfer effects if misapplied. The approach emphasizes brief ground contact to maximize the use of elastic energy in explosive actions.

Komi's (1979) SSC Theory explains that a muscle undergoes a rapid eccentric contraction followed immediately by a concentric contraction. This sequence stores and releases elastic energy, thereby increasing movement efficiency and force output (Sáez *et al.*, 2015). Ramirez-Campillo *et al.* (2018) demonstrated that plyometric training programs based on SSC principles significantly improve explosive movements, sprint speed, and directional agility.

Dr. Thomas K. Cureton's Specificity Principle posits that training adaptations are directly related to the nature of the training performed. According to Suchomel *et al.* (2016), the most effective performance gains occur when training mirrors the biomechanical and physiological demands of the target activity. Slimani (2016) supported this claim by noting that sport-specific plyometric routines result in greater functional improvements in agility and speed than general strength training. Chaabene *et al.* (2018) further emphasized that specificity in energy systems and movement patterns enhances performance transfer from training to competition.

These theories collectively provide a solid foundation for this study. They clarify the mechanisms through which plyometric training enhances agility and justify the use of structured, sport-specific training to improve neuromuscular coordination and athletic performance.

MATERIALS AND METHODS

Research Design

This study adopted a quantitative research design, namely a quasi-experimental approach, to investigate the influence of plyometric training on the agility of student-athletes. Quantitative research, which is based on the positivist paradigm, makes the assumption that reality is quantifiable, objective, and best studied via statistical analysis and numerical data (Creswell & Creswell, 2018). The measurement of variable relationships, hypothesis testing, and evidence-based conclusions are made possible by this method. According to Gay *et al.* (2016), these designs are especially well-suited for objectively and reproducibly assessing the effects of treatments. According to Belli (2018), quantitative approaches are useful for turning complicated phenomena into quantifiable indicators, which makes them ideal for research pertaining to education and sports.

The practical limitations of random assignment led to the use of a quasi-experimental design. According to Campbell and Stanley (2015), this kind of design permits comparisons between experimental conditions while allowing the utilization of intact or pre-existing groups. When complete randomization is restricted due to logistical or ethical constraints, quasi-experimental methods are particularly pertinent in practical research (Bärnighausen *et al.*, 2017; Bryman, 2016).

Locale of the Study

The study was carried out in two public secondary schools in the Maguindanao del Sur and Cotabato provinces. From Datu Paglas National High School in Datu Paglas, Maguindanao del Sur, the experimental group was selected. Tulunan National High School athletes from Tulunan, Cotabato, made up the control group. Using the Datu Paglas–Tulunan National Road, it takes 30 to 40 minutes to travel between these schools, which are around 18 kilometers apart.

Tulunan National High School was chosen as the control group because of its well-established futsal program and ease of access. It had the only active futsal squad among the surrounding schools that regularly competed in interschool tournaments. Additionally, its close proximity to the researcher's home made routine monitoring and seamless data collecting possible.

The experimental group was chosen from Datu Paglas National High School since the researcher has experience there as a futsal coach. This familiarity made it easier to communicate with athletes and school staff and to execute the training regimen.

The choice of these two schools was based on both logistical feasibility and existing institutional ties, which helped ensure a reliable and well-managed experimental setting.

Respondents of the Study

The study involved thirty (30) female futsal athletes enrolled for the school year 2024–2025. Fifteen (15) athletes from Tulunan National High School served as the control group, while another fifteen (15) from Datu Paglas National High School formed the experimental group. According to DepEd Memorandum No. 35, s.

2023, futsal teams must include a maximum of twelve (12) official players. Three (3) additional athletes were trained as alternates in case of injury among the main players.

Eligible respondents were between the ages of 13 and 18, as mandated by DepEd Memorandum No. 005, s. 2023, which states that secondary student-athletes must be born on or after January 1, 2006.

Appropriate participant selection is crucial to ensure the validity and reliability of research findings. As Subedi (2021) noted, factors such as research purpose, methodology, theoretical grounding, and data saturation must be considered when determining sample size.

Sampling Technique

The study adopted a Total Population Sampling technique. This method is ideal when the entire population is small and possesses unique characteristics not commonly found in the general population (Makwana, 2023). All qualified futsal athletes from the two identified schools were included in the study to ensure comprehensive and representative data.

Data Gathering Instruments

The primary instrument used was a Plyometric Exercise Training Program, adapted from J Sport Sci Med (2006). To measure agility, the Illinois Agility Test and 30-Meter Sprint Test were employed.

A survey questionnaire was also given out to evaluate the plyometric program's acceptance and relevance. A five-point Likert scale was employed in this survey, which was modified from Rubrico (2022):

Table 1: Likert scale on the survey data

Mean Score	Description	Interpretation
1.00–1.79	Strongly Disagree	Very Uninfluential
1.80–2.59	Disagree	Uninfluential
2.60–3.39	Neutral	Neutral or Uncertain
3.40–4.19	Agree	Influential
4.20–5.00	Strongly Agree	Very Influential

Illinois Agility Test

This test measures agility using a course with multiple direction changes and sprints. Each participant completed the test twice, with a five-minute rest in between. The faster of the two times was recorded.

Table 2: Illinois Agility Test

Time (seconds)	Agility Level
<17.0	Excellent
17.0–17.9	Good
18.0–21.7	Average
21.8–23.0	Fair
>23.0	Poor

The plyometric training program included three sessions per week on alternate days, with 48 hours of rest between sessions. The program followed a progressive overload design to allow for safe and effective adaptation.

Statistical Treatment

The perceived acceptability and usefulness of the training program were assessed using descriptive statistics, more especially the mean. The mean is a useful summary metric for assessing structured feedback, according to Salkind (2017). Triola (2018) and Gravetter and Wallnau (2017) highlighted the value of the mean in response analysis and group performance comparison in pretest-posttest designs.

After adjusting for agility pretest scores, the Analysis of Covariance (ANCOVA) was used to look at posttest differences between the experimental and control groups. A more accurate evaluation of the intervention's efficacy is provided by ANCOVA, which accounts for initial group differences.

Ethical Considerations

Prior to data collection, participants were briefed on the objectives, procedures, and confidentiality of the study. Informed consent was secured from all respondents. All data were treated with strict confidentiality, and the identities of participants were not disclosed to ensure privacy and avoid harm.

RESULTS AND DISCUSSION

The study's results are presented, examined, and interpreted in this part. It addresses the following topics: (1) the athletes' assessment of the plyometric training program's relevance and acceptability; (2) the experimental and control groups' pre- and post-training performance levels; and (3) the statistical significance of the agility performance differences between the two groups.

Quality of the Plyometric Training Program as Evaluated by the Athletes

Relevance

Table 3 presents the athletes' evaluation of the relevance of the plyometric training program. The overall mean score was 4.83 (SD = 0.22), interpreted as "Very Influential". All ten indicators received mean scores interpreted as "Strongly Agree", indicating that participants viewed the program as highly relevant in enhancing agility.

The slightly lower score for item 7 ("Aligned with current trends") suggests a need to further align training content with the evolving interests of young athletes. Nonetheless, the consistently high scores reinforce the program's perceived value and relevance.

The study by Mahmoud *et al.* (2025) demonstrated a significant improvement in agility, suggesting that plyometric training is effective in enhancing this skill in athletes. These findings are consistent with those of

Table 3: Relevance of the Plyometric Training Program

Statement	Mean	SD	Description
Exercises are appropriate to athletes' needs	5.00	0.00	Strongly Agree
Effectiveness shown through pre- and post-tests	5.00	0.00	Strongly Agree
Encourages further research	4.53	0.52	Strongly Agree
Aligns with expected skills and content	5.00	0.00	Strongly Agree
Meets minimum skill requirements	4.73	0.46	Strongly Agree
Suitable for athletes' capabilities	5.00	0.00	Strongly Agree
Aligned with current trends and interests	4.33	0.72	Strongly Agree
Promotes explosive performance	5.00	0.00	Strongly Agree
Helps develop targeted skills	5.00	0.00	Strongly Agree
Appropriate for local and regional competition	4.73	0.46	Strongly Agree

Ramirez-Campillo *et al.* (2020) and Ache-Dias *et al.* (2016), who also reported that plyometric training substantially improves agility and neuromuscular performance, especially in sports that demand explosive movements and quick changes in direction.

Acceptability

Table 4 shows that the overall mean score for acceptability was 4.81 (SD = 0.24), also interpreted as "Very Influential". Most items received perfect scores (5.00), reflecting high satisfaction among athletes with the content, structure, and execution of the training program.

Table 4: Acceptability of the Plyometric Training Program

Indicator	Mean	SD	Description
Builds lower-body strength	4.60	0.51	Strongly Agree
Matches athlete needs	4.73	0.46	Strongly Agree
Exercises are systematic	4.73	0.46	Strongly Agree
Promotes explosive movement	4.73	0.46	Strongly Agree
Easy to perform	5.00	0.00	Strongly Agree
Matches target participants	5.00	0.00	Strongly Agree
Follows skill development principles	4.20	0.68	Agree
Responds to developmental needs	4.67	0.49	Strongly Agree
Meets minimum training standards	5.00	0.00	Strongly Agree
Engaging and motivating	5.00	0.00	Strongly Agree
Requires appropriate attire	5.00	0.00	Strongly Agree
Considers hydration and safety	5.00	0.00	Strongly Agree
Minimizes injury risk	5.00	0.00	Strongly Agree
Promotes sportsmanship and growth	5.00	0.00	Strongly Agree
Valuable and transferable	4.53	0.52	Strongly Agree

The slightly lower score for item 7 suggests that some respondents felt the training could be better aligned with skill development theories such as overload and adaptation. Despite this, the overall ratings confirm that the program was highly acceptable to participants and well-structured.

Performance Levels Before and After the Training

Agility Performance

Table 5 summarizes the pre- and post-test agility results. Before training, both groups performed at a "Fair" level. After the intervention, the experimental group improved to an "Average" rating, while the control group also improved slightly but remained at the same level.

Table 5: Agility Performance Before and After the Training

Group	Pre-Test (Mean)	Post-Test (Mean)	SD (Post-Test)	Interpretation
Experimental	22.64	19.89	0.87	Improved
Control	22.00	21.42	1.05	Slightly Improved

The experimental group showed a marked improvement in agility following six weeks of plyometric training. This supports findings by Turkarsalan and Deliceoglu (2024), who reported similar outcomes among athletes who underwent structured plyometric programs.

Table 6 Difference in Agility Post-Test Scores (ANCOVA)

Group	Mean	SD	Mean Diff	F (ANCOVA)	p-value
Experimental	19.89	0.87	1.53	56.38	<0.0001
Control	21.42	1.05	—	—	—

ANCOVA Results

There was a statistically significant difference in agility performance in favor of the experimental group. This supports prior research Chandra *et al*., 2023); Pooja, (2019) which found that six weeks of plyometric training significantly improves agility.

CONCLUSIONS

Based on the findings of the study, the following conclusions were drawn

The extent of the quality of the plyometric exercise training program in terms of acceptability and relevance was very influential. The acceptability score was 4.81, and the relevance score was 4.83. The plyometric exercise training program was very acceptable and relevant in improving agility skill. Based on the study's results, the control group performed better compared to experimental group before the implementation of plyometric exercise training program in terms of agility and speed. Meanwhile, the experimental group exhibited a significant improvement, with mean scores increasing after using a plyometric exercise program, which indicates a positive impact on enhancing agility skill.

Recommendations

In light of the study's findings and conclusions, the following recommendations are proposed:

1. Coaches and trainers should integrate current training trends and athlete-centered strategies when designing training programs. Tailoring sessions to the athletes' interests and needs can increase motivation, participation, and performance outcomes.

2. Training programs should apply the FITT principle—Frequency, Intensity, Time, and Type—to ensure proper periodization, workload progression, and injury prevention. This structured approach supports sustainable skill development and physical conditioning.

3. Plyometric exercise training is highly recommended for athletes in sports that demand agility or quick directional changes, such as futsal. It should be incorporated as a regular component of team conditioning programs.

4. Future researchers may conduct longitudinal studies with larger sample sizes or explore the effects of combining plyometric training with other modalities (e.g., resistance training or agility ladders) to enhance both agility and speed performance.

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