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Effect of Soccer Training on Gross Motor Skill Improvement in Senior High School Students

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ABSTRACT

Gross motor skill such as agility and speed are essential indicators of physical development in adolescents. Soccer training involves dynamic movements that can prodive rapid neuromuscular stimulation This study aimed to analyze the effect of a single 60-minute soccer training session on the acute motor response of high school students. This study employed a quasi-experimental *one-group pretest–posttest* design involving 12 male grade-10 students from SMAN 4 Takalar. The intervention consisted of a 5-minute pre-test, 10-minute warm-up, 30-minute main training session, 10-minute cool-down, and a 5-minute post-test. The instruments used were the 30-Meter Sprint Test (speed) and the Illinois Agility Test (agility). Data were analyzed using descriptive statistics and a paired-sample t-test with a significance level of 0.05. The findings showed acute improvements in both agility and speed. Mean agility decreased from 8.08 ± 0.87 s to 7.72 ± 0.86 s (*Δ = 0.36 s; 4.45% improvement*). Mean speed decreased from 10.49 ± 0.86 s to 9.86 ± 0.78 s (*Δ = 0.63 s; 6.00% improvement*). Paired-sample t-tests confirmed significant differences in agility ($p = 0.000025$) and speed ($p = 0.000078$). These results indicate that even a single session can produce an acute neuromuscular response that immediately enhances gross motor performance. A single 60-minute soccer training session effectively elicited a positive acute motor response in students' agility and speed. Although the improvements do not represent chronic adaptations, such short-duration training is relevant for physical education settings with limited instructional time.

1. Introduction

Gross motor develompment ia an important component in the phycical growth of adolescents because it involves the use of large muscles, body coordination, balance, agility, and movement speed. During adolescence, there is a significant increase in neuromuscular function, making this period the most effective time to provide motor stimulation through structured physical activities. Recent studies on motor development explain that motor development is influenced by training, environment, and the opportunities for movement given to learners

Globally, adolescent physical activity remains at a concerning level. WHO report that more than 80% of adolescents worldwide do not meet the minimum recommendation of 60 minutes of moderate-to-vigorous physical activity daily (WHO, 2020). The Global Action Plan on Physical Activity also emphasizes that the trend of physical inactivity among adolescents increases every year, endangering long-term motor development and health (WHO, 2019).

In Indonesia, Riskesdas data show that 67.7% of adolescents have low levels of physical activity, which affects agility, coordination, and physical fitness in school-aged students (Kemenkes, RI, 2018). Recent studies also find that excessive gadget use and a sedentary lifestyle cause a significant decline in gross motor skills among adolescents (Ramadan & Juniarti, 2021)

In the educatinal context, the role of physical education, sport, and health (PJOK) is very important in prodiving varied physical activity opportunities. One model proven effective in enhancing adolescents' gross motor skills is game-based training, particularly soccer. Soccer is known as a multidimensional sport integrating locomotor, non-locomotor, and manipulative skills (Milovanović, M., Trkulja, S., Jeličić, M., & Stanković, 2019). Movements such as sprinting, dribbling, passing, shooting, and quick changes of direction provide strong neuromuscular stimulation, supporting the development of gross motor skills.

In addition, the small-sided games (SSGs) training approach, which has been widely studied in the last 5-10 years, has beeb proven more effective than conventional training in improving agility, speed, and changeof direction speed in young players. A meta analysis by (Sarmento, H., Clemente, F. M., Harper, L. D., Costa, I. T., Owen, A., & Figueiredo, 2018) shows that SSGs significantly increase movement ntensity, opportunities.

Based on empirical conditions among students at SMAN 4 Takalar, it was found that agility and speed abilities were not yet optimal, consistent with national dara on low adolescent physical activity levels. This condition indicates the need for structured physical activity even within limited time duration. In this study, the intervention was given through a single 30-minute soccer training session designed to provide direct motor stimulation. Although the training duration was short, it still incorporated locomotor, non-locomotor, and manipulative elements that could elicit initial motor responses.

Althought numerous previous studies have examined the effect of long-term soccer training programs, very few have responses *(acute motor responses)* in adolescents. In school-based physical education settings, training time is often limited to one class session, making it essential to understand whether a single session can produce short- term changes in gross motor performance. Therefore, this study addresses this gap bt investigating the acute motor response following one 60- minute soccer training session.

Therefore, this study aims to analyze the effect of soccer training sessions on the gross motor skills of student at SMAN 4 Takalar. The result are expected to provide an initial overview of the effectiveness of game-based training conducted within limited time and to serve as a consideration for PJOK teachers in designing efficient learning activities that still provide positive impacts on students' motor development.

2. Methods

This study used a quasi-experimental design with a one-group pretest-posttest approach, in which measurements were teken before and after treatment within the same group. This design is commonly used in physical education and sport science research because it is effective for identifying immediate changes resulting from short-term, single-session interventions, making is suitable for evaluating acute effects (Cohen, L, Manion, L, & Morrison, 2018). The study was conducted at SMAN 4 Takalar during the odd semester of the current academic year, utilizing the students' available schedule. The previously included sentence "thus supporting data collection within a single day" was removed as it lacked academic relevance.

The research subject consisted of twelve male grade X students selected through purposive sampling. This selection considered several criteria, such as the students' ability to participate in physical activities (Etikan, 2016). In addition, the characteristics of male students were chosen to

maintain data consistency, considering the physiological differences between male and female students in measuring speed and agility.

The variables measured in this study consisted of a short soccer training session as the independent variable and a dependent variable as the students' gross motor skills, specifically speed and agility. Gross motor skills were measured using two instruments: the 30-meter sprint test to measure running speed and the Illinois agility test to measure agility. These instruments were chosen because they have been widely used in previous studies, have high validity, and can be easily implemented within a limited time. (Lockie, R. G., Schultz, A. B., Callaghan, S. J., & Jeffriess, 2013). The thirty meter sprint test provides an overview of a student's acceleration and maximum speed capabilities, while the Illinois agility test measures the ability to change direction quickly and efficiently, which is an important component of gross motor skills.

The research procedure began with a 5 minute pretest during which students performed the 30-meter sprint and the Illinois agility test. The recorded times served as baseline data. After pretest, student underwent a structured 60-minute soccer training session, consisting of several stages. The training began with a 10-minute warm-up, including light jogging and dynamic movements such as high knees, butt kicks, and leg swings to prepare the neuromuscular system. The main training phase lasted 30 minutes, consisting of zigzag dribbling drills to develop coordination and agility, as well as short-passing drills to improve ball control and movement efficiency. These activities were intentionally designed to elicit acute neuromuscular responses despite the short duration. The session concluded with a 10-minute cool-down, consisting of static stretching and breathing exercises.

Immediately after the training, students completed a 5-minute posttest using the same instruments as the pretest. The posttest was administered directly after the intervention to capture immediate motor changes (acute responses) resulting from a single training bout. Pretest and posttest data were analyzed using descriptive statistics to obtain mean scores, score different, and percentage improvements. A paired-sample-t-test with a significance level of 0.05 was used to determine significant differences between pre-and post- intervention result (Pallant, 2020). The analysis served as the basis for evaluating the effectiveness of the single-session soccer training intervention on the gross motor skills of students at SMAN 4 Takalar.

3. Results

The results of this study present a comparison between pretest and posttest scores of agility and speed after one structured soccer training session. Updated descriptive statistics derived from the raw dataset are presented in Table 1.

Table 1. Group Pretest-Posttest Result of Agility and Speed

Variable	Pre-test (Mean ± SD)	Post-test (Mean ± SD)	ΔPerubahan	*%Change*
Agility (detik)	8.08 ± 0.87	7.72 ± 0.86	↓ 0.36	4,45%
Speed (detik)	10.49 ± 0.86	9.86 ± 0.78	↓ 0.63	6.00 %

The mean agility score improved from 8.08 ± 0.87 seconds in the pretest to 7.72 ± 0.86 seconds in the posttest, showing an improvement of 0.36 seconds (equivalent to 4.45%). Meanwhile, the mean speed performance also improved, with the mean sprint time decreasing from 10.49 ± 0.86 seconds to 9.86 ± 0.78 seconds, resulting in an improvement of 0.63 seconds (equivalent to 6.00%). All twelve participants demonstrated improvement in both agility and speed, indicating a consistent acute enhancement in gross motor performance after the intervention.

Table 2. Individual Pretest–Posttest Scores

No	Agility Pre	Agility Post	Δ	Speed Pre	Speed Post	Δ
1	7.55	7.37	0.18	9.77	9.23	0.54
2	7.22	6.76	0.46	9.23	9.11	0.12
3	7.78	7.65	0.13	10.11	9.65	0.46
4	9.67	9.56	0.11	11.56	10.88	0.68
5	7.65	7.33	0.32	10.22	9.87	0.35
6	7.74	7.37	0.37	10.76	10.21	0.55
7	7.28	6.88	0.40	9.55	9.06	0.49
8	8.89	8.14	0.75	10.87	10.22	0.65
9	9.36	9.13	0.23	10.83	10.23	0.60
10	8.32	7.87	0.45	9.98	9.19	0.79
11	7.43	6.99	0.44	10.02	9.98	0.04
12	8.11	7.65	0.46	11.99	10.76	1.23

Individual changes for each participant are provided in Table 2. A paired-sample t-test confirmed statistically significant differences between pretest and posttest scores for both variables. Agility showed a significance value of $p = 0.000025$, while speed showed $p = 0.000078$, indicating that the training session produced a strong and meaningful immediate effect on gross motor ability.

Table 3. Paired-Sample t-Test Results

Variable	df	p-value	Interpretation
Agility (Pre–Post)	11	0.000025	Significant
Speed (Pre–Post)	11	0.000078	Significant

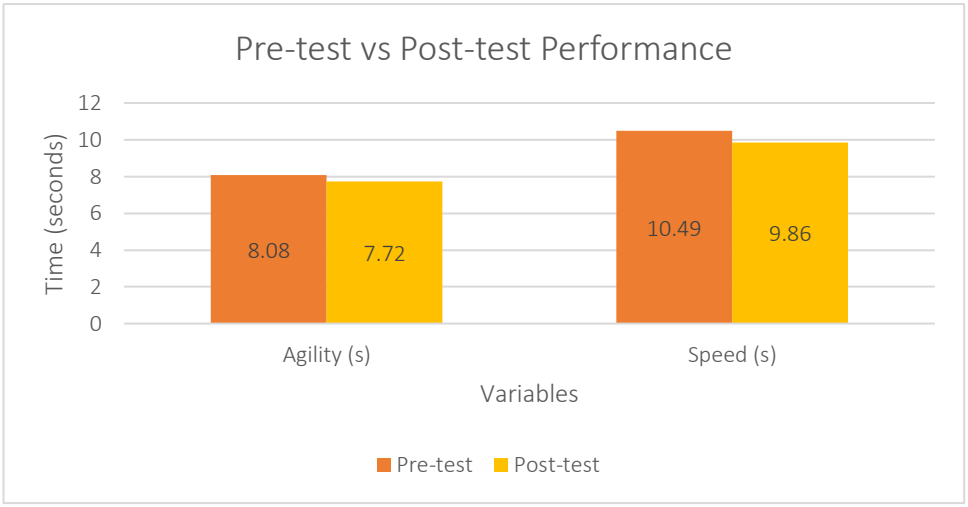

Figure 1. Comparison Diagram of Pre-test, Post-test

The results of the study showed that despite the very short training duration, students still responded positively to exercises that incorporated basic soccer techniques. Exercises such as zigzag dribbling have been shown to generate explosive leg muscle activation and improve motor coordination. A significant response was seen in sprinting ability, as game training tends to involve numerous short-term accelerative movements. Meanwhile, improvements in agility were influenced by the number of changes in direction students made during the training.

Physiologically, short but intense exercise can have a direct effect on motor unit activation and movement efficiency, resulting in improved reaction time and change of direction. These findings are in line with research. (Clemente, F, M., Afonso, J., & Sarmento, 2021) which shows that short sessions of small-sided games can provide significant stimulus to motor components such as speed and agility.

Thus, the results of this study indicate that short soccer training sessions still have an impact on improving gross motor skills in students at SMA Negeri 4 Takalar. Although the improvements were limited to the body's initial response, these findings provide a basis for the application of structured training, even in short sessions, in physical education (PJOK) as a strategy to improve students' motor skills.

4. Discussion

The results of this study showed a measurable improvement in students gross motor performance after a single 30-minute soccer training session. Quantitative analysis demonstrated that the mean agility time decreased from 8.08 ± 0.87 seconds in the pretest to 7.72 ± 0.86 seconds in the posttest, indicating an improvement of $\Delta = 0.36$ seconds. The paired-sample test produced a significance value of $p = 0.000025$, confirming that the improvement was statistically significant.

A similar pattern was observed in speed performance. The mean 30-meter sprint time decreased from 10.49 ± 0.86 seconds before the intervention to 9.86 ± 0.78 seconds afterward, resulting in an improvement of $\Delta = 0.63$ seconds with a significance level of $p = 0.000078$. These results indicate that although the intervention was carried out only once, it triggered an acute neuromuscular response capable of improving students' coordination, acceleration, and movement efficiency during short-duration activity.

The improvement in agility can be explained by the nature of the training, particularly drills that require rapid changes of direction such as zigzag dribbling. Such activities demand repeated deceleration–acceleration patterns that stimulate lower-limb muscle activation and enhance change-of-direction ability. This aligns with the findings of. (Clemente, F, M., Afonso, J., & Sarmento, 2021) who reported that game-based and direction-change drills can enhance agility even within short training durations. Dynamic activities expose students to repeated acceleration bursts, quick stops, and reactive directional shifts, which acutely influence neuromuscular control mechanisms.

In terms of speed performance, the improvement of 0.63 seconds reflects rapid motor adjustments involving increased motor-unit recruitment and improved movement economy during sprinting. (Hammami, M., Chaouachi, A., Makhlouf, I., Granacher, U., & Behm, 2018) reported that short-duration high-intensity stimuli can enhance sprint performance through better coordination and neuromuscular efficiency. Additionally, motivational factors likely contributed, as competitive game-based training increases effort, focus, and movement intensity. This is consistent with (Milovanović, M., Trkulja, S., Jeličić, M., & Stanković, 2019) who found that competitive small-sided games elicit higher physical engagement among students.

Despite these positive results, several limitations must be acknowledged. First, the improvements observed represent acute responses rather than long-term adaptations. Genuine gross motor development requires extended, progressive, and repeated training sessions. Therefore, the findings should not be interpreted as evidence of developmental change, but rather short-term physiological readiness. Second, the one-group pretest–posttest design used in this study lacks a control group, making it susceptible to internal validity threats as noted by Cohen et al. (2018). Third, the learning effect may have influenced the posttest results, as students were already familiar with the test procedures, which could naturally lead to improved performance regardless of the training. Fourth, the small and homogeneous sample (12 male students) selected through purposive sampling (Etikan, 2016) limits the generalizability of the findings.

Practically, the significant improvements in agility and speed—even within a single short session—illustrate how physical education teachers can make effective use of limited instructional time through game-based activities. This approach is aligned with WHO (2020), which states that short bouts of moderate-to-high-intensity physical activity can still provide meaningful benefits when performed consistently. Thus, soccer-based training can serve as a practical and effective method to stimulate students' gross motor skills, particularly in school environments with limited training time.

5. Conclusion

This study aimed to analyze the effects of structured soccer training delivered in a single thirty-minute session on the gross motor skills of students at Takalar 4 State Senior High School. Based on the measurements and statistical analysis, it was found that this brief intervention had a positive and significant impact on two gross motor components: agility and speed.

In the agility aspect, there was a performance improvement indicated by a decrease in the average time from 8.08 ± 0.87 seconds in the pre-test to 7.72 ± 0.86 seconds in the post-test, resulting in an improvement of $\Delta = 0.36$ seconds. The significance value of $p = 0.000025$ indicates that this improvement is not merely a random variation but is indeed the effect of the training intervention. Meanwhile, in the speed aspect, the thirty-meter sprint performance also improved from 10.49 ± 0.86 seconds to 9.86 ± 0.78 seconds, with a difference of $\Delta = 0.63$ seconds and a significance value of $p = 0.000078$. The improvements in these two motor components demonstrate that soccer training is effective even when conducted within a very limited duration.

This positive response can be explained by physiological mechanisms involving increased motor unit activity, enhanced neuromuscular coordination efficiency, and acute motor adaptations that occur during high-intensity activity. The literature supports the potential for rapid motor skill improvement in soccer due to its dynamic movement characteristics, rich in acceleration, changes in direction, and ball manipulation. (Sarmento, H., Clemente, F. M., Harper, L. D., Costa, I. T., Owen, A., & Figueiredo, 2018) This shows that gross motor improvement does not have to depend on long duration of exercise, but more on the intensity and quality of the activity provided.

The results of this study also confirm that physical education (PJOK) learning can be maximized even with limited learning time. Medium-high intensity game activities have been recommended by the WHO (2020) as an effective form of physical activity that can improve motor capacity and physical health, even if done for a short duration. Therefore, in the context of education, soccer training is a practical and efficient strategy for PJOK teachers to quickly improve students' motor skills.

Overall, it can be concluded that structured soccer training has been shown to have a positive and significant impact on the gross motor skills of students at SMA Negeri 4 Takalar, both in terms of agility and speed. These findings provide empirical data that game-based training can be an effective learning approach to improve gross motor components in a short time. Therefore, it is recommended that such training activities be routinely integrated into physical education (PJOK) lessons and extracurricular activities to achieve optimal and sustainable adolescent physical development.

6. Author Contribution

Muh. Takbir Adha and Agus Awal Putra conducted the experiments and developed the research design. Ikra Saputra and Fachrul Rozy were responsible for data collection. Nur Annisa was responsible for the analysis and interpretation of the results. All authors participated in the writing and preparation of the final manuscript.

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