

เปรียบเทียบผลของการฝึกความแข็งแรงและความอ่อนตัวต่อความสามารถ ในการตีลูกกอล์ฟในนักกีฬาگอล์ฟเยาวชนชาย

A COMPARISON OF STRENGTH TRAINING AND FLEXIBILITY EXERCISE ON DRIVING ABILITY IN YOUNG MALE GOLFERS

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บทคัดย่อ

การวิจัยครั้งนี้มีวัตถุประสงค์เพื่อเปรียบเทียบผลของการฝึกความแข็งแรงของกล้ามเนื้อและการฝึกความอ่อนตัวต่อความสามารถในการตีไดรฟ์ของนักกีฬาگอล์ฟเยาวชนชาย การวิจัยครั้งนี้ใช้รูปแบบการวิจัยแบบกึ่งทดลอง โดยใช้การจัดกลุ่มตัวอย่างแบบจับคู่ พร้อมการวัดก่อนและหลังการทดลอง (quasi-experimental matched-group pretest-posttest design) กลุ่มตัวอย่างเป็นนักกีฬาگอล์ฟเยาวชนเพศชายจำนวน 10 คน อายุเฉลี่ย 17.1 ± 3.2 ปี ทำการจัดกลุ่มโดยอาศัยความสามารถในการตีไดรฟ์ แบ่งออกเป็นกลุ่มที่ 1 ฝึกความแข็งแรงของกล้ามเนื้อ (Strength Training Group: STG, $n = 5$) และกลุ่มที่ 2 ฝึกความอ่อนตัว (Flexibility Exercise Group: FEG, $n = 5$) ทั้งสองกลุ่มเข้าร่วมโปรแกรมการฝึกเป็นระยะเวลา 8 สัปดาห์ สัปดาห์ละ 3 ครั้ง ทำการประเมินความเร็วหัวไม้กอล์ฟและระยะการตีไดรฟ์ก่อนและหลังการฝึก โดยใช้เครื่อง Swing Speed Radar® วิเคราะห์ข้อมูลด้วยสถิติเพื่อเปรียบเทียบความแตกต่างภายในกลุ่มและระหว่างกลุ่มโดยใช้ T-test และANOVA และวิเคราะห์ความสัมพันธ์เชิงบวกโดยใช้ pearson correlation ผลการวิจัยพบว่า กลุ่มฝึกความอ่อนตัวมีค่าความเร็วหัวไม้กอล์ฟและระยะการตีไดรฟ์เพิ่มขึ้นอย่างมีนัยสำคัญทางสถิติหลังการฝึก ($p < 0.05$) ในขณะที่กลุ่มฝึกความแข็งแรงของกล้ามเนื้อไม่พบความแตกต่างอย่างมีนัยสำคัญทางสถิติ ($p \geq 0.05$) นอกจากนี้ยังพบความสัมพันธ์เชิงบวกระดับสูงระหว่างความเร็วหัวไม้กอล์ฟและระยะการตีไดรฟ์หลังการฝึก ($r = 0.885$) สรุปได้ว่าโปรแกรมการฝึกที่เน้นความอ่อนตัวเป็นระยะเวลา 8 สัปดาห์มีประสิทธิภาพในการพัฒนาความสามารถในการตีไดรฟ์ของนักกีฬาگอล์ฟเยาวชนชาย ผลการวิจัยสนับสนุนการบูรณาการการฝึกความอ่อนตัวเข้าสู่โปรแกรมการฝึกกอล์ฟ เพื่อเพิ่มประสิทธิภาพของการสวิงและผลลัพธ์ด้านการตีไดรฟ์

คำสำคัญ: การฝึกความแข็งแรงของกล้ามเนื้อ, การฝึกความอ่อนตัว, ความสามารถในการตีไดรฟ์, นักกีฬาگอล์ฟเยาวชนชาย
ชั้นเลิศ

Abstract

The present study aimed to compare the effects of strength training and flexibility exercise on driving performance in young male golfers. This study employed a quasi-experimental matched-group pretest–posttest design. Ten elite young male golfers (age 17.1 ± 3.2 years) were randomly assigned based on baseline driving performance to either a strength training group (STG, $n = 5$) or a flexibility exercise group (FEG, $n = 5$). Both groups participated in an 8-week training program performed three times per week. Club head speed and driving distance were assessed using a Swing Speed Radar® before and after the intervention. Data were analyzed using t-tests and repeated-measures analysis of variance (ANOVA) to examine within- and between-group differences, while Pearson's correlation coefficient was applied to determine the relationship between club head speed and driving distance. The findings of this study indicate that the flexibility exercise group demonstrated significant improvements in both club head speed and driving distance following the intervention ($p < 0.05$), whereas no significant changes were observed in the strength training group ($p \geq 0.05$). A strong positive correlation was found between club head speed and driving distance after training ($r = 0.885$). An 8-week flexibility-focused exercise program was effective in enhancing driving performance in young male golfers. These findings support the integration of flexibility-based conditioning into golf training programs to improve swing efficiency and driving outcomes.

Keywords : Strength training, Flexibility exercise, Driving ability, Young male golfers

Introduction

Golf is one of the most popular sports worldwide, attracting a wide range of participants (Farrally et al., 2003). Traditionally, golf performance has been viewed primarily as a skill-based outcome, emphasizing technical proficiency in swing mechanics and putting accuracy rather than physical conditioning (Fletcher & Hartwell, 2004; Keogh et al., 2009). However, recent developments in sport science have highlighted the importance of physical fitness components, such as muscular strength, flexibility, and neuromuscular coordination, in enhancing golf performance.

Driving distance is an important performance measure in golf and is influenced by multiple factors, including swing technique, club characteristics, segmental coordination, and power generation (Fletcher & Hartwell, 2004; Lennon, 1998). Among these factors, club head speed (CHS) has been consistently identified as a primary determinant of driving distance, particularly in the long game (Broadie, 2008). Biomechanical analyses further suggest that the interaction between CHS, ball speed, and driving distance is governed by efficient kinematic sequencing of the golf swing (Alderson & Elliott, 2013).

Resistance training has been shown to enhance muscle force production by increasing muscle cross-sectional area and improving motor unit recruitment (Yeung & Gabriel, 2000; Gibala et al., 1995). In golf, the swing involves coordinated activation of multiple muscle groups, including the lower extremities, trunk, and upper body, functioning through a stretch-shortening cycle from backswing to downswing (Fletcher & Hartwell, 2004). While strength training primarily contributes to increased force

generation, flexibility plays a critical role in enabling effective range of motion and coordinated segmental sequencing during the golf swing. Consequently, both strength and flexibility are considered essential components for optimizing swing efficiency and power transfer.

Despite growing interest in golf-specific conditioning, empirical evidence comparing the effects of different training modalities on driving performance remains limited. Previous studies have reported improvements in club head speed following resistance or combined training programs; however, findings regarding driving distance and the specific contribution of flexibility-focused exercise remain inconsistent (Lennon, 1996; Hetu et al., 1998). Notably, few studies have directly compared strength training and flexibility-focused exercise within the same experimental framework, particularly in youth golfers. In addition, concerns persist among golfers that strength training may reduce flexibility and negatively affect swing mechanics.

Accordingly, a clear theoretical and practical gap exists regarding the relative effectiveness of strength training versus flexibility exercise in enhancing driving performance while preserving functional movement quality. Thus, the present study addresses a clearly defined theoretical and practical gap by systematically comparing the effects of strength training and flexibility-focused exercise on key driving performance variables within the same experimental framework. Therefore, the purpose of this study was to compare the effects of strength training and flexibility exercise on driving ability in elite athlete young male golfers. By focusing specifically on club head speed and driving distance, this study extends existing research by clarifying the relative contribution of each training modality and providing applied evidence to inform conditioning program design for youth golfers seeking performance enhancement without compromising functional movement quality.

Research Objectives

The objectives of this study were:

1. To compare the effects of strength training and flexibility-focused exercise on driving performance, as assessed by club head speed and driving distance, in young male golfers.
2. To examine the relationship between club head speed and driving distance following an 8-week golf swing-specific training intervention.

Research Hypotheses

H1: There are significant differences in driving performance, as assessed by club head speed and driving distance, between elite athlete young male golfers who participate in strength training and those who participate in flexibility-focused exercise following an 8-week training intervention.

H2: There is a significant relationship between club head speed and driving distance following the 8-week training intervention.

Methods

This study employed a quasi-experimental design with a matched-group pretest–posttest approach. Participants were matched-group design into groups based on driving ability to ensure baseline comparability between the strength training and flexibility exercise groups.

Participants

Ten elite athlete young male golfers with handicaps ranging from 0 to 9 were recruited from Aeksima Driving Range, Nakhon Ratchasima Province. All participants were healthy and had no history of musculoskeletal injury during the six months preceding the study. Baseline assessments included resting heart rate, blood pressure, body mass index, body composition, muscle strength, forced vital capacity (FVC), estimated maximal oxygen consumption (VO_2max), and training history. Participants were allocated into two groups based on driving ability (club head speed and driving distance): a strength training group (STG, $n = 5$) and flexibility exercise group (FEG, $n = 5$). The flexibility exercise group was treated as the experimental group, while the strength training group served as the comparison group. Baseline characteristics of both groups are presented in Table 1.

Table 1. Baseline characteristics of the experimental group (feg) and group (stg)

Variable	Group 1 (STG) $n=5$	Group 2 (FEG) $n=5$
Age (years)	16.0 ± 0.7	16.2 ± 1.3
Body mass (kg)	$60.8 \pm 6.9^*$	56.4 ± 7.0
Height (cm)	$165 \pm 6.7^*$	178.4 ± 3.2
BMI (kg/m^2)	19.2 ± 3.7	21.1 ± 2.11
Heart rate (bpm)	69.6 ± 3.8	68.0 ± 1.5
Systolic BP (mmHg)	118 ± 2.7	118.4 ± 2.1
Diastolic BP (mmHg)	77 ± 6.1	67.0 ± 3.2
FVC (L)	3.0 ± 4.7	2.9 ± 2.38
VO_2max ($\text{mL}/\text{min}/\text{kg}$)	66.2 ± 3.8	64.8 ± 4.05
Handicap (point)	5.2 ± 2.8	4.8 ± 3.5
Training History (month)	6.2 ± 0.8	6.6 ± 0.9

Data are presented as means (SD). * indicates differences between experimental group and control group

Abbreviations: BMI; Body Mass Index, BP; Blood Pressure, FVC; Forced Vital Capacity, VO_2max ; Maximal Oxygen Consumption (estimate)

Physiological and Physical Fitness Measurements

Maximal Oxygen Uptake (VO₂max)

Maximal oxygen uptake (VO₂max) was assessed using the Åstrand test, a submaximal exercise testing protocol. The test was conducted on a cycle ergometer following standardized procedures. Participants exercised at a constant workload, and heart rate responses were recorded to estimate VO₂max using the Åstrand-Ryhming nomogram. This method is widely accepted for evaluating aerobic capacity in sport science research, particularly in youth populations.

Forced vital capacity (FVC) was measured using a standardized spirometer following established pulmonary function testing guidelines.

Training history was collected using a structured questionnaire that assessed years of golf participation, weekly training frequency, and prior involvement in strength or flexibility training programs.

Golf Driving Performance Assessment

Golf driving performance was assessed before and after the 8-week training intervention. Each participant performed ten maximal golf drives using a standardized golf driver, with explicit instructions to apply their normal competitive swing technique while aiming for maximal swing speed, thereby ensuring task specificity to the golf swing. Prior to data collection, participants completed a standardized warm-up protocol consistent with golf practice routines. Club head speed (CHS) and driving distance (DD), which are key indicators of golf driving performance, were measured using a Swing Speed Radar® (Sports Sensors, Inc., USA). The average values from the ten valid swings were used for statistical analysis to reflect representative driving performance. All testing sessions were conducted under similar environmental conditions and at the same testing location to minimize external variability.

Training Interventions

Both groups trained three times per week for eight weeks in addition to their regular golf practice.

Strength Training Group (STG)

The strength training program targeted major muscle groups involved in the golf swing, including the lower limbs, trunk, and upper body. Exercises included calf raises, half squats, bent-knee sit-ups, trunk rotations with a barbell, shoulder lateral raises, lat pull-downs, bench press, triceps extensions, arm curls, and wrist curls. Training intensity progressed from 60% of one-repetition maximum (1RM) during weeks 1–4 to 70% 1RM during weeks 5–8, with 3 sets per exercise (8–10 repetitions per set), as outlined in Table 2.

Table 2. Resistance exercise protocols

Muscle	Resistance	Equipment	Weeks 1-4	Weeks 5-8
			60% 1 RM	70% 1 RM
			Sets/ reps	Sets/ reps
Biceps	Standing biceps stretch	Lat-pull-down	3x8 reps	3x10 reps
Hamstring	Leg extension	Leg extension	3x8 reps	3x10 reps
Triceps	Standing triceps stretch	Lat-pull-down	3x8 reps	3x10 reps
Gastrocnemius	Leg curl	Leg curl	3x8 reps	3x10 reps
Pectoralis major	Pectoral machine	Pectoral machine	3x8 reps	3x10 reps
Gluteus Maximus	Half squat	Olympic bar	3x8 reps	3x10 reps
Trapezius	Lat-pull-down	Lat-pull-down	3x8 reps	3x10 reps
Erector spinea	Bent-knee Ab	Bent-knee Ab machine	3x8 reps	3x10 reps
Deltoid	Shoulder lateral raise	Shoulder lateral raise machine	3x8 reps	3x10 reps

Abbreviation: 1RM = 1 repetition maximum

Flexibility Exercise Group (FEG)

Participants in the flexibility exercise group performed static flexibility exercises using a gym ball, emphasizing trunk rotation, core stability, and range of motion relevant to golf swing mechanics. The program included straddle ball rolls, hip circles, total body stretches, seated and standing trunk rotations, back extensions, and golf swing-specific movements with a gym ball. Exercise volume progressed from 3 sets of 8 repetitions (weeks 1–4) to 3 sets of 10 repetitions (weeks 5–8), as shown in Table 4. Prior to each session, participants completed standardized warm-up stretching exercises (Table 3).

Table 3 Static Stretching exercise (Warm up)

Static Stretching Exercise	Duration
Shoulder and chest	20-30 Sec
Arm across chest	20-30 Sec
Triceps stretch	20-30 Sec
Glute stretch	20-30 Sec
Adductor stretch	20-30 Sec
Single leg hamstring	20-30 Sec
Standing quadriceps	20-30 Sec
Standing calf	20-30 Sec

The flexibility exercise program using a gym ball, designed to enhance trunk rotation, core stability, and range of motion relevant to golf swing mechanics, is detailed in Table 4.

Table 4 Flexibility exercise (Gym ball)

Flexibility Exercise	Equipment	Weeks 1-4 Sets/Reps	Weeks 5-8 Sets/Reps
Straddle ball roll	Gym ball	3x8 Reps	3x10 Reps
Hip circle	Gym ball	3x8 Reps	3x10 Reps
Total body stretch	Gym ball	3x8 Reps	3x10 Reps
Seated horizontal twists	Gym ball	3x8 Reps	3x10 Reps
Standing horizontal twists	Gym ball	3x8 Reps	3x10 Reps
Standing back extensions	Gym ball	3x8 Reps	3x10 Reps
Extensions golf swings	Gym ball	3x8 Reps	3x10 Reps
Hip drop	Gym ball	3x8 Reps	3x10 Reps
Golf swing with gym ball	Gym ball	3x8 Reps	3x10 Reps

Control of Confounding Variables

To control potential confounding variables, participants were instructed to maintain their usual daily activities and refrain from engaging in additional resistance or flexibility training outside the prescribed intervention throughout the study period. Physical activity levels outside the intervention were monitored through self-reported activity logs, which were reviewed weekly to ensure compliance. Dietary intake was not strictly controlled; however, participants were advised to maintain their habitual eating patterns during the intervention.

Statistical Analysis

Descriptive statistics were calculated for all variables. T-test and ANOVA was used to examine within-group (time) and between-group (group) differences in club head speed and driving distance across measurement points. Pearson's correlation coefficient was applied to investigate the relationship between club head speed and driving distance following the 8-week intervention. Statistical significance was set at $p < 0.05$.

Results

Results for Objective 1 to compare the effects of strength training and flexibility-focused exercise on driving performance, as assessed by club head speed and driving distance, in young male golfers.

Table 5 presents the baseline characteristics and physical fitness variables of the participants by group, along with the results of the independent samples t-test. The results indicate that most variables—including handicap, age, body weight, height, body mass index (BMI), heart rate, systolic blood pressure, forced vital capacity (FVC), training history, and measures of muscular strength of the hand, leg, and back did not differ significantly between Group 1 and Group 2 ($p > 0.05$), suggesting that the two groups were comparable prior to the intervention. However, a significant difference was observed in Flex2, with Group 2 demonstrating a higher mean value than Group 1 ($p = 0.019$). In addition, diastolic blood pressure differed significantly between the two groups ($p = 0.012$). The variable Back1 showed a trend toward significance but did not reach the conventional threshold for statistical significance ($p = 0.066$).

Table 5. Baseline characteristics and physical fitness variables of the participants by group, along with the results of the independent samples t-test.

Variables	Groups				t	P-value
	Group 1 (STG)		Group 2 (FEG)			
	Mean	S.D.	Mean	S.D.		
Handicap	3.20	1.79	4.80	3.49	-0.912	0.389
Age	16.00	0.71	16.20	1.30	-0.302	0.771
Weight	60.80	6.98	56.40	7.02	0.994	0.349
Height	165.00	6.78	168.40	3.21	-1.013	0.341
BMI	19.24	3.79	21.24	2.11	-1.031	0.333
HR	69.60	3.85	68.00	1.58	0.860	0.415
Systolic	118.20	2.77	118.40	2.19	-0.126	0.902
Diastolic	77.00	6.16	67.00	3.16	3.227	0.012
FVC	2,990.00	472.23	2,920.00	238.75	0.296	0.775
Training years	6.20	0.84	6.60	0.89	-0.730	0.486
Handgrip1	32.60	5.13	30.80	1.92	0.735	0.483
Handgrip2	35.60	4.67	31.40	2.97	1.698	0.128
Leg1	141.50	18.36	151.08	9.51	-1.036	0.331
Leg2	154.06	13.20	152.46	11.93	0.201	0.846
Back1	52.86	7.62	63.04	7.49	-2.131	0.066
Back2	59.22	8.05	63.30	5.87	-0.916	0.387
Flex1	7.40	3.36	10.40	2.07	-1.698	0.128
Flex2	7.80	2.86	12.60	2.30	-2.921	0.019*

* $p < 0.05$ level. Statistical analysis was performed using independent sample t test.

Overall, these findings indicate that while baseline characteristics were largely comparable between the groups, certain differences in flexibility and diastolic blood pressure were present prior to the intervention and should be considered when interpreting the subsequent training effects.

Results for Objective 2 to examine the relationship between club head speed and driving distance following an 8-week golf swing-specific training intervention.

Table 6 presents the mean values and standard deviations of club head speed (CHS) and driving distance across three repeated measurements for each group. The results show an overall increasing trend in CHS over time in both groups. In Group 1, mean CHS increased from 72.00 ± 10.07 at the first measurement to 75.40 ± 9.07 at the third measurement. In Group 2, CHS values remained relatively stable across the three measurements.

Regarding driving distance, both groups demonstrated a gradual increase over time. Group 1 showed an increase in mean driving distance from 205.40 ± 22.92 at the first measurement to 211.00 ± 18.51 at the third measurement. Similarly, Group 2 exhibited an increase from 203.00 ± 15.48 to 210.40 ± 14.79 across the same measurement points.

Table 6. Mean values and standard deviations of club head speed (CHS) and driving distance across three repeated measurements for each group.

Variables	Groups			
	Group 1 (STG)		Group 2 (FEG)	
	Mean	S.D.	Mean	S.D.
CHS1	72.00	10.07	75.20	10.18
CHS2	72.40	9.10	75.00	10.46
CHS3	75.40	9.07	75.60	8.82
Distane1	205.40	22.92	203.00	15.48
Distance2	210.60	21.72	203.80	20.23
Distance3	211.00	18.51	210.40	14.79

*p < 0.05 level. Statistical analysis was performed using Anova of repeated measure design

Overall, these descriptive results indicate a tendency toward improved club head speed and driving distance over the training period in both groups. Statistical comparisons of within-group and between-group differences over time are presented in the repeated-measures ANOVA results in the subsequent table.

Furthermore, Pearson's correlation analysis revealed a strong positive relationship between club head speed and driving distance after the training period ($r = 0.885$), as illustrated in Figure 1. This finding indicates that increases in CHS were closely associated with improvements in driving distance among the participants.

Pearson's correlation analysis revealed a strong positive relationship between club head speed and driving distance after the 8-week training program ($r = 0.885$), as illustrated in Figure 1.

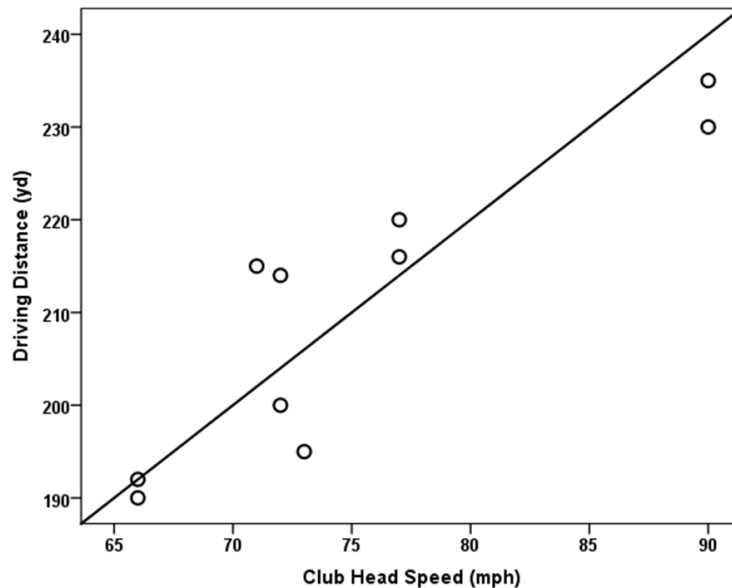


Figure 1. The relationship between club head speed and driving distance after the 8-week training program ($n = 10$)

Discussion

The primary finding of this study was that an 8-week flexibility-focused exercise program significantly improved both club head speed and driving distance in young male golfers, whereas strength training alone did not produce significant changes in driving performance. In addition, a strong positive association between club head speed and driving distance was observed, reinforcing the central role of swing speed in determining driving outcomes in golf.

The performance improvements observed in the flexibility exercise group may be attributed to enhanced trunk rotation, segmental coordination, and range of motion, which are critical components of an efficient golf swing. The golf swing is characterized by a sequential kinetic chain involving coordinated motion of the lower extremities, pelvis, trunk, and upper limbs (Fletcher & Hartwell, 2004; Alderson & Elliott, 2013). More recent biomechanical evidence further emphasizes that effective pelvis–thorax kinematic sequencing is strongly associated with increased club head speed and overall swing efficiency (Kwon et al., 2013; Lindsay & Horton, 2020). Accordingly, flexibility-focused exercises that emphasize trunk mobility and rotational control may facilitate more efficient energy transfer from the lower body to the club head during the downswing phase. (Gordon et al., 2021)

In contrast, although resistance training is well established as a means of increasing muscle force production through neuromuscular adaptations such as enhanced motor unit recruitment and force-generating capacity (Yeung & Gabriel, 2000; Gibala et al., 1995), these adaptations alone may not be

sufficient to elicit meaningful improvements in golf driving performance. Golf performance depends not only on muscular strength but also on movement specificity, timing, and intersegmental coordination (Wells et al., 2009). Recent evidence suggests that strength gains must be integrated with mobility and swing-specific training to translate into performance outcomes in rotational sports such as golf.

The strong correlation between club head speed and driving distance identified in this study is consistent with both classical and contemporary research demonstrating that increases in swing speed directly contribute to longer driving distance (Broadie, 2008; Kwon et al., 2013). Recent performance analyses continue to support club head speed as a key determinant of long-game performance in competitive golfers (Hellström et al., 2022).

From a physiological perspective, flexibility-focused training may enhance muscle-tendon compliance, joint range of motion, and neuromuscular control, all of which contribute to rapid and coordinated rotational movements required during the golf swing (Behm & Chaouachi, 2011). Such adaptations may explain why flexibility training produced measurable performance benefits in the present study, whereas strength training alone did not. Importantly, the results also address common concerns among golfers that strength training may negatively affect flexibility or swing mechanics. While strength training did not significantly enhance driving performance in this study, it did not impair performance either, suggesting that strength training may still play a supportive role in injury prevention and general conditioning when appropriately integrated with flexibility- and golf-specific movement training.

From a practical perspective, the findings of this study suggest that flexibility-focused conditioning programs should be prioritized in youth golf training to enhance driving performance, particularly during developmental stages where movement quality and neuromuscular coordination are still adaptable. While strength training did not significantly enhance driving performance in the present study, it may still serve a complementary role in injury prevention and physical robustness when appropriately combined with flexibility- and golf-specific movement training.

Several limitations of this study should be explicitly acknowledged. The relatively small sample size and short intervention duration (8 weeks) may limit the generalizability of the findings. In addition, baseline anthropometric differences between groups, although not statistically significant, may have influenced individual responses to training. Furthermore, the absence of direct biomechanical measurements, such as three-dimensional kinematic analysis of the golf swing, limits the ability to confirm the specific movement mechanisms underlying the observed performance changes. Physical activity outside the intervention was primarily monitored through self-report, which may not fully capture variations in training load.

Future research is also recommended to examine combined or periodized training models that integrate strength, flexibility, and swing-specific exercises. Such approaches may provide greater insight into the optimal balance of physical conditioning strategies for enhancing golf performance across different age groups and competitive levels.

Conclusion

In conclusion, the findings of this study indicate that an 8-week flexibility-focused exercise program can effectively enhance driving performance in young male golfers, as evidenced by significant improvements in club head speed and driving distance. The strong positive relationship between club head speed and driving distance further underscores the importance of swing efficiency in golf performance. While strength training alone did not result in significant performance gains, it did not negatively affect driving ability, suggesting that resistance exercise may serve a complementary role within a comprehensive conditioning program. Overall, these results support the inclusion of flexibility-oriented and movement-specific exercises in golf training programs to optimize driving performance in youth athletes.

Practical Implications

From a practical perspective, golf coaches and practitioners are encouraged to incorporate flexibility-based exercises that emphasize trunk rotation, core stability, and coordinated movement patterns into regular training routines. Such exercises can improve swing efficiency and power transfer, leading to enhanced driving performance within a relatively short training period. Strength training may still be applied to support overall physical conditioning and injury prevention; however, it should be combined with flexibility-focused or golf-specific movement training to maximize performance benefits. These findings provide applied guidance for the development of evidence-based conditioning programs for young golfers.

Recommendations

Based on the findings of this study, several recommendations can be proposed for practical application and future research.

Recommendations for Practice

Coaches and practitioners working with young golfers should incorporate flexibility-focused exercise programs, particularly those emphasizing trunk rotation, core stability, and coordinated movement patterns, into regular training routines. Such programs may enhance swing efficiency and power transfer, leading to improvements in club head speed and driving distance. Strength training may still be included as a complementary component to support overall physical conditioning and injury prevention; however, it should be integrated with flexibility-based and golf-specific movement training to optimize performance outcomes.

Recommendations for Future Research

Future studies should employ larger sample sizes and include golfers of different age groups, skill levels, and genders to enhance the generalizability of the findings. Longitudinal research examining the long-term effects of combined strength and flexibility training programs on golf performance is also recommended. In addition, future investigations should consider incorporating biomechanical analyses,

such as kinematic and kinetic assessments, to further elucidate the mechanisms underlying improvements in club head speed and driving distance.

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