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Comparative Effect of Functional and Traditional Training on Movement Efficiency, Injury Risk, and Performance in Young University Players

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ABSTRACT
The primary objective was to evaluate the comparative efficacy of functional versus traditional resistance training on holistic athletic development. The current study compared the effects of conventional and functional training on young university athletes' sport performance, injury risk, and movement efficiency. Finding the best training technique for improving overall athletic development was the main goal. Pre-test and post-test were used in a quantitative experimental study design. Purposive sampling was used to choose 60 university athletes between the ages of 18 and 25. They were further divided into two groups at random: a functional training group (n = 30) and a traditional training group (n = 30). Three training sessions were held each week for the duration of the eight-week intervention. While, the traditional training group worked in machine-based resistance and isolated muscle workouts, on the other hand, the functional training group engaged in multi-joint, balance, stability, and agility activities. Standardized performance tests (speed, agility, power, and endurance), an injury risk assessment scale, and the Functional Movement Screen (FMS) were used to gather data on movement efficiency. IBM SPSS Statistics (Version 28) was used for data analysis. The results were assessed using descriptive statistics, paired sample t-test, independent sample t-test, and Pearson's correlation analysis. Both training approaches considerably improved performance outcomes, according to the results; however, the functional training group showed significantly higher increases in athletic performance, movement efficiency, and injury risk reduction ($p < .05$). Performance and movement efficiency were found to be strongly positively correlated by correlation analysis; both measures were adversely correlated with injury risk. The findings indicated that by improving neuromuscular coordination and movement quality, functional training offered a more all-encompassing strategy for athletic development. For young university athletes, functional training was found to be more beneficial than traditional training in terms of enhancing overall athletic performance and lowering the chance of injury. For best outcomes, it is recommended that coaches and practitioners use parts of traditional strength training in their regular training regimens, together with functional training.

KEYWORDS
Functional and Traditional Training, Movement Efficiency, Injury Risk, Player Performance

Overview of Training Modalities

Sports training techniques have developed over time to improve athletic performance, movement quality, and injury avoidance. The main goal of traditional training often known as resistance or strength training was to build individual muscles using machine-based or single-joint exercises. Although this method was frequently criticized for its limited application to dynamic athletic activities, it was commonly employed to develop muscle strength and hypertrophy. Functional training, which emphasized integrated, multi-joint,

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and multi-planar motions that imitated every day and sport-specific activities, was created to solve these constraints.

In order to increase general movement efficiency and neuromuscular control, functional training included components such as proprioception, balance, and coordination. Functional training focused on the notion of specificity, according to earlier research, where benefits were attained depending on movement patterns practiced throughout training (Liu et al., 2025). Functional training is more relevant to real-life and sports situations than traditional methods because it involved the coordinated activation of numerous physical capacities such as strength, balance, and flexibility.

Functional Training and Movement Effectiveness

Movement efficiency, which represented the capacity to execute motions with the least amount of energy expenditure and the best biomechanics, is a crucial factor in determining athletic success. Because functional training emphasized integrated kinetic chain activation, it has been widely linked to increases in movement quality. When compared to conventional training techniques, functional training dramatically enhanced movement quality and sport-specific skill performance in a randomized controlled experiment with young tennis players (Xiao et al., 2025). Functional training programs improved functional movement abilities more successfully than traditional physical education programs which concentrated on isolated exercises.

Functional training improved balance, coordination, and agility, all essential elements of effective movement patterns. These results suggested that functional training improved athletes' readiness for challenging, real-world movement demands. Although its solitary nature hindered its efficacy in generating integrated movement patterns, certain research suggested that conventional training might still improve movement efficiency when paired with sport-specific activities (Li et al., 2025).

Traditional Training and Performance Development

It has long been known that traditional resistance training is an efficient way to increase muscle power, strength, and hypertrophy. These qualities are essential for athletic success especially in sports that need a lot of power. Classical training greatly increased muscle mass and maximum strength which are critical for performance outcomes including endurance, sprinting, and leaping consistently improved coordination, agility, and sport-specific performance.

Comparative research showed that although strength-related measures were increased by conventional training, improved functional performance was not necessarily the result. For example, a controlled study comparing traditional versus functional training in athletes found that while traditional programs increased strength, they had less of an impact on functional movement scores and overall athletic performance. Although functional exercises may need to be added to conventional training in order to obtain comprehensive athletic performance, traditional training is still necessary for strength development (Kovac et al., 2022).

Effect on Injury Risk

In sports communities, injury prevention is a top priority especially for young university athletes who are subjected to intense training schedules. The main factors that increase the risk of injury included inadequate neuromuscular control, muscle imbalances, and movement dysfunction. Functional training has been widely associated with reduced injury risk due to its focus on improving movement mechanics and stability.

Functional training improved muscle coordination, proprioception, and joint stability, all of which helped prevent injuries. Notable injury rated in functional training contexts, especially in high-intensity programs like CrossFit, have also been observed in several studies. According to epidemiological research, past injury history and insufficient supervision were risk factors for the nearly 46% of functional training participants who had at least one injury during the six months.

Functional training can lower the risk of injury when done correctly; inadequate programming or high intensity can raise

the risk of injury. Conventional training involved regulated motions and less intricacy; it was thought to be safer for beginners. However, it frequently neglected to address underlying biomechanical inefficiencies which may indirectly increase the risk of injury during actions particular to a certain activity.

Effect on Athlete Performance

Strength, speed, agility, endurance, and coordination are all components of the multifaceted concept of athletic performance. It has been demonstrated that both functional and conventional training approaches have distinct effects on these variables. Functional training greatly enhanced key performance markers, including speed, agility, balance, and muscular strength. The dynamic and sport-specific character of functional workouts was blamed for these gains.

Traditional training exhibited uneven effects on agility and sport-specific performance but it produced better results in maximal strength and hypertrophy. Comparative studies showed that functional training improved overall athletic performance more thoroughly especially in tasks demanding coordination and effective movement. The best outcomes came from combining functional and conventional training methods which enabled athletes to concurrently improve their strength and movement efficiency. Despite the increasing amount of material, there are still several gaps in the comparison of conventional and functional training.

Instead of looking at movement efficiency, injury risk, and performance as a whole, much research has concentrated on specific outcomes like strength or balance. Young university athletes are a crucial demographic making the switch from amateur to competitive sports, but little study has been done on them. Due to differences in training methods, length, and participant characteristics, previous results were frequently contradictory. Consequently, a thorough analysis contrasting the effects of conventional and functional training on performance, injury risk, and movement efficiency within a single framework was required.

Closing this gap would yield important information for creating training plans based on research that are specific to young athletes (Beck et al., 2025). While conventional training was better at increasing muscle strength and hypertrophy, functional training was more successful at increasing movement efficiency, coordination, and overall athletic performance. Each strategy showed distinct advantages, and their combination seemed to provide the best results. The necessity for additional study concentrating on mixed effects in certain populations, such as young university athletes, was brought to light by inconsistent findings in previous studies.

1. Method

The research technique utilized to compare the effects of conventional versus functional training on young university athletes' performance, injury risk, and movement efficiency was described in this portion. It explained the demographic, sampling strategy, tools, data collection methodologies, and statistical methods for data analysis.

Research Design

A quantitative experimental research design was used in the study. The effects of two training interventions, functional training and conventional training, were compared using a pre-test and post-test design. Participants were divided into two groups at random: the control group (traditional training) and the experimental group (functional training). The evaluation of causal connections between training techniques and outcome variables was made possible by this strategy.

Population of the Study

The group was made up of young athletes between the ages of 18 and 25 who were enrolled in university sports science programs. These individuals played competitive sports including hockey, cricket, and football.

Sample & Sampling Technique

Purposive sampling was used to choose a total sample of N = 60 individuals based on the following criteria:

A. Inclusive Criteria

Active athletes at universities had having 18 to 25 years of age with no significant injuries throughout the previous six months.

B. Exclusives Criteria

Health issues are limiting physical activity. Participation in training is irregular.

The Participants were divided into two groups at random: functional training group (n=30) and traditional training group (n=30)

Instrument for Data Collection

The standardized instruments listed below were employed:

A. Functional Movement Screen (FMS)

- Assessed movement efficiency
- Scored on a Scale of 0-20

B. Injury Risk Assessment Questionnaire

- Measured frequency and likelihood of injuries

C. Performance Tests

- 40-meter sprint test (speed)
- Illinois agility test (agility)
- Vertical jump test (power)
- Endurance Test (YO-YO Test)

Every instrument showed adequate reliability ($\alpha > 0.70$) and was verified in prior research.

Training Protocol

The duration of training protocol was based on 8 weeks and 3 sessions per week. Machine-based exercises used to ensure the traditional group's intensity was comparable to the functional group.

a. Functional Training Program

- Multi-joint exercises
- Balance and Stability drills
- Plyometrics and agility training

b. Traditional Training Group

- Machine-based resistance training
- Isolated muscle exercise
- Linear strength routines

Each session lasted approximately 60 minutes in both groups.

Data Collection

Pre-tests were conducted before the training intervention. Participants underwent 8 weeks of training. Post-tests were conducted after completion. Data were recorded and coded for statistical analysis. All subjects gave their informed permission and ethical approval was secured.

Data Analysis Techniques

Descriptive Statistics, Mean, Standard Deviation, and Frequency were used to characterize baseline data and demographic traits. Normality Test: The Shapiro-Wilk test is used to determine if the data have a normal distribution. Paired Sample t-test used to compare each group's pre-test and post-test results. Independent Sample t test used to compare the functional and conventional groups' post-test results. Pearson's Correlation analysis was used to examine the relationship between movement efficiency, injury risk, and performance outcome. A significant alpha level was set at $p< .5$.

The approach for comparing the effects of conventional and functional training was described in this portion. The validity and reliability of the results were guaranteed by a quantitative experimental design, standardized tools, and suitable statistical methods.

2. Results

The statistical analysis of data gathered from young university athletes to compare the effect of conventional versus functional training on performance, injury risk, and movement efficiency was presented in this portion. IBM SPSS Statistics (Version 28) was used to edit the data. Tables displaying the results were followed by explanations.

Results of Demographic Information of Participants

Table 1. Demographic Characteristics of Participants (n=60)

Variable	Category	Frequency	Percentage
Gender	Male	42	70%
	Female	18	30%
Age	18-20	22	36.7%
	21-23	25	41.7%
	24-25	13	21.6%
Sports Participations	Football	24	40%
	Cricket	20	33.3%
	Tennis	16	26.7%

The results revealed that 70% of the competitors were men and the bulk of the athletes were between the ages of 21 and 23 years. The largest group consisted of football players suggesting a greater level of team sports activity.

Descriptive Statistics of the Study Variable

Table 2. Descriptive Statistics (Pre-Test Score)

Variable	Group	Mean	SD
Movement Efficiency	Functional	12.46	2.11
	Traditional	12.31	2.06
Performance Score	Functional	45.21	5.61
	Traditional	44.81	5.45
Injury Risk Score	Functional	3.82	1.11
	Traditional	3.73	1.03

There were no discernible changes between the groups in the pre-test data suggesting homogeneity before intervention.

Table 3. Normality Test (Shapiro-Wilk test)

Variable	p-Value
Movement Efficiency	0.213
Performance	0.187
Injury Risk	0.221

Every variable had $p > 0.05$ indicating that the data had a normal distribution.

Paired Sample t-Test Group Comparison

Table 4. Functional Training Group (Pre vs Post)

Variable	Pre-Test Mean	Post Test Mean	t-value	p-value
Movement Efficiency	12.45	17.80	8.92	0.001
Performance	45.20	58.60	9.45	0.001
Injury Risk	3.80	2.10	6.88	0.001

All indicators showed significant gains ($p < 0.05$) demonstrating the great efficacy of functional training.

Table 5. Traditional training program group (Pre vs Post)

Variable	Pre-Test Mean	Post-Test Mean	t-value	p-value
Movement Efficiency	12.30	14.10	4.12	0.002
Performance	44.80	50.20	5.01	0.001
Injury Risk	3.75	3.10	2.95	0.006

Although results were improved by traditional training as well, the degree of improvement was less than that of functional training

Independent Sample t-Test (Between-Group Post-test)

Table 6. Group comparison after intervention

Variable	Functional Mean	Traditional Mean	t-value	p-value
Movement Efficiency	17.80	14.10	6.45	0.001
Performance	58.60	50.20	5.98	0.001
Injury Risk	2.10	3.10	4.87	0.001

In every category, functional training performed considerably better than conventional training ($p < 0.05$).

Table 7. Person's Correlation Analysis

Variable	R-Value	p-Value
Movement Efficiency and Performance	0.72	0.001
Movement Efficiency and Injury Risk	-0.65	0.001
Injury Risk and Performance	-0.58	0.002

The results revealed that performance and movement efficiency were strongly and positively correlated, although, injury risk was negatively correlated with both. Functional training greatly enhanced performance, reduced the risk of injury, and improved movement efficiency. Moderate gains were seen with traditional training. Overall, functional training was more successful. Performance and movement efficiency were strongly correlated.

3. Discussion

This portion examined the study's results in light of the body of research on the relative effects of conventional and functional training on young university athletes' athletic performance, injury risk, and movement efficiency. To emphasize the parallels, differences, and contributions of the current study, the data were evaluated in the context of prior research.

Comparing functional training to conventional training, the current study discovered a substantial reduction in the risk of injury. Improved joint stability and fewer biomechanical imbalances were shown by the functional group's participants' higher drop in injury risk ratings. According to the results, neuromuscular training regimens successfully decreased the

frequency of lower limb injuries in athletes. Similarly, functional training improved proprioception and muscle control which were essential for preventing injuries. Neuromuscular training regimens successfully decreased the frequency of lower limb injuries in athletes.

Similarly, functional training improved proprioception and muscle control which were essential for preventing injuries. They found a significant correlation between poor movement patterns and a higher risk of injury. By enhancing muscle balance and movement quality, functional training corrected these shortcomings. Traditional training did reduce the likelihood of injury but the results were not as noticeable. Its exclusive emphasis on dynamic and sport-specific motions may be the cause of this. According to these results, functional training might greatly improve injury prevention tactics in sports programs (Hewett et al., 2005).

Compared to traditional training, the results of this study showed that functional training greatly increased movement efficiency. The functional training group's participants showed more gains in their general biomechanics, coordination, and movement patterns. Higher athletic performance and less compensatory movements were linked to improved functional movement patterns. Indicated better movement efficiency and a decreased risk of injury were demonstrated by athletes with higher functional movement scores (Cook et al., 2014). Programs for neuromuscular training improved joint stability and muscle coordination, which increased biomechanical efficiency.

Traditional training on the other hand, only somewhat improved, perhaps because it concentrated more on separate muscle development than on integrated movement patterns. As a result, it was cleared that functional training offered a more thorough method of enhancing movement efficiency confirming the idea that multi-joint, sport-specific workouts are more beneficial than isolated motions (Myer et al., 2011). Functional training greatly outperformed conventional training in terms of improving athletic performance. The functional training group had greater improvements in performance metrics including speed, agility, power, and endurance. They found that integrated training regimens improved young athletes' physical fitness in a number of areas showed that dynamic balance and agility were enhanced more successfully by functional training than by conventional resistance training.

Strength and physical endurance were the main benefits of traditional training which helped to increase performance. This highlighted the importance of resistance training for building muscle but pointed out that it had little bearing on performance in certain sports. Functional training's advantage in improving performance may be explained by its focus on neuromuscular coordination and multidirectional movements, both of which are crucial in competitive sports (Faigenbaum et al., 2009).

The study's correlation analysis showed a negative link between injury risk and both movement efficiency and performance as well as a high positive correlation between movement efficiency and performance. These results were in line with earlier researches. Superior performance outcomes were shown by athletes with improved movement patterns discovered that better neuromuscular control increased performance while lowering the chance of injury. Athletes having a higher risk of injury were less likely to perform at their best according to the negative association between injury risk and performance. This strengthened the idea that preventing injuries is essential to improving performance.

The results of this study demonstrated that functional training was superior to traditional training in terms of increasing young university athletes' athletic performance, decreasing their risk of injury, and improving movement efficiency. The increasing amount of research supporting functional training as a comprehensive strategy for athletic development was bolstered by these findings. Nonetheless, conventional exercise was still crucial for building muscle strength and should not be entirely disregarded. The best option for maximizing athletic performance may be a blended training approach that incorporates both traditional and functional techniques (Myer et al., 2011).

Conventional and functional training techniques were found to have a favorable effect on athletic performance; their efficacy differed depending on several factors. The findings showed that functional training greatly increased movement efficiency. When compared to participants in the traditional

training group, those who participated in functional training showed improved balance, coordination, and general movement patterns. This suggested that multi-joint and multi-planar workouts improved biomechanical efficiency and neuromuscular control. Functional training was shown to be more effective in lowering the risk of injuries.

Participants in the functional training group had significantly lower injury risk ratings, according to the results. This demonstrated the significance of training regimens that emphasize muscle balance, proprioception, and stability. Functional training improved athletic performance more in terms of speed, agility, power, and endurance. Traditional training increased muscle strength and enhanced performance, but it was less successful in converting these improvements into motions particular to a certain activity.

Additionally, the study found that while injury risk was negatively correlated with both factors, movement efficiency and performance had a substantial positive link. This highlighted the fact that enhancing movement quality decreased the chance of injury while simultaneously increasing performance. It was determined that functional training is a more thorough and successful strategy for enhancing young college athletes' overall athletic development. Nonetheless, conventional training is still crucial for building strength and has to be properly incorporated (Xiao et al., 2025).

To increase athletic performance and movement efficiency, coaches and trainers should include functional training activities in their regular training regimens. For lower athletes' risk of injury, training regimens should incorporate stability, balance, and coordination activities. A mixed training strategy that incorporates both functional and conventional techniques should be used. Functional performance exercises should be included in strength training rather than being disregarded and reduced the danger of damage during training, proper monitoring, and technique correction.

Recommendations

Athletes should concentrate on improving their movement quality rather than just their strength. Movement screening instruments should be used for routine evaluation. Athletes should adhere to organized training regimens created by certified experts. Universities ought to offer cutting-edge training facilities that facilitate practical instruction. Coaches should be taught about evidence-based training techniques through workshops and seminars. Regular training should include injury prevention initiatives from sports departments. The study emphasized how crucial it is for sports scientists to use cutting-edge empirically supported training methods. It has become clear that functional training is the best way to increase movement efficiency, lower the risk of injury, and boost performance. To attain balanced athletic development, it is recommended to include both traditional and functional training techniques (Wang et al., 2023).

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