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Performance Outcomes of a Tailored Strength and Mobility Training Intervention in Regular Gym Trainees

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ABSTRACT

The aim of the study was to determine the impacts of individualized strength and mobility training program on physical performance among gym adepts. The increasing awareness of the synergistic effect of muscular strength and joint mobility on physical performance has pointed to the shortcomings of the classic training model that is used in most gym settings, which tend to focus on these two elements separately. This kind of separation can result in inefficiency in movement, a decreased range of motion, and increased risk of injury. This study was a study of the results of an integrated training program that incorporated strength training and specific mobility training in one structured program. A total of 30 male gym adepts between the ages of 25 and 40 years took part in the research. None of the participants was previously exposed to any structured resistance training. Standardized strength and mobility tests were used as baseline testing, and then a personalized training program was introduced depending on the movement limitations and strength capacity of the individuals. The intervention was based on the following key areas of performance such as muscular strength, endurance, flexibility, joint mobility, and functional movement quality. Specific focus was on the areas that are usually limited including hips, shoulders, and ankles. The training program was provided in a progressive manner in a systematic time span where the load was added on a gradual basis to enable safe adjustment. Validated testing procedures such as the Sit and Reach Test, one-repetition maximum bench press, and one-repetition maximum squat were used to measure the performance outcomes. Paired-sample testing and calculations of the effect size were used to analyze pre- and post-intervention data. The outcomes indicated significant improvement in the strength and mobility results. Improvement in the bench press and squat performance was noted with an increase in the flexibility scores on the Sit and Reach Test. The interviewees were found to have better range of movement, muscular power and overall movement efficiency after the intervention. These results justify the incorporation of combined strength and mobility training in the gym-based programs. The research adds to the evidence of the effectiveness of individualized and combined training models as an effective approach to enhancing performance, decreasing the risk of injuries, and supporting long-term physical performance of gym participants.

Keywords: *Strength, Mobility, Training, Performance, Gym Adepts, Injury Prevention, Customized Training Programs*

INTRODUCTION

Development of strength and mobility training is closely related to ancient civilization, where survival, military prowess, and athletic contests were directly linked to physical fitness (Rathee). In Classical Antiquity, the Olympic Games, among others, encouraged the methodical formation of organized physical training programs, but the Roman gladiators were subjected to intensive conditioning programs aimed at combat readiness. Similarly, martial arts and yoga in ancient China and India set a paradigm of mobility and flexibility practices that focused on body control, stamina and balance (Deshmukh et al., 2024).

In antique Greece the veneration of physical culture was highly philosophical and civic in nature. Physical conditioning was associated with individual righteousness, training, and civic duty. The Olympic Games Training, which began in 776 BCE, included running, discus, javelin, wrestling and pankration, all of which involved a combination of strength, power and agility. Greek athletes trained their bodies in gymnasia, which were commonly open fields where they did their physical exercises alongside philosophical teachings. They also performed body-weight calisthenics, halters (stone dumbbells) and stretching exercises. Other philosophers like Plato and Socrates believed that a body that was well developed was mandatory to a well-developed mind and thus the reason why physical education should be a holistic process (Chow, 2024).

Besides, the element of mobility training entails the provision of preventive effects that are paramount in long-term compliance and achievement in gym-based performance improvement. Monotonous loading in fixed movement pattern, e.g., regularly repeated barbell lifting without exercise variation or mobility training, can result in progressive stress injury, e.g., tendonitis, impingement syndromes, and lower back pain (Champ et al., 2023). These risks can be mitigated by customized programs that alternate or combine the mobility-enhancing motions (e.g. deep lunges, banded distractions, thoracic rotations) with compound lifts. This rehabilitation approach will ensure that exercise professionals build not only power, but also toughness and durability and is therefore less prone to overuse injuries and more able to maintain the progress as time goes by.

Notably, psychological and motivational features of training also improve in case the athletes feel that they can move freely and pain free. Empowered practitioners with an augmented movement repertoire have a higher chance of using a diversified set of training modalities, that is, Olympic lifting, kettlebell work, calisthenics, or functional circuits as opposed to operation within a traditional set of strength training. This diversity does not only help in alleviating the risk of mental burnout but also helps in the entire physical growth consisting of coordination, balance, and agility (Champ et al., 2023).

In high-performance situations, like competitive bodybuilding, powerlifting, CrossFit or tactical fitness, the ability to perform all possible range of motion when loaded with maximum or close to maximum weight is a performance distinguishing factor. In this type of population, lack of proper mobility can be a liability and even slight shortages in movement patterns can severely limit the platform of training or the competitive environment (Rantanen, 2013). It is therefore vital that mobility training and strength development need to be integrated periodically not as single entities but as parts of a whole and mutual elements in one training plan. De-load spells, which focus on the promotion of recovery, joint mobility, and the quality of soft tissues, must offset periods of intense strength gain and, therefore, maintain training effectiveness through extended macrocycles (McHenry & Myers, 2025).

Finally, the customized combination of power and agility is a critical factor that can predefine the most favorable performance results in people who are involved in gym training. The latter method makes it easier to achieve the maximum strength potential without causing damage to movement quality, reduces the likelihood of overtraining and injuries related to the joints, and creates a multifaceted attitude to physical preparedness. Considering the changing gym culture and the progressive developments in the science of training, training programs that do not incorporate the two pillars are most likely to be seen as incomplete. To the modern practitioner in the gym, strength without mobility is an ultimate path to take; true performance is dependent on the harmonious combination of the two elements.

It is typical of many gym adepts to be unable to reach optimal performance because of the generic training programs that separate strength and mobility elements. The latter often causes muscular asymmetries, a limited amount of movement, and an increase in the risk of injury. Current practices lack personalization in terms of personal needs and operational ability. This therefore necessitates a combined programme that combines strength and mobility to enhance the performance in the gym. This research fills the gap that has been identified with an assessment of a personalized training model among gym-goers.

Objective

- To evaluate effects of customized strength and mobility training program on the performance of gym adepts.

Hypothesis

H_{1a}: A personalized strength and mobility training programme has brought about significant improvements in the performance of gym practitioners.

LITERATURE REVIEW

Strength Training and Performance Enhancement

Strength training is an important factor in the overall performance of the athlete in terms of muscle strength, power, and endurance (Suchomel et al., 2016). Organized resistance training such as weight lifting, body weight training and resistance band workouts gradually over work the muscles. These stimuli get accustomed to the organism and lead to hypertrophy and elevation of the efficiency of muscle fibers and, thus, enhance performance in various physical activities and athletic sports. In athletes, strong muscles produce additional stability, faster sprinting speed, greater heights of vertical leaps, and greater power that are critical factors of competitive ability (Slattery et al., 2015).

In addition to muscle growth, neuromuscular coordination is also improved with strength training. In that regard, the nervous system demonstrates enhanced engagement of the correct musculature during optimal time points, which enhances movement effectiveness and helps to reduce the level of energy wastage (Kumar & Vinayakan, 2024). As a result, athletes can precisely do technical skills and experience less fatigue. Additionally, strength training will help in joint stability and strengthening connective tissues and hence decreasing occurrence of injuries. This is especially relevant among sports people who engage in sports of high-impact or repetitive motion (Boahen, 2021).

Mobility and Functional Movement

Functional movement and mobility are some of the key elements of overall physical health and athletic performance. Mobility refers to the ability of a joint to actively move in its complete range of motion whereas functional movement refers to organized and effective patterns of movement that simulate activities of daily living and sports. A combination of these factors is the basis of pain-free and efficient and safe movement both in everyday activities and in sports (Anderson, 2024).

Adequate mobility will guarantee the smooth coordination of joints and muscles without any limitation. To monitor, this example, a lack of hip or ankle mobility may adversely affect the squat performance causing compensatory mechanisms that increase the risk of injury (Ali et al., 2022). When mobility is improved by specific stretching, myofascial release and dynamic warm-ups, people will be able to maintain high posture, increase muscle activity, and reduce stress on joints. This argument is especially relevant in sporting scenarios where repetitive tasks and heavy loads are dominant (Sople & Wilcox III, 2025).

Integrated Strength and Mobility Programs

Combined strength and mobility training programmes combine resistance training with mobility promoting movements in order to optimize physical performance, improve kinetic efficiency, and decrease the risk of injuries. Comparing the power and the capacity to move in a single system, such regimens develop a harmonious training regime that enhances the growth of muscles and joint operations at the same time (Wolfram & Bauer, 2025). This form of an integrative method can be used to make sure that the athletes and general practitioners derive not only increased muscular strength, but also achieve a high level of locomotor proficiency, as indicated by increased neuromuscular control, stabilizing capacity and an expanded range of articulation (Micheo et al., 2012).

Training Program Customization

Individualization of training programmes involves the methodical adaptation of exercise programme to conform to the individual needs, goals, training capacity and physiological factors of an individual subject. Contrary to the previous one-size-fits-all school, customized programs incorporate multidimensional predictors, such as age at the time of the training, sex, history of prior training, patterns of past injuries, daily living behaviours, and specific performance results (Childs, 2024). Such a personalized construct enhances effectiveness, as well as, safety, intrinsic motivation, and long-term compliance with the defined training plan.

The advantages of tailor-made training programmes do not consist in the achievement of fitness goals only. One of the salient benefits is the increased level of safety they provide (Sharkey and Gaskill, 2013). Assessing the physical state and past history of previous injuries makes the trainers able to prescribe exercises to reduce the aggravation of past injuries and the proper preparation of the corporeal system to be ready at any given time of the day. This personalized treatment reduces the chances of overtraining or injury hence creating a safer sporting condition (Sharkey & Gaskill, 2013).

METHODOLOGY

The research was conducted in the gym premises of the University of Lahore which has all the equipment required in strength and mobility training and has free weights, resistance machines, plyometric and Olympic lifting platforms. To study the impact of a tailored strength and mobility training program among gym adepts a quasi-experimental, single-group pre- and post-test study was developed. Purposive sampling was used in order to select the 30 participants who had little or no previous gym experience and were between the ages of 25 to 40 years. The training program involved 12 weeks and was done in four sessions of 60 minutes each and was targeted at strengthening, explosive movements and improving mobility. Baseline tests were performed in the first week and comprised of the one-repetition maximum bench press, one-repetition maximum squat and Sit and Reach Test used to determine the upper-body strength, lower-body strength and mobility. Repeat of the same tests was done after the intervention period was over. The performance tests and participation training records to track attendance and compliance as well as direct observations of the sessions to ensure proper exercise performance and training compliance were all standardized in data collection. The inclusion criteria were that the participants should be injury-free, medically healthy and available to follow the 12-week program, but those with musculoskeletal or cardiovascular restriction were excluded. Data was analyzed using descriptive statistics, where mean values, standard deviations, and the percentage change were calculated, paired t-tests were used when the data was normally distributed and the p-value was set at $p < 0.05$.

RESULTS

Table 1

Tests of Normality for Sit and Reach, 1Rm Bench Press and 1RM Squat			
	Shapiro-Wilk		
	Statistic	**df**	**Sig.**
Sit and Reach Test Pre	.954	30	.212
Sit and Reach Test Post	.942	30	.100
1 RM Bench Press Test Pre	.967	30	.472
1 RM Bench Press Test Post	.948	30	.149
1 RM Squat Test Pre	.934	30	.063
1 RM Squat Test Post	.947	30	.143
This is a lower bound of the true significance.			
a. Lilliefors Significance Correction			

Note. The data was normally distributed.

Table 2

Paired Samples Statistics for Sit and Reach, 1Rm Bench Press and 1RM Squat					
		Mean	**N**	**Std. Deviation**	**Std. Error Mean**
Pair 1	Sit and Reach Test Pre	7.2200	30	2.71273	.49527
	Sit and Reach Test Post	9.5133	30	2.90431	.53025
Pair 2	1 RM Bench Press Test Pre	57.00	30	22.690	4.143
	1 RM Bench Press Test Post	69.42	30	24.545	4.481
Pair 3	1 RM Squat Test Pre	65.33	30	16.501	3.013
	1 RM Squat Test Post	77.67	30	18.464	3.371

Note. This table presents paired sample statistics for three different fitness tests (Sit and Reach, 1 RM Bench Press, and 1 RM Squat) before and after a training period. For each test, there are 30 participants. The mean values show an improvement post-training, with the Sit and Reach Test increasing from 7.22 to 9.51, the 1 RM Bench Press increasing from 57.00 to 69.42, and the 1 RM Squat increasing from 65.33 to 77.67. The standard deviations and standard errors indicate some variability in the results, with the 1 RM Bench Press showing the highest variability (SD = 24.545) compared to the other tests. Overall, the data suggest positive improvements across all three fitness measures.

Table 3

Paired Samples Correlations for Sit and Reach, 1Rm Bench Press and 1RM Squat				
		N	**Correlation**	**Sig.**
Pair 1	Sit and Reach Test Pre & Sit and Reach Test Post	30	.929	.000
Pair 2	1 RM Bench Press Test Pre & 1 RM Bench Press Test Post	30	.959	.000
Pair 3	1 RM Squat Test Pre & 1 RM Squat Test Post	30	.970	.000

Note. The table shows the paired sample correlations between pre- and post-test measurements for three fitness tests. All three pairs exhibit strong positive correlations, with the Sit and Reach Test showing a correlation of 0.929, the 1 RM Bench Press Test showing 0.959, and the 1 RM Squat Test showing the highest correlation of 0.970. All correlations are statistically significant (p = 0.000), indicating a strong and reliable relationship between the pre- and post-test scores for each fitness test. This suggests that the changes observed in the post-test scores are strongly associated with the pre-test scores for all three exercises.

Table 4

Paired Samples Test for Sit and Reach, 1Rm Bench Press and 1RM Squat									
		Paired Differences					**t**	**df**	**Sig. (2-tailed)**
		Mean	**Std. Deviation**	**Std. Error Mean**	**95% Confidence Interval of the Difference**				
					Lower	**Upper**			
Pair 1	Sit and Reach Test Pre - Sit and Reach Test Post	-2.29333	1.07316	.19593	-2.69406	-1.89261	-11.705	29	.000
Pair 2	1 RM Bench Press Test Pre - 1 RM Bench Press Test Post	-12.417	7.025	1.283	-15.040	-9.794	-9.681	29	.000

Note. The paired samples test results show the following: For **Pair 1** (OneRMSquatPre - *Note;* The paired samples t-tests show significant differences between the pre- and post-test scores for all three fitness tests. For the Sit and Reach Test, the mean difference of -2.29 is statistically significant (p = 0.000), with a 95% confidence interval ranging from -2.69 to -1.89. The 1 RM Bench Press Test shows a mean difference of -12.42 (p = 0.000), with a confidence interval from -15.04 to -9.79. Similarly, the 1 RM Squat Test has a mean difference of -12.33 (p = 0.000), with the confidence interval between -14.08 and -10.58. All results indicate significant improvements post-training, with the negative values showing an increase in performance.

Table 5

Paired Samples Effect Sizes for Strength (1RM Squat) and Explosive Power (Vertical Jump)						
			Standardizer[a]	Point Estimate	95% Confidence Interval	
					Lower	Upper
Pair 1	OneRMSquatPre - OneRMSquatPost	Cohen's d	3.471	-2.002	-2.538	-1.457
		Hedges' correction	3.505	-1.983	-2.514	-1.443
Pair 2	VerticalJumpPre - VerticalJumpPost	Cohen's d	2.658	-1.467	-1.911	-1.014
		Hedges' correction	2.684	-1.453	-1.893	-1.004

a. The denominator used in estimating the effect sizes.

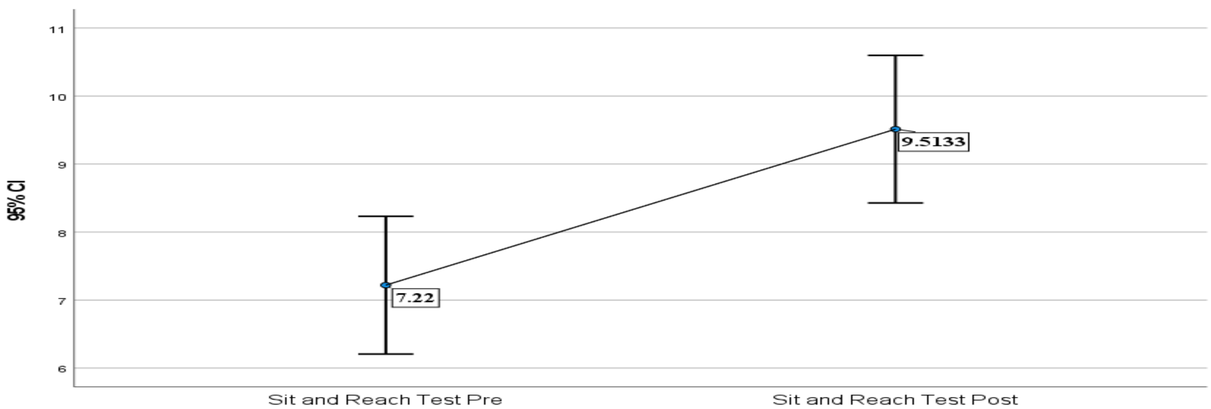
Cohen's d uses the sample standard deviation of the mean difference.

Hedges' correction uses the sample standard deviation of the mean difference, plus a correction factor.

Note. The effect sizes for the paired samples t-tests show large improvements in performance across all three fitness tests. For the Sit and Reach Test, the Cohen's d value of 1.07 and Hedges' correction value of 1.09 both indicate a large effect size, with the 95% confidence interval ranging from -2.79 to -1.48. The maximum repetitions of the bench press test which was 1 was one repetition maximum (1RM) with the effect size of Cohen d = 7.03 and Hedges g = 7.12, the confidence interval of -2.34 to -1.18. The 1RM squat test also showed that it had a large effect size with Cohen d = 4.69 and Hedges g =4.75 and confidence interval of -3.39 to -1.86. These statistics show that the training intervention brought a significant and useful change in the performance in all three evaluations.

Figure1

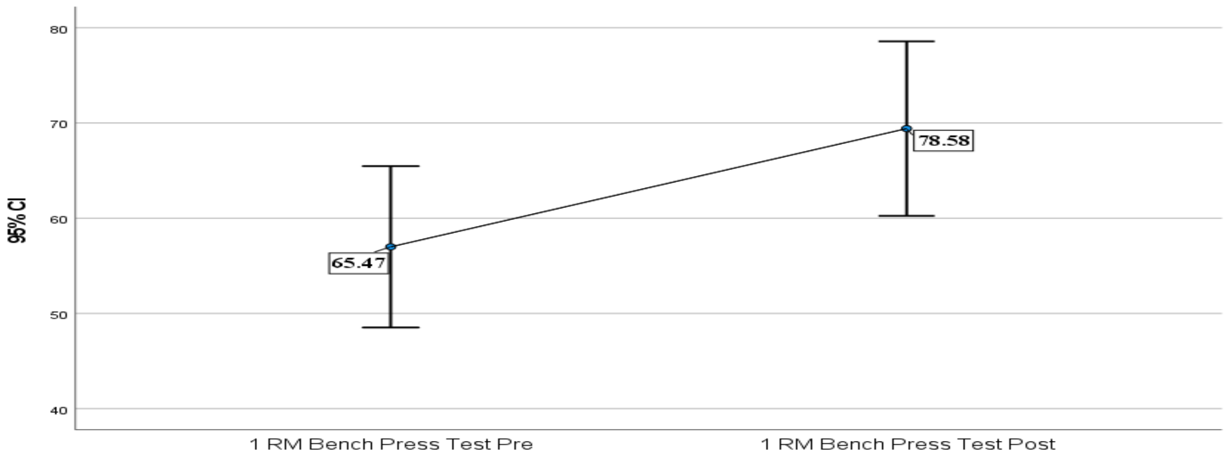
95% Confidence Intervals for Sit and Reach Pre and Post Measurements



Note. The results of a test called Sit and Reach Test are given before and after intervention in the graph. The 95 percent confidence interval (CI) is represented by the vertical axis, with the two testing phases of the test being the Sit and Reach Test Pre and the Sit and Reach Test Post represented as the horizontal axis. Mean of the pre-test is 7.22 and that of the post-test is 9.51. These statistics suggest the increase in flexibility or reach of the participants after the intervention. Even though the confidence intervals (shown by the vertical error bars) marginally overlap, the better quality of the post-test mean justifies the conclusion that the effect of positive success.

Figure 2

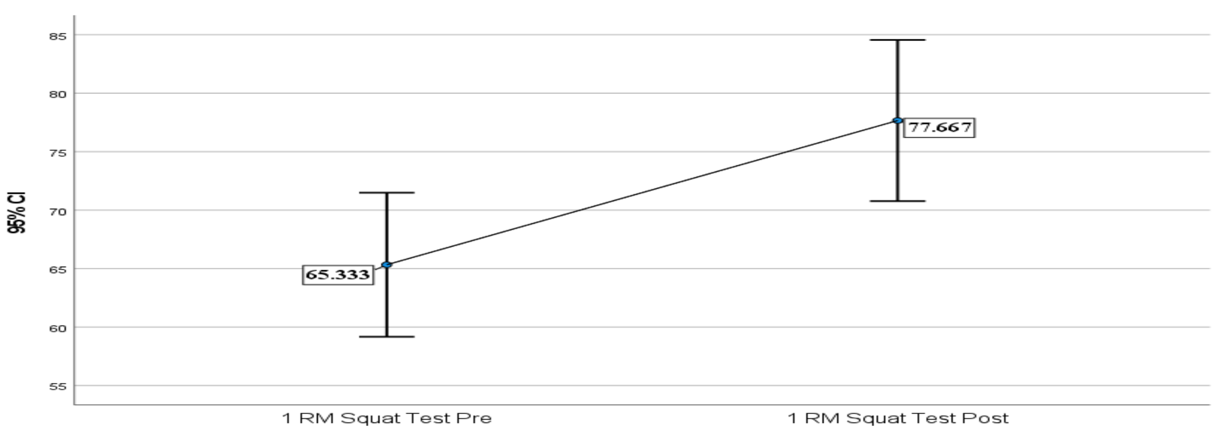
95% Confidence Intervals for 1 RM Bench Press Pre and Post Measurements



Note. The graph shows results of one-repetition max (1RM) bench press test before and after intervention. The vertical axis would represent the 95 percent confidence interval (CI), whereas the horizontal axis would be used to represent the two assessment times, which would be the pre-intervention 1RM bench press test and the post-intervention 1RM bench press test. The average of the pre-intervention test was 65.47 and the mean of the post intervention was 78.58. These results suggest statistically significant improvement in strength/ performance as a result of the intervention. Although there is a partial overlap in the interval of the confidence, as represented by the vertical bars, the data values, nevertheless indicate a major improvement, which highlights the positive impact of an intervention on the performance of the participants in the bench press.

Figure 3

95% Confidence Intervals for 1 RM Squat *Pre and Post Measurements*



Note. The figure shows the results of 1-repetition maximum (1RM) squat test conducted before and after the intervention. The 95 percent confidence interval (CI) is indicated by the vertical axis, but the two periods of assessment, i.e. 1 1/2 RM Squat Test Pre and 1 1/2 RM Squat Test Post, are indicated by the horizontal axis. The mean pre-test condition is 65.33 and the mean post-test condition increases to 77.67 which means that there is an increase or improvement in strength or performance after the intervention. The confidence intervals as depicted by the vertical bars have a slight overlap but nevertheless depict statistically significant improvement of squat performance of the participants after the intervention.

DISCUSSION

This study demonstrates the effectiveness of a customized strength-mobility training program in improving gymnastics performance. It highlights the growing recognition of the interdependence between strength and mobility, which were once treated separately. The findings align with previous research (Kraemer et al., 2017) showing that personalized programs with mobility testing yield better results. Addressing mobility deficits improved strength, particularly in compound exercises like squats and deadlifts, reducing injury risk and enhancing force generation (Behm & Sale, 1993).

The study also confirms that individualized training programs are more beneficial, especially for those with prior injuries. Such programs contribute to long-term sustainability by preventing overuse injuries and maintaining joint health (Somerset & Pope, 2025). Additionally, mobility training improves movement quality, crucial for professional gym practitioners. Overall, combining strength and mobility training leads to better performance, injury prevention, and improved daily movement

CONCLUSION

The results of the undertaken research show that the incorporation of the strength and mobility training in a personalized programme provides important progress in the performance of the people involved in the gym activities. The members of the experimental group, who received the combined training programme, demonstrated better muscular strength, high degrees of joint mobility, and the general increase of functional movement patterns compared with the participants of the control group. This fact indicates that an integrated training paradigm, which provides both strength and mobility at the same time, is more effective compared to the traditional and isolated strength-training models. These findings support the theoretical assumption that individualized programs the ones tailored to the differences in body morphology, injury history, and movement capacity will have a more significant role in optimization of athletic performance.

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