Comparative Analysis Of Selected Physical And Physiological Characteristics Among Inter-Collegiate Male Volleyball Players

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ABSTRACT

The aim of the study was to assess the advantages of weight (resistance) training on specific physical and physiological attributes of inter-collegiate male volleyball players who engage in a regular weight training program to enhance fitness, compared to those who do not participate in weight training at all. Data was gathered from student athletes across various colleges affiliated with Goa University. Employing a convenient sampling method, a sample of 100 male volleyball players was selected during the Goa University Inter-Collegiate Volleyball Championship, forming two equal groups: 50 athletes who regularly engage in weight training and 50 who do not. Lower body explosive strength was evaluated through the vertical jump test (Sargent jump test). Physiological characteristics, including Basal Metabolic Rate (BMR), body fat percentage, and skeletal muscle mass, were measured using Vandelay's Brand bioelectrical impedance weighing scale. A comparative analysis between the two groups was conducted using descriptive statistics and a One-way Analysis of Variance (ANOVA). The results indicated that athletes who practiced weight training exhibited significantly greater lower extremity explosive power and a more enhanced physiological profile compared to their non-training counterparts. Considering the impact of progressive resistance training on physical conditioning, incorporating scientific weight training into an athlete's regimen is highly beneficial for the comprehensive development and competitive preparedness of volleyball players.

Keywords: Explosive strength, physiological characteristics, Basal Metabolic Rate (BMR), Body Mass Index (BMI), body composition, athletic performance.

Introduction

Volleyball is an energetic and high-intensity sport that necessitates a sophisticated blend of explosive strength, agility, and cardiovascular stamina (Silva et al., 2019). Essential technical skills such as spiking, blocking, and serving rely significantly on the swift generation of force, especially from the lower limbs (Bobula et al., 2024). To meet these demanding physical requirements and enhance vertical jump ability, athletes frequently engage in various conditioning techniques, with progressive resistance and weight training being among the most widely utilized methods worldwide (Cormie et al., 2011; Suchomel et al., 2016).

Although the general physiological advantages of strength training are extensively documented in mainstream sports science, its specific effects on the comparative physical and physiological characteristics of regional inter-collegiate athletes necessitate more localized empirical research (Jastrzebski et al., 2014). Physiological indicators—such as Basal Metabolic Rate (BMR) and body composition metrics like skeletal muscle—have a direct impact on an athlete's endurance, metabolic efficiency, systemic recovery, and overall injury resilience (Milić et al., 2017). Gaining insights into how localized training approaches modify these indicators enables more focused athletic development.

This study intends to conduct a comparative analysis between male volleyball players from Goa University who participate in a structured scientific weight training program and those who do not engage in weight training. By assessing these distinct athletic cohorts, this research aims to quantify the tangible benefits of weight training on explosive strength and localized body composition. Ultimately, this study aspires to provide data-driven insights for regional coaches, physical educators, and sports scientists to strategically improve and modernize local athletic training practices.

Research Methodology

Participants and Procedure

A convenient sampling method was employed to recruit 100 male inter-collegiate volleyball players from various colleges affiliated with Goa University for this study. The sample was divided into two equal groups:

Group 1 : 50 players who regularly engage in weight training as part of their fitness regimen.

Group 2 : 50 players who do not partake in any organized weight training program.

Variables and Instrumentation

To evaluate the physical and physiological characteristics of the subjects, the following testing protocols were implemented:

Variable Type	Specific Variable	Measurement/Protocol
Physical	Lower Body Explosive Strength	Vertical Jump Test(Sargent Jump Test)
Physiological	BMR, Body Fat%, Skeletal Muscles	"Vandelay Brands" Bioelectrical Impedance Analysis(BIA) Weighing Scale.

Research design and Statistical Analysis

The data collected were organized in Microsoft Excel and analysed using descriptive statistics, including means and standard deviations, to provide a summary of the profiles of both groups.

To assess whether the differences between the weight-training group and the non-weight-training group are statistically significant, a One-way Analysis of Variance (ANOVA) was conducted. The significance threshold was established at $p < 0.05$ to reject the null hypothesis.

Table 1: *Comparison of Physical and Physiological Parameters of Both groups.*

Variables Evaluated	Weight Training Group (n=50)		No Weight Training Group (n=50)		F-Value	p-value
	Mean	SD	Mean	SD		
Vertical Jump	45.92	3.73	41.34	2.82	47.31	<0.001*
Skeletal Muscles(Kg)	59.54	2.64	51.78	1.63	313.45	<0.001*
Body Fat(%)	11.36	3.28	15.54	2.05	58.01	<0.001*
BMR(Kcal)	1845.82	83.18	1467.42	107.01	381.12	<0.001*

**p<0.05 level of significance*

Results & Data Analysis

Analysis of Lower Body Explosive Strength

- As shown in Table 1, the physical evaluation indicates that the group performing weight training achieved a noticeably higher vertical jump capacity (Mean: 45.92) compared to the non-weight training athletes (Mean: 41.34) with F-Value as 47.31 which was found to be significant at 0.05 level ($p<0.05$).

Analysis of Physiological Metrics

The body composition values revealed extensive structural differences between the groups:

- Skeletal Muscle Mass: The weight training group displayed substantially greater muscle mass (mean: 59.54) as compared to the control group (mean: 51.78). This structural difference was highly significant, F-313.45, $p < 0.001$.
- Body Fat Percentage: The control group demonstrated higher systemic body fat percentages (15.54) compared to the leaner weight training group (11.36), a difference that was highly significant, F- 58.01, $p < 0.001$.
- Basal Metabolic Rate (BMR): Reflecting their increased muscular development, weight-training individuals showed an elevated daily metabolic resting output (1845.82) compared to the non-training athletes (1467.42). The ANOVA confirmed this difference was highly significant, F-381.12, < 0.001.

Discussion

The findings derived from this evidence-based study demonstrate that structured weight training significantly alters both the external functional outputs and the internal physiological systems of collegiate volleyball players. The noticeable difference in vertical jump performance indicates distinct neuromuscular adaptations. Progressive resistance exercises stimulate high-threshold motor units to activate rapidly, thereby improving the rate of force development (RFD) in the quadriceps, hamstrings, and gastrocnemius muscles (Cormie et al., 2011). This explains why the weight training group achieved significantly higher jumps, as their training regimen optimized the stretch-shortening cycle necessary for explosive jumping during spikes and blocks.

From a physiological perspective, the significant differences in skeletal muscle mass account for the corresponding changes in body fat and resting energy expenditure. Muscle tissue is considerably more metabolically active than adipose tissue. The implementation of structured resistance training induces muscular hypertrophy through enhanced protein synthesis (Suchomel et al., 2016).

As a direct result of carrying an average of 7.76 kg more muscle tissue, the athletes engaged in weight training exhibited markedly superior resting metabolic profiles, burning approximately 378 more calories per day compared to their non-training counterparts. Simultaneously, the body fat percentage observed in the weight training groups suggests that structured training loads improve body composition, decreasing fat weight and consequently reducing joint stress during the repetitive landing phases of volleyball matches.

Conclusion

This study presents compelling data-driven evidence that the incorporation of regular weight training into the training regimen of inter-collegiate male volleyball players yields significant physical and physiological benefits. It boosts functional explosive power, systematically increases skeletal muscle mass, enhances resting metabolic efficiency, and maintains low levels of systemic body fat.

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