EFFECT OF CONCURRENT AND COMPLEX TRAINING IN COMBINATION WITH GAME SPECIFIC TRAINING ON SKILL PERFORMANCE OF WOMEN VOLLEYBALL PLAYERS

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Abstract

The aim of this study was to investigate the effect of concurrent and complex training in combination with game specific training on skill performance of women volleyball players. To achieve the purpose of the study, the investigator chosen 45 women volleyball players as participants in the age group of 18 to 23 years. The selected subjects were randomly divided into three equal groups of 15 each. Group-I performed combined complex and game specific training in combination with game specific training, group-II performed complex training in combination with game specific training and group III acted as control. They did these 2 trainings weekly 3 days for 12 weeks. All 3 groups were measured before and also after 12weeks on chosen variables. The following volleyball skills such as upper arm pass and under arm pass were chosen as dependent variables. The chosen dependent variables were assessed prior to and immediately after the training period by using the standardized test items. The data obtained were analyzed by paired 't' test to know the differences if any between the two testing periods. Additionally, magnitude of variation was also calculated. In addition, ANCOVA was also applied. When the adjusted 'F' was considerable, Scheffe's test was applied. To test the obtained results the significance level 0.05 was chosen and considered as sufficient. The combined concurrent and game specific training and also combined complex and game specific training group's upper arm passing skill and under arm passing ability improved following 12 weeks training. However, combined complex and game specific training was superior to combined concurrent and game specific training in improving upper arm pass and under arm pass volleyball skills.

Keywords: *Concurrent training, Complex training, Game specific training, Upper arm pass, Under arm pass and Women volleyball players*

INTRODUCTION

Contemporary volleyball is a high-intensity, intermittent team sport marked by swift rallies, explosive actions, and intricate tactical cooperation. Since its inclusion into the Summer Olympics in 1964, the sport has experienced significant development regarding playing style, regulations, and performance standards. The implementation of the libero position, rally point scoring system, and accelerated offensive strategies has markedly enhanced the pace and intensity of match play. Modern volleyball necessitates that athletes execute repeated short intervals of peak or near-maximal exertion, alternating with shorter rest phases (Sheppard, Gabbett, & Stanganelli, 2009).

From a physiological standpoint, volleyball predominantly depends on anaerobic energy systems owing to the explosive characteristics of movements like leaping, spiking, and blocking. Aerobic ability also aids in recuperation between rallies and sets (Smith, Roberts, & Watson, 1992). Athletes generally execute many vertical leaps throughout a match, underscoring the significance of lower-body muscular strength and neuromuscular synchronization (Ziv & Lidor, 2010). Studies suggest that professional volleyball players can do 250–300 high-intensity movements every match, encompassing leaps, dives, and swift directional shifts (Sheppard et al., 2009).

Recent advancements in strength and conditioning highlight the significance of concurrent training (the integration of resistance and endurance training within a single program) and complex training (the deliberate pairing of heavy resistance exercises with biomechanically analogous plyometric movements). Studies indicate that complex training augments neuromuscular adaptations via processes including post-activation potentiation (PAP), resulting in enhanced explosive power, essential for vertical jumping and rapid directional shifts in volleyball. Concurrent training enhances both physical strength and aerobic capacity, so assuring consistent performance during matches.

While these training strategies have been independently analyzed across numerous sports, there is a paucity of research investigating their synergistic effect in conjunction with game-specific training among female volleyball players. Most prior research has concentrated on male players or on discrete physical elements, neglecting the integration of psycho-motor factors such as response time and synchronization with real volleyball skill performance.

Female volleyball athletes frequently have distinct physiological and performance-related problems, encompassing variations in strength levels, muscle fiber composition, and training response patterns relative to their male counterparts. Consequently, it is essential to develop and assess training strategies particularly designed for female athletes, rather than extrapolating results from research predominantly focused on males.

Moreover, the escalating competitiveness in national and international volleyball competitions, like the FIVB Volleyball Women's World Championship and the Olympic Games, underscores the necessity for scientifically verified training regimens that improve multidimensional performance metrics. Coaches and trainers necessitate evidence-based methodologies to enhance training efficacy throughout constrained preparation intervals.

A significant justification for this study is the amalgamation of game-specific training with simultaneous and intricate training methodologies. General conditioning enhances physical abilities, whilst game-specific activities facilitate the application of training adaptations in real match scenarios. The integration of these methodologies may yield enhanced advancements in motor fitness, psychomotor capabilities, and volleyball-specific competencies relative to conventional training techniques. This study aims to address the research gap by examining an integrated training model designed to enhance overall performance in women volleyball players, thus advancing the fields of sports training science and women's volleyball performance.

METHODOLOGY

Subjects and Variables

To achieve the purpose of the study, the investigator chosen 45 women volleyball players as participants in the age group of 18 to 23 years. The selected subjects were randomly divided into three equal groups of 15 each. Group-I performed combined complex and game specific training in combination with game specific training, group-II performed complex training in combination with game specific training and group III acted as control. The following volleyball skills such as upper arm pass and under arm pass were chosen as dependent variables and these skills were assessed by Russell - Lange Volleyball skill test

Training Program

During the training period, both the treatment groups performed their respective training three days per week for twelve weeks. Group-I performed concurrent training in combination with game specific training, Concurrent (resistance & aerobic) training groups performed resistance training during every odd numbered week and aerobic training during every even numbered week. The resistance training program was a total body workout consisting of 3 sets of 6-10 repetitions on 6 exercises that trained all the major muscle groups. A percentage of each subject’s one-repetition maximum for each exercise was used to determine the intensity of each week. The intensity (60- 85% of 1RM) and number of repetitions performed for each exercise was progressively increased. The aerobic training group performing continuous running of two minutes duration for proposed repetitions and sets, alternating with active recovery based on work-rest ratio. The running intensity was determined by a percentage of maximum heart rate (HRmax). The intensity (60- 85% of HRmax) was amplified as training progressed.

The experimental group-II performed complex training in combination with game specific training. Complex (resistance & plyometric) training groups performed resistance training during every odd numbered week and plyometric training during every even numbered week. The resistance training program was a total body workout consisting of 3 sets of 6-10 repetitions on 6 exercises that trained all the major muscle groups. A percentage of each subject's one-repetition maximum for each exercise was used to determine the intensity of each week. The intensity (60- 85% of 1RM) and number of repetitions performed for each exercise was progressively increased. The plyometric training program consists of variety of exercises designed for the upper and lower extremity. Training volume ranged from 90 foot contacts to 140 foot contacts per session.

After performing the concurrent and complex training, the subjects of the experimental group-I and II performed the specially designed games specific training. The training sessions were conducted three days a week over a period of twelve weeks. They performed ten game specific drills. A week schedule was repeated to the proceeding week and the load was adjusted progressively. The training intensity was increased progressively from first week to proceeding week. The frequency of training was three in a week. The work rest ratio of 1:1 between exercises and 1:3 between sets was given.

Statistical Procedure

The data collected from the experimental and control groups on selected dependent variables was statistically analyzed by paired 't' test to find out the significant differences if any between the pre and post test. In order to nullify the initial mean differences the data collected from the three groups prior to and post experimentation on selected dependent variables were statistically analyzed to find out the significant difference if any, by applying the analysis of covariance (ANCOVA). In all the cases the level of confidence was fixed at 0.05 level for significance.

RESULTS

The t' test outputs as well as magnitude of changes on upper arm passing skill of combined concurrent and complex training with game specific training and control groups are put on show in table -I.

Table – I: Results of 'T' Test & Magnitude of Changes on Upper Arm Pass of Combined Concurrent and Complex Training with Game Specific Training and Control Groups

Group	Tests	No	Mean Scores	S.D	Std. Error Mean	M. Diff	't' – test	%
Concurrent & Game Specific Training	Pre	15	29.0000	3.76070	.97101	1.933	8.473*	6.67%
	Post	15	30.9333	4.00832	1.03494			
Complex & Game Specific Training	Pre	15	29.0667	3.57505	.92307	3.800	6.862*	13.07%
	Post	15	32.8667	3.77712	.97525			
Control	Pre	15	29.1333	1.68466	.43498	0.267	0.503	0.92%
	Post	15	28.8667	3.15926	.81572			

df -14 =2.13(0.05 level)
**Significant*

The upper arm passing skill vary significantly between pre and post assessment period since the combined concurrent and game specific training (8.473) as well as combined complex and game specific training (6.862) group's 't' scores were more than necessary value (2.13).

The combined concurrent and game specific training (6.67%) and also combined complex and game specific training (13.07%) group's upper arm passing skill improved following 12 weeks training.

The upper arm pass skill of combined concurrent and complex training with game specific training and control groups was explored by ANCOVA technique as given in table–II.

Table – II: **ANCOVA Output on Upper Arm Pass Skill of Combined Concurrent and Complex Training with Game Specific Training and Control Groups**

Variable	Concurrent & Game Specific Training	Complex & Game Specific Training	CG	SoV	SS	df	MS	'F'
Upper Arm Pass	31.001	32.867	28.799	B	124.371	2	62.185	19.004*
				W	134.158	41	3.272	

(df -2 & 41= 3.21)
**Significant (.05 level)*

The adjusted means (31.001, 32.867 & 28.799) on upper arm pass skill of combined concurrent and complex training with game specific training and control groups fluctuate significantly as the discovered 'F' (19.004) is more than set value (3.21). The follow up test Scheffe's was utilized as in table -III.

Table –III: Scheffe's Test Results on Upper Arm Pass Skill of Combined Concurrent and Complex Training with Game Specific Training and Control Groups

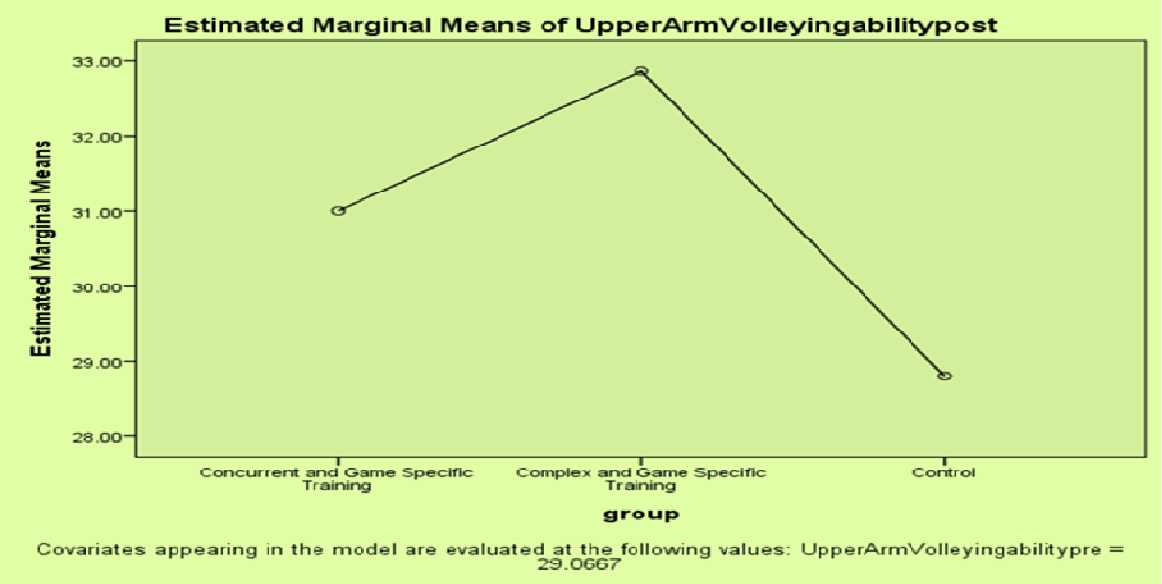
Concurrent & Game Specific Training	Complex & Game Specific Training	CG	MD	CI
31.001	32.867		1.866*	1.674
31.001		28.799	2.202*	1.674
	32.867	28.799	4.068*	1.674

**Significant (.05 level)*

Because of combined concurrent and game specific training (2.202) and combined complex and game specific training (4.068) the upper arm pass skill was noticeably improved still, combined complex and game specific training was better than combined concurrent and game specific training (1.866) as the CI score (1.674) is lower than MD scores.

Estimated marginal means on upper arm pass skill of combined concurrent and complex training with game specific training and control groups are graphically represented in figure-I.

Figure- I: Estimated Marginal Means on Upper Arm Pass Skill of Combined Concurrent and Complex Training with Game Specific Training and Control Groups



Under Arm Passing Skill

The 't' test result as well as magnitude of changes on under arm passing ability of the combined concurrent and complex training with game specific training and control groups are displayed in table -IV

Table-IV:Results of 'T' Test and Magnitude of Changes on Under Arm Pass of Combined Concurrent and Complex Training with Game Specific Training and Control Groups

Group	Tests	No	Mean Scores	SD	Std. Error Mean	M. Diff.	't' – test	%
Concurrent & Game Specific Training	Pre	15	24.2000	1.74028	.44934	2.533	8.264*	10.47%
	Post	15	26.7333	2.21897	.57293			
Complex & Game Specific Training	Pre	15	23.8667	2.09989	.54219	4.000	11.832*	16.76%
	Post	15	27.8667	2.50333	.64636			
Control	Pre	15	24.0667	2.54858	.65804	0.133	0.264	0.55%
	Post	15	23.9333	2.60403	.67236			

Df -14 =2.13(0.05 level)
**Significant*

The under arm passing ability of two testing periods vary extensively since the combined concurrent and game specific training (8.264) as well as combined complex and game specific training (11.832) group's 't' scores were more than pre set value (2.13). The combined concurrent and game specific training (10.47%)and combined complex and game specific training (16.76%) group's under arm passing ability improved following 12 weeks training.

Via ANCOVA technique, the under arm passing ability of combined concurrent and complex training with game specific training and control groups were scrutinized and put on display in table –V.

Table – V:ANCOVA Output on Under Arm Passing Skill of Combined Concurrent and Complex Training with Game Specific Training and Control Groups

Variable	Concurrent & Game Specific Training	Complex & Game Specific Training	CG	SoV	SS	df	MS	'F'
Under Arm Passing	26.594	28.026	23.913	B	130.622	2	65.311	28.092*
				W	95.319	41	2.325	

(df -2 & 41= 3.21)
**Significant (.05 level)*

The ANCOVA result proved that the adjusted means (26.594, 28.026 & 23.913) on under arm passing ability of combined concurrent and complex training with game specific training and control groups fluctuate drastically since the derived 'F' score (28.092) is more than df value (3.21). The follow up test was also followed as put on display in table -VI.

Table –VI: Scheffe's Test Results on Under Arm Passing Skill of Combined Concurrent and Complex Training with Game Specific Training and Control Groups

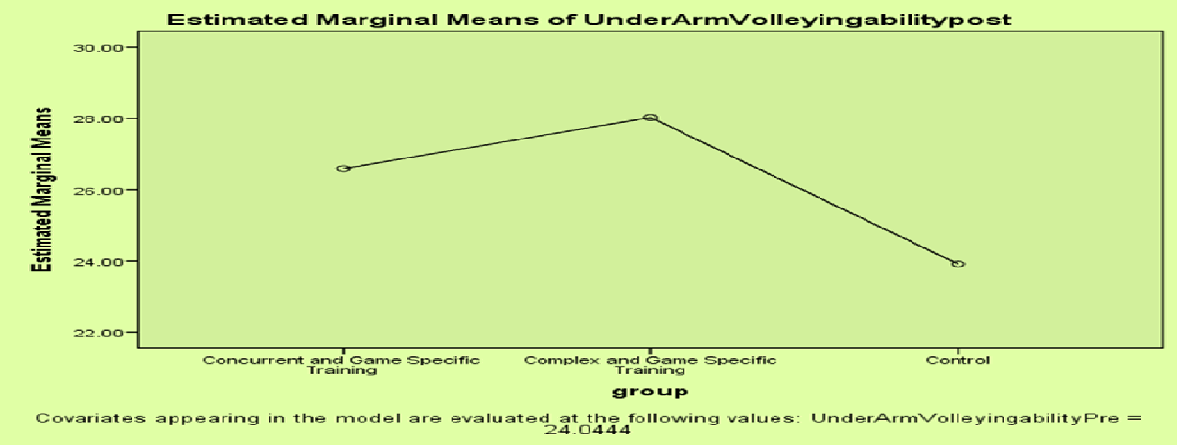
Variable	Concurrent & Game Specific Training	Complex & Game Specific Training	CG	MD	CI
Under Arm Passing	26.594	28.026		1.432	1.411
	26.594		23.913	2.681*	1.411
		28.026	23.913	4.112*	1.411

**Significant (.05)*

Because of combined concurrent and game specific training (2.681) and combined complex and game specific training (4.112) the under arm passing ability was very much improved because the CI score (1.411) is higher than MD scores. Though, combined complex and game specific practices was better than combined concurrent and game specific training, as this MD score (1) is l.432 is higher than the CI score (1.411).

Estimated marginal means on under arm pass skill of combined concurrent and complex training with game specific training and control groups are graphically represented in figure-II

Figure- II: Estimated Marginal Means on Under Arm Pass Skill of Combined Concurrent and Complex Training with Game Specific Training and Control Groups



DISCUSSION

The notable enhancement shown in both groups can primarily be ascribed to the incorporation of game-specific training. Volleyball passing is a vital technique necessitating exact synchronization of the arms, shoulders, torso, and lower extremities, as well as accurate timing, body equilibrium, and spatial awareness. Game-specific workouts replicate actual match scenarios, necessitating players to consistently execute forearm and overhead passes under varying conditions, including diverse ball speeds, trajectories, and opponent pressures. This repetitive, contextual practice improves motor learning, movement consistency, and the

efficiency of skill performance (Schmidt & Lee, 2011).

Moreover, advancements in physical fitness attributes from both training programs certainly facilitated improved passing capability. Enhanced physical strength, muscle endurance, flexibility, balance, and coordination allow players to sustain stable body postures, regulate ball contact, and perform precise passes despite exhaustion. Enhanced neuromuscular efficiency enables players to absorb and redirect ball forces more proficiently, which is essential for good volleyball passing (Sheppard, Gabbett, & Stanganelli, 2009).

Although both experimental groups exhibited gains, the group receiving combined sophisticated and game-specific training showed a superior boost in passing skill proficiency. This advantage can be attributed to the nature of complex training, which systematically integrates heavy resistance workouts with biomechanically analogous explosive actions. This exercise improves neuromuscular activation, force generation rate, and intermuscular coordination, which are crucial for swift and regulated upper-limb movements during passing (Cormie, McGuigan, & Newton, 2011).

Complex training enhances postural control and dynamic stability by improving core and lower-limb strength. Successful passing in volleyball relies significantly on sustaining a low, stable posture and performing rapid modifications to the ball's trajectory. Complex training induces neuromuscular changes that enhance an athlete's capacity to stabilize the body during precise arm movements, resulting in improved accuracy and consistency in passing performance (Bompa & Buzzichelli, 2019).

Conversely, concurrent training integrates strength and endurance stimuli, which, while advantageous for overall conditioning, may induce an interference effect that restricts optimal neuromuscular changes pertinent to skill performance. Elements emphasizing endurance may compromise the quality of explosive and finely coordinated movements by producing tiredness or diminishing neural adaptations linked to quick force output (Hickson, 1980; Wilson et al., 2012). Thus, the group undergoing mixed concurrent and game-specific training exhibited significant progress, although did not attain the same degree of augmentation in passing skills as the complicated training group.

The specificity principle underpins the enhanced results shown in the group undergoing both sophisticated and game-specific training. Complex training accurately emulates the explosive but controlled movement patterns essential for volleyball passing, especially when

combined with sport-specific drills. This facilitates the transfer of physical and neurological adaptations directly to match-related abilities, leading to enhanced passing accuracy and consistency (Newton & Kraemer, 1994).

CONCLUSION

The combined concurrent and game specific training (6.67%) and also combined complex and game specific training (13.07%) group's upper arm passing skill improved following 12 weeks training. The combined concurrent and game specific training (10.47%)and combined complex and game specific training (16.76%) group's under arm passing ability improved following 12 weeks training. However, combined complex and game specific training was superior to combined concurrent and game specific training in improving volleyball skills. The significant enhancement may be ascribed to higher neuromuscular coordination, increased explosive strength, enhanced movement stability, and improved transfer of training benefits to sport-specific skill performance. These findings underscore the significance of integrating complicated training techniques with game-specific drills to enhance volleyball passing performance.

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