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## Effect of calisthenics exercises on the vertical high jump on intermediate female volleyball players

**Niharika V Ramanarao Cintre, Dr. Ronald Prabhakar and Dr. Archana Methé**

### Abstract

This study aimed to find out the effect of the calisthenics exercises on the vertical high jump on intermediate female volleyball players. 59 volleyball players participated in the study. The Sargent jump test was taken as an outcome measure for assessing the vertical high jump of the players for core and lower limb strength. All the players completed their 4week calisthenics protocol. There was a significant difference between the pre-intervention vertical high jump and the post-intervention vertical high jump. Paired t-test was done to compare the effect of calisthenics exercises on the vertical high jump. It revealed that the mean jump score before calisthenics exercises was  $26.26 \pm 3.98$  cm which significantly increased to  $30.05 \pm 4.64$  cm after the performance of calisthenics exercises ( $P < 0.0001$ ).

**Keywords:** Calisthenics, sargent jump test, female volleyball players, high jump

### 1. Introduction

Volleyball is a very complex physically enduring sport that requires enough amount of core strength as well as lower body strength to produce powerful vertical jumps as well as coordination for landing back on the ground due to the rapid postural movements and sway [1]. Calisthenics is the form of an exercise training program based around your body weight, using minimal equipment. Due to the activation of various types of muscular groups, it develops coordination and proprioception in the individual, and hence for this particular reason, it is used in both rehabilitation and sports training. Calisthenics exercises are dynamic and aerobic. It is a beneficial form of exercise because of the cadent, low-intensity modification of the large muscle groups used in the upper and the lower extremity [2]. This discipline aims to increase strength, such as performing the maximum number of repetitions of pull-ups or parallel bar dips with and without an external overload, for strength endurance, or to lift the maximum possible weight in the previously mentioned exercises, for maximal strength, and perform gymnastic based skills of increasing difficulty, for isometric strength [3].

Calisthenics is based on the two physical key components: First is movements; all Calisthenics movements demand a high level of joint mobility and coordinated muscle activation. Which consists of movement preparation, aim here is to remove muscular tension, improve muscular length, enhance mobility and activate the muscles we intend to use in preparing to move. Another one is movement patterning includes teaching the brain and body new movements patterns. The second one is strength consisting of applied strength which is a specific type of strength used in calisthenics eg putting your body in such a position where it requires a high level of muscle force. Here exercises are goal specific. Another is capacity strength; Here the exercises are less specific, global strength exercises that will build up strength, postural stability, and muscular coordination [1, 2, 3, 4].

Hence, such types of exercises are specially designed to increase flexibility and strength through various movements such as swinging, twisting, jumping, kicking, or bending. There are different types of variations in calisthenics training [5]. This training model consists of performing sets of effort interspersed with a rest interval, and in each set, practitioners should be instructed to perform bodyweight exercises (eg. jumping jacks, burpee, among others) at the maximum possible velocity, without controlled or rhythmic cadence. In the studies, it is shown that calisthenics improves the general physical fitness of the individual [6].

In this context, calisthenics is an innovative and vital approach in the terms of the fact that it consists of all the movements performed by the person's body weight and the group of muscles in the volleyball without the use of the external weight protocol.

## 2. Material and Methodology

The experimental study was conducted at the volleyball district club, Sangli. The study was approved by the Institutional Ethical research committee of Miraj Medical Center, College of physiotherapy, Wanless Hospital, Miraj.

### 2.1 Participants

Subjects who completed the inclusion and exclusion criteria were included in the study. The inclusion criteria Age group of female players between 15 to 17 years who play volleyball for more than 6 months with no history of any injury or problem for the past 2-3 months. Participants are those who have not participated in any authorized competition. The exclusion criteria were Patient with any musculoskeletal cardiovascular or respiratory issues Cognitive problems that decreased the compliance of the players to participate in the study and any medical condition that would impair their playing activities. Written informed consent was obtained from all the subjects.

### 2.2 Procedure

The training program was explained to the subjects in their

vernacular language. Demographic data like name, age, height, weight, BMI, number of playing years, history of any previous injuries, and any medical condition of the player was recorded in the data collection sheet. During the training phase of the study subjects were applied for the 4-week training program and during that period subjects did not participate in any training program, The overall time of the protocol was 60 min including warm-up for 10 mins, calisthenics for 40 mins and cooldown for 10 mins exercises. The outcome measured in the study was vertical jump, measured by the Sargeant jump test. The athlete stands side on to a wall and reaches up with the hand closest to the wall. Keeping the feet flat on the ground, the point of the fingertips is marked or recorded. This is called the standing reach height. The athlete then stands away from the wall and leaps vertically as high as possible using both arms and legs to assist in projecting the body upwards. Attempt to touch the wall at the highest point of the jump. The difference in distance between the standing reach height and the jump height is the score. The best of three attempts is recorded. The reliability of the sergeant jump test is  $r=0.09$ .

### 2.3 Training plan

Subjects completed there a training protocol for 4week 5 days per week with 60 minutes of the training session. According to the increased loading principle, as time progresses, the version of the movement became harder and their number increased.

**Table 1:** 4-week calisthenics program

#### Jumping sessions

Movements	First week	Second week	Third week	Fourth week
Straight jump	2x10rep	2x12 rep	2x14 rep	2x16 rep
Broad jump	2x10 rep	2x12 rep	2x14 rep	2x16 rep
360-degree jump	2x10 rep	2x12 rep	2x14 rep	2x16 rep
Net blocking jump	2x10 rep	2x12 rep	2x14 rep	2x16 rep
Squat jump		2x12 rep	2x14 rep	2x16 rep
Butt kicks		2x12 rep	2x14 rep	2x16 rep
Slack tuck jump		2x12 rep	2x14 rep	2x16 rep
Straddle jump		2x12 rep	2x14 rep	2x16 rep
Kangaroo Hops			2x14 rep	2x16 rep
Sideways squat jump			2x14 rep	2x16 rep
Catch tuck jump			2x14 rep	2x16 rep
Full pike jump				2x16 rep
Split jump				2x16 rep

#### Core session

Movements	First week	Second week	Third week	Fourth week
Plank	30 sec	40 sec	50 sec	1 min
Leg lowers	2x10 rep	2x12 rep	2x14 rep	2x16 rep
Normal crunches	2x10 rep	2x12 rep	2x14 rep	2x16 rep
Backbend /chakrasana	30sec	40 sec	50 sec	1min
Bicycle crunches		2x12 rep	2x14 rep	2x16 rep
Dead bugs		2x12 rep	2x14 rep	2x16 rep
Arch hold			30 sec	45 sec
Flutter kicks			2x12 rep	2x16 rep
Side planks				1min
Walkout				2x16 rep
Leg lowering withhold				30 sec

#### Lower limb session

Movements	First week	Second week	Third week	Fourth week
Squats	2x10 rep	2x12 rep	2x14 rep	2x16 rep
Cossacks	2x10 rep	2x12 rep	2x14 rep	2x16 rep
Mountain climbers	2x10 rep	2x12 rep	2x14 rep	2x16 rep

Lunges		2x12 rep	2x14 rep	2x16 rep
Duck walk		2x12 rep	2x14 rep	2x16 rep
Donkey kicks			2x14 rep	2x16 rep
Burpees				2x16 rep
Push and get up				2x16 rep

### 3. Results

**Table 2:** Descriptive Statistics of weight, height, BMI

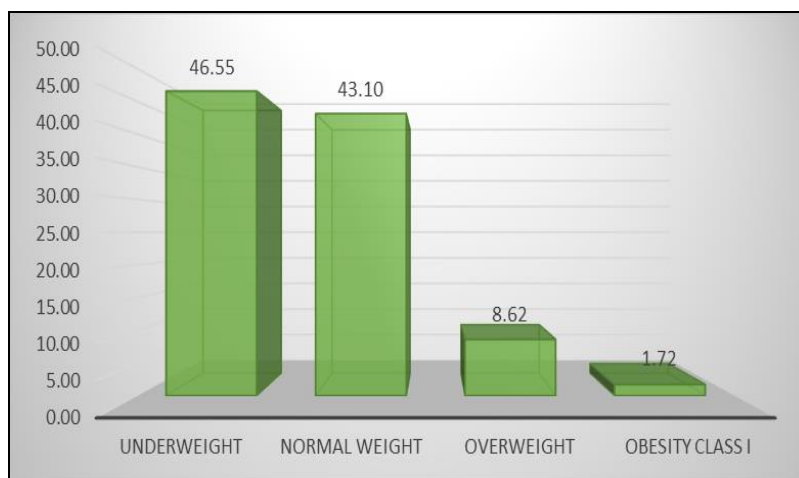
	Mean	Std. Dev.
Weight	46.64	9.54
Height	157.05	8.95
BMI	19.00	3.93

The mean weight of female volleyball players was  $46.64 \pm 9.54$  kg and the mean height was  $157.05 \pm 8.95$  cm.

**Table 3:** BMI of female volleyball players

BMI Range	Category	Frequency	%
Below 18.5	Underweight	27	46.55
18.5-24.9	Normal weight	25	43.10
25.0-29.9	Overweight	5	8.62
30.0-34.9	Obesity class I	1	1.72

Table 3 revealed that most i.e. 27 (46.55%) players were underweight, 25(43.10%) players were having normal weight, 5(8.62%) were overweight and 1 (1.72%) player was in obesity class I.

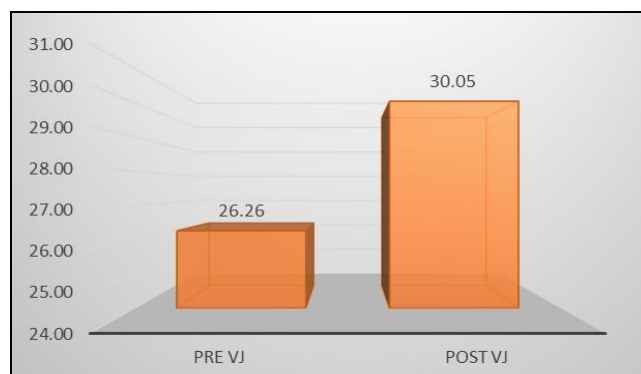


**Fig 1:** BMI of female volleyball players

**Table 4:** Effectiveness of calisthenics exercises on the vertical high jump (cm)

Pre VJ		Post VJ		Paired t statistic	p-value
Mean	Std. Dev	Mean	Std. Dev		
26.26	3.98	30.05	4.64	11.60	<0.0001

Paired t-test was done to compare the effect of calisthenics exercises on the vertical high jump. It revealed that the mean jump score before calisthenics exercises was  $26.26 \pm 3.98$  cm which significantly increased to  $30.05 \pm 4.64$  cm after effects of calisthenics exercises ( $P < 0.0001$ ).



**Fig 2:** Comparative effect of pre and post intervention (cm)

### 4. Discussion

The study is aimed to find the effect of calisthenics exercises

on the vertical high jump of the intermediate volleyball players. The subjects in the study had baseline ages between 15 to 17 years. The results of the study revealed that the body weight calisthenics exercises show a significant effect on the vertical high jump of the players due to the increase in the strength of the core as well as the lower limb musculature which was measured by the Sargeant high jump test. It was carried out in 4 weeks with a fixed protocol and were divided into core session, and jumping session. Where there was a fixed progression set week by week according to the loading principle. Where it was seen that the mean jump score before the calisthenics exercise was  $26.26 \pm 3.98$  cm which significantly increased to  $30.05 \pm 4.64$  cm after the performance of calisthenics exercises ( $P < 0.0001$ ).

One of the selective studies was carried out by B. Don Franks and George C. Moore which aimed at the Effects of Calisthenics and Volleyball on the AAHPER Fitness Test and Volleyball Skills Seventy-six tenth-grade boys participated in one of the following three physical education classes for five weeks. The calisthenics consisted of strength, agility, and flexibility exercises similar to a pregame warm-up of a high school football team, and the volleyball classes consisted of drills and competition adapted from within the scope of this study, it is concluded that 5 weeks. of a daily calisthenics class or a combination of calisthenics and volleyball class caused greater improvements in muscular endurance, as measured by sit-ups and pull-ps than an all-volleyball class. The combination class also caused greater improvement in speed, as measured by the 50-yd. ruthenium the volleyball

class [6].

Another similar study was done by Harry k. Company and Richard Wehr on the undergraduate students from the nine were male and ten were female. The calisthenics program was designed for 10 weeks in which the aim was to study the physical fitness components of the subjects. The programs for men and women differ only in the number of repetitions or the form of a conditioning calisthenic, or the intensity of a circulatory activity. Both sexes receive instructions to exercise at a pace established by the individual with the suggestion that work rates be increased during the progression from level to level. Five workouts a week are called for throughout the program. Rest periods between calisthenics are permitted but discouraged. At last, there was a marked difference between the pre-training and post-training numbers of the strength, flexibility, and the other components of the physical fitness program, and hence calisthenics was concluded an effective training [7].

Michael E. Powers studied the vertical high jump raining for volleyball, where he has performed various explosive strength and power training protocols including calisthenics. According to him improving explosive strength of the legs, hip and core result in a higher vertical jump. As explosive training will help in increasing the rate of the force development of the type II muscle fibre through neuromuscular adaptation. They concluded that calisthenics works as strength training and helps to improve the vertical high jump of the players [9].

In any sporting activity, the performance is influenced by the psychological status of that athlete. Calisthenics exercises also help in concentrating mind and body coordination. If done properly it can reduce anxiety and enhance athletic performance. Hence, as a result, it can be said that calisthenics exercises show a significant effect on the strength of the vertical high jump of the female volleyball players when trained for 4 weeks under the fixed protocol.

## 5. Conclusions

The study aimed to find the effect of calisthenics exercises on the vertical high jump on the intermediate female volleyball players, and after the study, it was found out that due to the 4 weeks protocol of calisthenics exercises there was a significant effect on the vertical high jump length on the intermediate female volleyball players.

## 6. Acknowledgment

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