

## Reference values of Jumping Test in Professional Badminton Players and in Recreational Badminton Players (10-14 years): A Cross Sectional Study

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### ABSTRACT

**Aim:** To find the reference values of jumping test in professional badminton and in recreational badminton players of age 10-14 years.

**Materials and methods:** 100 players from badminton clubs of age group 10-14 years participated in the study for 6 months.

**Result:** Significant difference were found in height of the professional badminton players showed significant higher values compared to recreational badminton players  $p=0.0013$ , the weight also showed significant higher values in professional badminton players compared to recreational badminton players  $p=0.0037$ . BMI does not showed any significant difference between professional and recreational badminton players ( $p=0.1543$ ). Counter movement jump (CMJ) showed higher values when compared to Squat jump (SQJ) values the different is highly significant  $p=0.0000$ . Jump test values of CMJ and SQJ in professional badminton players are higher than recreational badminton players but difference between them are non-significant in CMJ ( $p=0.1333$ ) and in SQJ ( $p=0.1667$ ). Jump test values of CMJ in male and female showed no significant difference in CMJ  $p=0.857$  and in SQJ  $p=0.828$ . We also found that as age advances the jump test values increases.

**Conclusion:** The result of present study can be taken as reference values for recreational and professional badminton players of age group 10 to 14 years. There is no gender wise difference in both jump test values (CMJ and SQJ) in both professional and recreational badminton players.

**Key words:** Professional badminton players, Recreational badminton players, Counter movement jump, Squat jump, BMI, Muscle strength.

### INTRODUCTION

Badminton requires open and fast actions toward the shuttlecock. [1] In athletes, key factors for physical sports are physical, mental and technique preparation. [2] Physical preparation in any type of training includes the physical elements of sports such as mobility, flexibility, strength, speed and power etc, for good physical performance. [3-7] Muscle strength, power and speed are important in players. [3-7] According to study, lower limb muscle strength increases, from the low to intermediate in professional sport training in age groups of (4-7yr) & (8-10yr) and stabilized thereafter. [8] In study, it was found that, the vertical jump height is significantly associated with the lower limb strength. [8]

Jumping ability is a key element of success in athletes [9-11] which greatly affects athlete performance. [9] Jumping test is a performance test which also assesses the balance ability of the athletes. [10,12,13] The sports like basketball, volleyball and badminton requires stamina, jumping, running and good body balance while playing. [4,6,7,10,12,14,15] Good body balance is also important for quality shots and better footwork in badminton. [12,13] Jumping test is proved to be an valid and reliable for CMJ(0.97), SJ(0.93) measure for squat and countermovement jump test in sports like badminton, basketball, volleyball, soccer players. [11,16-19]

Vertical jump test like counter movement jump (CMJ) and squat jump (SQJ) are one of the key tests used to

measure and evaluate the jumping ability of the athletes. [1,2,4-6,8-10,21] These both tests are valid and reliable. [11,16-20] Average vertical jump test values of different age groups are: age 20-29 year (50.8cm), age 30-39 year (43.18cm), age 40-49 years (35.56cm), age 50-59years ( 27.94cm). [22] The percentage of agreement between examiners (inter observer agreement) for handball is (70.11 %, SD = 0.57) and badminton (70.03 %, SD = 0.68) [23] Average values of jumping test in age group of under 12 years is  $22.8 \pm 3.6$  cm & under 14 is  $30.0 \pm 5.9$  cm. [23,24]

In previous study badminton players was involved, males and females were taken in the same ratio of age group  $17.24 \pm 1.8$  years in males and  $15.21 \pm 2.06$  years in females, the jumping test were conducted such as CMJ and SQJ in that males have higher values (CMJ= $36 \pm 6.7$ cm, squat= $39.3 \pm 5.7$ cm) as compare to the female (CMJ= $27.2 \pm 2.1$ cm, squat= $28.1 \pm 2.4$ cm). [9] In previous study of volley ball, all male players of age group 20-29 year were recruited, values of vertical jumps before vibration was  $60.3 \pm 3.2$ cm and after it was  $63.0 \pm 3.2$ cm. [2] Like that in the young basketball players, all males of age group 9-18 are selected they were divided into 3 groups (under-12, under-15, under-18), the score of CMJ test was  $29.9 \pm 8.5$ cm(12-15 years), BMI was considered and higher BMI person scores less in the jump test. [8] In previous study of basketball players of age 18-22 years and all males were taken they score in CMJ ( $45.51 \pm 5.55$ cm). [1]

Regarding vertical jump test result, there was significant difference between genders in vertical jumps. It was found that the male badminton player score was higher as compared to female. The abdominal strength/ resistance of the male athletes were greater as compared to female. [10] The association between running jumps and standing jumps was lower which indicates that standing and running jump performance should not be observed as same quality and players who have superior jumping capabilities was able to outperform their opponents in numerous situations. [3] In

jumping activity, the lower limb explosive and organic motion are required to act on the ground against a players weight and gravity with strong force, by using muscle strength. [9]

Recreation is an activity often done for enjoyment, amusement or pleasure and are considered to be fun, satisfaction and enjoyment. [3,25,26] Professional means any person who earns their living from a specified professional activity, with the particular knowledge and skill necessary to perform their specific role within that profession. [9,25,27] The achievement of an optimal body mass was main concern because previous study has shown that body mass index (BMI) has direct effect on performance of the individual. [11] Lower or normal BMI perform better in physical fitness test than overweight/obese. [11] The studies have pointed out the importance of physical characteristics for different sports such as volleyball and basketball. [10] Jumping test is a performance test in athletes. Jumping ability greatly affects the player performance. [9] There was difference between the jumping test performance of male [3,9,11] and female. [3]

Till date jumping evaluation tests is been conducted in sports like Badminton (male age 15-19years & female age 13-18years), Basketball (male age 18-22 years), Volleyball (males age 21-29years). [2,3,9,10,12,22,28] Till date limited studies present on age group of 10-14 years hence present study proposed to compare two jumping test values in both professional badminton players and in recreational badminton players among both genders.

Previous research found that if the jumping ability of the player was good then the performance of the player will also be good (YONG-YOUN KIM et al 2016). But there are few studies (Nikolaidis; 2015; USA) in badminton players on jumping test between the age group of 10 to 14 years as well as comparison between genders. Very few studies evaluated squat jump values among females. [3] As well as no study has compared jump test values among

professional and recreational badminton players.

The purpose of study was to compare jumping test values in professional badminton players and recreational badminton players of 10-14 years.

## MATERIALS & METHODS

**Study Area:** Local badminton clubs of Nagpur city, Maharashtra (India)

**Study Setting:** A comparative cross sectional study.

**Sample Size:** Selected by Simple randomization (Total =100)

The data was collected from the local badminton clubs of the Nagpur city(Maharashtra).The criteria for the selection was the badminton players of age group 10-14 year both genders willing to participate are taken and the BMI percentile 10<sup>th</sup> to 90<sup>th</sup> range for height and weight [11] are also included. Recent lower extremity trauma or injury within last 6 months, chronic pediatric disease, [11] any orthopedic condition [11] are excluded. The jumping test

was conducted in badminton clubs only. The permission from the clubs are taken from the club incharge. The consent was taken from the subjects and demographic data was also collected. Anthropometric reading such as height, weight, was measured: body mass index (BMI) was calculated which was followed by the general details. Two test were performed such as counter movement jump (CMJ) and squat jump (SQJ).

## Statistical Analysis:

Statistical analysis was done by using software STATA, version 10.1, 2011.

Pair t-test was used for the comparison between age, height, weight and BMI in professional and recreational Badminton players. It was used to do comparison of CMJ and SQJ in between professional and recreational badminton players. Unpaired t-test was used to compare the difference between male and female.

p <0.05 was considered statistically significant.

## RESULTS

**Table No.1. Shows general characteristics of professional and recreational badminton players.(n=100)**

VARIABLES	PROFESSIONAL PLAYERS (n=50)	RECREATIONAL PLAYERS(n=50)	p-VALUES	t- VALUES
	MEAN ±SD	MEAN ±SD		
AGE (yrs)	12±1.42	12 ±1.42	1.0000 (NS)	0.0000
HEIGHT(cm)	153.14 ±9.35	147 ±9.13	0.0013(HS)	3.3207
WEIGHT( Kgs)	48.3 ±7.82	43.68 ±7.72	0.0037(HS)	2.9728
BMI(kg/m <sup>2</sup> )	20.45 ±1.29	20.05 ±1.49	0.1543(NS)	1.4356

Height of professional badminton players showed significantly higher values compared to recreational badminton players. (p=0.0013)

Weight of professional badminton players showed significantly higher values compared to recreational badminton players. (p=0.0037)

BMI does not show significant difference between professional and recreational badminton players.(p=0.1543)

**Table No: 2. Shows comparison of best score of Counter movement jump (CMJ) (n=100) and Squat jump (SQJ) (n=100)**

VARIABLES	MEAN ±SD	p-VALUE	t-VALUE
BEST OF CMJ (cm)	27.71 ±5.91	0.0000	
BEST OF SQJ (cm)	25.68 ±5.62	(HS)	19.1791

Jump test values of Counter movement jump (CMJ) showed higher values when compared with Squat jump (SQJ) values and showed highly significant difference. (p=0.0000)

**Table No: 3. Shows the comparison of CMJ and SQJ in professional and recreational badminton players.**

JUMP TEST	PROFESSIONAL PLAYERS	RECREATIONAL PLAYERS	p-VALUES	t- VALUES
	MEAN ±SD	MEAN ±SD		
CMJ (cm)	28.6 ±6.1	26.46 ±5.75	0.1333 (NS)	1.5138
SQJ (cm)	26.82 ±5.5	24.9 ±5.43	0.1667 (NS)	1.3949

Jump test values of CMJ in professional badminton players were greater than recreational badminton players but showed no significant difference between professional and recreational badminton players. (p=0.1333)

Jump test values of SQJ in professional badminton players were greater than recreational badminton players but showed no significant difference between professional and recreational badminton players. (p=0.1667)

**Table No : 4. Shows the gender wise comparison in CMJ and SQJ**

	GENDER	MEAN± SD	p-VALUES	t- VALUES
CMJ (cm)	FEMALE	28.44 ±6.172	0.857	-0.181
	MALE	28.76 ±6.320		
SQJ (cm)	FEMALE	26.28 ±5.727	0.828	-0.219
	MALE	26.64 ±5.894		

Jump test values of CMJ in male and female showed no significant difference in CMJ (p=0.857)

Jump test values of SQJ in male and female showed no significant difference in SQJ (p=0.828)

**Table No : 5. Shows the jump test performance in different age group.**

Age	Professional badminton players.				Recreational badminton players.			
	CMJ		SQJ		CMJ		SQJ	
	Males	Females	Males	Females	Males	Females	Males	Females
10	21.6	20.6	20	18.6	21.2	20.2	19.2	18.8
11	22	22.2	20.6	21	23	21	20.6	19.4
12	30.6	32.2	28.4	29.8	32	27.6	29.6	26.4
13	32.6	33	29.8	30.2	31.6	28.8	29.8	27.2
14	37	34.2	34.4	31.8	29.8	33	27.6	30.4

As the age advances the Counter movement jump test values and Squat jump test values increases.

## DISCUSSION

Present study showed comparative values of jump tests i.e. Countermovement jump test (CMJ) and Squat jump test (SQJ) in both genders of age 10-14 years and showed significantly higher values of CMJ when compare to SQJ {CMJ (27.71 ± 9.1cm) and SQJ (25.68 ± 5.62cm)} in groups of professional (n=50) and recreational (n=50) badminton players (p=0.0000). Both males and females showed similar values of jump tests among both professional and recreational badminton players (i.e. M=50 and F=50). The study performed by Acero Rafel et al (2011) [16] found that squat and countermovement jump test in children of age 6 to 8 years (n=56), showed CMJ score (16.06 ± 3.56cm) and SQJ score (13.0 ± 2.82cm) which indicates that CMJ has greater values than the SQJ which is in support of the present study.

A study performed in Brazilian (2002) [29] volleyball players of age group (13 to 18 yrs) found that CMJ values were 43.6 ± 2.4cm and SQJ values were 42.2 ±

6.0cm which suggest that values of CMJ and SQJ among volleyball players were greater than badminton players (10 to 14 years) of present study. In previous study,(1997) [30] on young Spanish volleyball players of age 13 to 18 yrs, CMJ values were 42.4 ± 6.0cm and SQJ values were 37.6 ± 6.1cm which indicates that CMJ has greater values than SQJ (CMJ > SQJ) which is in support of present study. Previous study done by Fabio et al (2009, Brazil) [10] on only 20 junior badminton players of age group 17.24 ± 1.18 yr in males, 15.21 ± 2.06 yr in females found that CMJ values were lesser than SQJ values (i.e. CMJ < SQJ) which is in contradictory to the result of present study. This can be explained biomechanically as, during SQJ half flexion of knee is attained and no countermovement is possible as compared to CMJ hence CMJ values are more than SQJ. [32]

In present study jump test values i.e. CMJ and SQJ showed no statistical difference among both genders but females showed slightly lesser values compared to males. The study done by Fabio et al (2009, Brazil) [10] on junior badminton players of age group 17.24 ± 1.18 yr in male and 15.21 ± 2.06 yr in female and found that males

jumping values of CMJ ( $36.7 \pm 6.0\text{cm}$ ) and vertical squat jump ( $39.3 \pm 5.7\text{cm}$ ) was greater than females jumping values in CMJ ( $27.2 \pm 2.1\text{cm}$ ) and in vertical squat jump ( $28.1 \pm 2.4$ ) i.e. (Males > Females) values which is in support to the result of present study. The strength and height was more in males as compared to females so the boys showed greater values as compared to girls. [10] The previous study done by Temfemo et al (2009) [31] on relationship between vertical jumping performance and

anthropometric characteristics during growth in boys and girls (age 11 to 16 years), calculated the difference between maximum CMJ and SQJ and they found that CMJ and SQJ were greater in boys as compare to girls (more difference is seen in the age 14 years and older) i.e. (Boys > Girls). After 14 years the more changes were observed due to increase in leg length and leg muscle volume in boys than in girls. [31]

Sr. no.	Age group	Jump test values
1.	6 yr to 8 yr (children)	16.6cm (CMJ) AND 13.0 cm (SQJ)
2.	10 yr to 14yr (present study)	27.71cm (CMJ) AND 25.68cm(SQJ)
3.	13yr to 18yr (badminton)	31.95cm(CMJ) AND 33.7cm(SQJ)
4.	13yr to 18yr (volleyball)	43.6cm (CMJ)
5.	18yr to 25yr (basketball)	46.44cm (CMJ)

Present study showed that professional badminton players performed better in jump test than recreational badminton players. But difference is non-significant statistically.  $p=0.1333$  (NS) of CMJ &  $p=0.1667$  (NS) of SQJ. It was also found that while testing, both recreational and professional groups players were under regular training effect for badminton during local tournament sessions. This would have contributed for equal jump test performance in both group as well as genders.

The previous study done by Temfemo A et al (2008) [31] proved that as age advances the jump test values also increases and they also said more changes were observed after 14 years. This study supports the present study we also found same result i.e. as the age advances the jump test values increases which is shown in table no. 5.

## CONCLUSION

Result of present study can be taken as reference values for recreational and professional badminton players of age group 10 to 14 years.

There is no gender wise difference in both jump test values (CMJ and SQJ) in both professional and recreational badminton players.

## Implication Of Further Study

Comparison of anthropometric characteristic with the jump test can be done.

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