ORIGINAL RESEARCH PAPER

Volume-6 | Issue-11 | November-2017 | ISSN No 2277 - 8179 | IF : 4.176 | IC Value : 78.46

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

ASSOCIATION OF BODY MASS INDEX WITH POWER, STRENGTH AND FLEXIBILITY OF ELITE KABADDI PLAYERS

Physiotherapy

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ABSTRACT

BACKGROUND OF STUDY: Kabaddi is a well known game usually played in every corners of India as well as in some other countries. We studied the correlation between selected fitness parameters (power, strength. flexibility) and body mass index of elite kabaddi players.

METHODOLOGY: Total 47 Kabaddi players aged 18-25 were selected for the study based on inclusion and exclusion criteria from Sports Authority of India Stadia, Delhi NCR, India. Every individual's height, weight, BMI, power, strength and flexibility were assessed. Data analysis was done by using Pearson's correlation coefficient test.

RESULTS: There was a varying level of correlation seen in normal and high BMI groups. Normal BMI group shows positive correlation with lower limb power, no correlation with hand grip strength and low back and hamstring flexibility, whereas, high BMI group shows negative correlation with power, low back and hamstring flexibility and positive correlation with hand grip strength.

CONCLUSION: We concluded that lower limb power positively correlates with normal BMI. Lower back and hamstring flexibility and lower limb power negatively correlates whereas grip strength positively correlates with high BMI.

KEYWORDS

Body Mass Index, Power, Strength, Flexibility.

INTRODUCTION

Kabaddi is a contact team sport that originated in ancient India. It is a game of strength, flexibility and most importantly power. It requires individual proficiency, quick reflexes, intelligence, strategy and presence of mind of both attackers and defenders. [1,2,3] It also requires a small playing area with dimensions of 12.5 meters x 10 meters rectangular court (for adults) which divided by midline into two equal halves (each 6.25 x 10 meters) either indoors or outdoors. Each half is the territory of a team that is one for the raiders and one for the defenders. Total 14 players take part while seven players on each side of ground. Both sides get equal chances of raid and defense [4, 5]. Kabaddi players used to play at different positions perform specific skills during the competition which requires different specified body shape and capacity. Thus, possession of essential anthropometric characteristics provides an edge to player to outperform his/her opponent [6].

Body Mass Index is an indicator for different weigh categories in all ages irrespective of gender. This may overvalue the fat percentage level because muscle mass is more and denser than fat that weighs less in skilled subjects. It is right for skilled and trained individuals that their BMI can be high but body fat level is normal or low. [7,8]

Producing explosive lower limb power is the important skill in many sports.[9] For the evaluation of power performance maximum vertical jump is the most common used method. Researchers already have studied and recorded the jump height as an index for muscle Power [10,11,12]. By using protocol of vertical Jump and reach, lower body muscle power can be evaluated. This can play significant role in kabaddi match to lift and push an antagonist or oppose a move by a challenger. The vertical jump is an easy and inexpensive field test. It has been noticed that judo male athletes had an average vertical jump of 63.2 cm, national boxers 61.0 cm and wrestlers 62.0 cm.[13]

Hand Grip Strength (HGS) is the capability of fingers and hand to produce force and power. For athletes it plays a vital role in several sports such as weight lifting, judo, rock climbing, wrestling, martial arts and racquet sports [14]. It is a significant indicator of general health, screening for upper motor neuron and motor unit function. It is widely used and reliable clinical determinant of human strength in adults. Grip strength is the product of maximum voluntary forced action of hand [15, 16]. Mean hand grip strength exhibits by junior level kabaddi players in dominant and non-dominant hands were 36.17 kg and 34.67 kg respectively for males and 19.31 kg and 17.62 kg respectively for females [17]has been claimed in a recent report.

One of the most frequently used method for evaluation of low back and hamstring flexibility is Sit and Reach (SR) test [18]. This test is generally used in every health associated fitness testing, because it has been found that by means of sustaining a excellent low back and hamstring flexibility several musculoskeletal disorders, musculoskeletal injuries, low back problems, gait limitation and postural deviations can be averted [19]. Thereby sit and reach test is most common on field method for low back and hamstring flexibility evaluation. A recent literature suggested that it has a low validity for low back and moderate validity for hamstring flexibility evaluation [20] in contrast to previous study's statement of valid measure for leg and back flexibility [21].

Therefore the purpose of the study was to correlate moderate and high body mass index of kabaddi players with their power, strength and flexibility.

METHODOLOGY

A convenient sample of 47 elite Kabaddi players with age group of 18-25 falling in normal (33 males) and high BMI (14 males) range those who met the inclusion criteria were recruited from Sports Authority India (SAI), Stadia, Delhi NCR between January and April 2017. Subjects were agreed to participate voluntarily for the study after signing informed consent. To be eligible for inclusion the players had to have at least 1 year experience of training and playing Kabaddi, whereas, low BMI, any recent injury and non Kabaddi players were excluded in the study.

Measured parameters were Body Mass Index (BMI), lower limb power, hand grip strength, and lower back and hamstring flexibility. Body Mass Index (BMI) was calculated as body weight in kilogram (kg) divided by the height in square meters (kg/m^2) [7].

Lower limb muscular power was evaluated by using vertical jump (VJ) and reach test. All subjects were performed controlled worm up which includes jogging, stretching and 3 practice jumps. Participants were instructed to jump as much high as possible and mark the reached highest point with dominant hand. Participants were permitted for a counter movement with arms and legs. Each subject was allowed to 3 test jumps with 3 minutes of recovery in-between. Best of 3 was taken to determine vertical jump [9], which can be calculated by using formula: VJ = Maximum jump height – Initial reach height. This was used to determine the peak power which was calculated by using formula of Harman et al (1990) [11]. Peak power (W) = 61.9 (jump height (cm)) + 36.0 (body mass (kg)) + 1822.

Hand Grip Strength (HGS) was measured for maximal muscle strength. This was evaluated with subject's dominant hand with a hydraulic dynamometer. Subjects were instructed to adjust the dynamometer griping by self so that it fits easily and contentedly to their hand to obtain their maximal performances. Before procedure warm-up session was performed so that participants can get familiar with instrument and procedure. Finally subjects were asked to perform maximum possible griping force through the dynamometer gripper upon the voice command. For measurement the subject was standing with both hands by the sideways to the body with dynamometer facing downwards and outwards. Three measurements were taken with 1 minute of rest in between and the highest value was used to represent HGS [15].

Lower back and hamstrings muscles were evaluated for flexibility by using modified sit and reach test. A standard tailored sit and reach test box (test-retest reliability 0.994) with standard hand gripped meter ruler placed on sliding rooftop of box was used with heel position for each test. Reaching up to the toes was recorded as negative forward reach scores and reaching beyond the toes was recorded positive forward score. Forward reach scores was recorded in centimeters (cm) using scale on the box. The subjects were sitting with their feet's approximately hip wide against the testing box. They keep their knees extended and place the right hand over left, and reaches forward as far as they can by sliding their hand along measuring board [18].

RESULTS

Table-1 Demographic data:

Parameters	Mean±SD² normal BMI	Mean±SD² high BMI
AGE (years)	19.91±2.11	22.36±2.1
HEIGHT (cm)	168.91±6.59	167.68±3.83
WEIGHT (kg)	62.89±7.87	74.2±2.58
BMI (kg/m²)	21.99±1.93	26.40±.78
VERTICAL JUMP AND REACH (cm)	42.75±7.83	41.29±6.0
LOWER LIMB POWER (watt)	6682.80±662.69	7063.96±370.04
HAND GRIP STRENGTH (kg)	41.67±6.71	41.61±3.26
SIT AND REACH (cm)	18.97±4.32	20.49±2.98

Table-2 Correlation of normal BMI with fitness parameters

Parameters	Mean±SD²	Pearson Correlation= r
BMI(kg/m²)	21.99±1.93	
Power(watt)	6682.80±662.69	.451
Strength(kg)	41.67±6.71	.043
Flexibility(cm)	18.97±4.32	.191

In table 2 it shows that Lower Limb Power was positively correlating with normal BMI which was significant at the level of 0.01 (p=.008) whereas Hand Grip Strength and Low Back and Hamstring flexibility was not correlating in 33 subjects.

Table-3 Correlation of high BMI with fitness parameters

Parameters	Mean±SD²	Pearson Correlation= r
BMI(kg/m²)	26.40±.78	
Power(watt)	7063.96±370.04	-.355
Strength(kg)	41.61±3.26	.416
Flexibility(cm)	20.49±2.98	-.265

In table 3 it shows that Lower Limb Power and Low Back and Hamstring Flexibility were negatively correlating with high BMI whereas Hand Grip Strength was positively correlating in 14 subjects.

DISCUSSION

In our study 47 subjects of trainee professional kabaddi players with experience of one year and above were taken for consideration. Lower limb power, grip strength, low back and hamstring flexibility were measured as outcome parameters.

The present study found that there was a positive (direct) relationship of Lower Limb Power with normal BMI group whereas negative (inverse) relationship in high BMI group. This finding supports the study of Harman et al (1988), the possible reasons for this may be individual's body weight, height, joint range of motion, muscle group involved, type of movements (fast, slow, flexion, extension, isotonic, accelerating, concentric, eccentric etc). A heavier individual will have to exert more force to reach the vertical height of performed by other individual of less weight than him. This shows the ability to generate greater power by heavier individual which puts him on advantage in activities which requires manipulation of mass outside body such as in blocking, weight lifting, football etc [11,12].

The current study was not found any significant correlation of Hand Grip Strength with normal BMI group whereas there is a direct relationship found in high BMI group. This could be due to hand muscle hypertrophy of high BMI Kabaddi players. Hypertrophied muscles contain increased number of muscle fibers thereby increase protein synthesis and satellite cell proliferation occurs during resistance activity. The hypertrophic process couples directly to increase mononuclear number and synthesis of cellular components, particularly protein filaments (myosin heavy chain and actin) that constitute the contractile element thereby maximum number of muscle recruitment will bring above the high Hand Grip Strength [24].

Current study supports the report of Koley et al (2007) and Leyk et al (2015) who found the significant correlation between the higher BMI with better Hand Grip Strength with possible reason for this could be age, body size and physical fitness and level of training, lean body mass, hand length and width etc [17,25].

Current study slightly differs to study of Newman et al (1989) and Koley et al (2007) in hand grip strength of normal BMI group that increase in Body Mass Index will have increase hand grip strength [16,17]. The present study found that there was no correlation of low back and hamstring flexibility with normal BMI group where as there was an inverse relationship of flexibility with high BMI group. Reduced low back and hamstring flexibility has been seen in increase BMI which may be due to less worm up and level of activity. In support of this study Sethi (2008) already claimed the inverse relationship between these variables among computer professionals because of insufficient recovery time among athletes and sedentary life style normal population [26].

LIMITATION

Our study focused on evaluation of fitness parameters and its relationship with Body Mass Index among elite kabaddi players having normal or high BMI, age group of 18-25 and experience of one year and above and an available smaller sample size.

RECOMMENDATION

Current study is somewhat a beginning of scientific call on fitness issues of elite kabaddi player population of India and the world. The study can also be extended to find the relationship of Body Mass Index with parameters of visual imagery, standing reach, double handed grip strength, hand width and length, foot width and length, hip-waist ratio and length, width of deferent bones. Bigger sample size and equal ratio of male and female kabaddi players could be of a better consideration for future study.

CONCLUSION

Present study concluded that there is significant association of Body Mass Index with lower limb power in normal BMI group of Kabaddi Players whereas negative association of lower limb power in high BMI group of Kabaddi Players. There is no association hand grip strength with normal BMI group of Kabaddi Players whereas there is positive association of hand grip strength with high BMI group of Kabaddi Players. There is no association of low back and hamstring flexibility with BMI in normal group of Kabaddi Players whereas negative association in high BMI group of Kabaddi Players.

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