

CORRELATION OF ABDOMINAL MUSCLE ACTIVITY AND LOW BACK PAIN DURING DROP JUMP PERFORMANCE AMONG WOMAN BASKETBALL AND VOLLEYBALL PLAYERS

K.JEEVANATHAN¹, I.RAJALAKSHMI²

¹ASSISTANT PROFESSOR, ²BACHELOR OF PHYSIOTHERAPY
SRM COLLEGE OF PHYSIOTHERAPY, SRM IST

ABSTRACT

BACKGROUND: In the context of low back pain, great emphasis has been placed on the importance of abdominal muscle instability during high performance activity such as drop jump or landing the repetitive and intense loads on the low back muscle.

OBJECTIVE: To find the plank holding time and its correlation with low back pain during drop jump performance among women basketball and volleyball players.

STUDY DESIGN: Non experimental study design, observational type.

SUBJECTS: 30 subjects, between the age group of 18 to 25 years, women volley ball and basket ball players.

PROCEDURE: According to inclusion and exclusion criteria subjects were selected. The plank holding time for the subjects with low back pain during drop jump subjects were taken and documented.

OUTCOME MEASURES: Plank holding time.

RESULTS: The plank holding capacity is reduced among women basketball and volleyball players with low back pain. (< 2 minutes).

CONCLUSION: The study concluded that there exist a correlation between the abdominal muscle activity and low back pain during drop jump performance among women basketball and volleyball players.

KEYWORDS: Low back pain, abdominal muscle, drop jump, plank exercise, Basketball players, Volley Ball Players

INTRODUCTION

Low back pain is a common problem during drop jump performance at a rate of 8- 20% in sports players^{1,2} Dynamic loading on the low back during jumping activities leads to abdominal muscles fatigue and reduced maximum strength capacity of the low back muscles and abdominal muscles³⁻⁹. Causes of low back pain are repetitive micro-trauma and insufficiency of the muscle tendon complex based on an inadequate neuromuscular and postural control³⁻⁹.

Low back pain in volley ball and basket ball players is very complex and can detect the possible number of issues, ranging from muscle strains to stress fractures and nerve root irritation¹⁰.

Spinal column has bony vertebral bodies and separated by cushions referred as intervertebral disks. Repetitive hyperextension of the lower back is often required for gymnasts, swimmers, basket ball players, volley ball players which can provide unusual stress on the spinal which results in the stress fractures of the vertebrae and also changes in the posture of the human body¹⁰.

Abdominal muscles (transverse abdominus, external oblique, internal oblique, rectus abdominus) weakness due to continuous loading on lumbar region leads to low back pain. Concentric loading on trunk and abdominal muscles during drop jump performance result in low back pain¹¹.

In the eccentric-concentric cycle stretching of muscle occurs due to an external force in its first phase and shortening of muscle occurs in the second phase i.e. stretch-shortening cycle (SSC)¹². Efficiency of eccentric-concentric contraction also depends on the time of transition¹³. Active muscle undergoes eccentric contraction followed by concentric contraction in vertical and drop jump during takeoff period¹³.

Drop jump performance is an explosive activity, mostly occurs in sports players such as volleyball and basketball players. It improves the lower limb power during the performance of drop jump¹⁴. It may cause injury to the ligaments of ankle, knee, and hip. This may leads to fatigue of the lower limb and low back muscles which results in weakness of abdominal muscles and may cause low back pain.

Additional loading to the trunk muscle is up to eight times the body weight during drop landing. The importance of abdominal strength capacity is recently beneficial not only for compensating the load and stabilizing the trunk while counteracting force act on it, but also it enhancing the performance of sports players^{22,23}.

Furthermore reported that the association between abdominal muscle activity and lower limb kinematics during landing activity. There is an increasing the risk of injury due to decreased neuromuscular activation²³.

During high levels of physical activity, core muscle plays an important role in stabilizing the peripheral joints and reducing the risk of injury. Efficient body mechanics has been promoted by core stability. Core musculature includes the abdominals anteriorly, posteriorly the paraspinals and gluteus muscle, superiorly the diaphragm and inferiorly pelvic floor muscle and hip girdle musculature²⁷.

Plank is an isometric core strength exercise that involves maintaining the position similar to a push up for a maximum possible time. Muscles involved in the front plank includes the primary muscles are erector spinae, rectus abdominis, and transverse abdominis. Secondary muscles are trapezius, rhomboids, rotator cuff, the anterior, medial, posterior deltoid muscles, pectorals, serratus anterior, gluteus maximus, quadriceps and gastrocnemius²⁸.

Muscles involved in side plank include primary muscles such as transverses abdominis muscle, gluteus medius and gluteus minimus muscles, the adductor muscles of the hip, and the external and internal obliques. Secondary muscles are gluteus maximus, quadriceps and hamstrings²⁸.

Therefore, the aim of the study is to reveal the correlation of abdominal muscle activity and low back pain during drop jump performance among the women basketball and volleyball players.

Lots of study has supported the trunk muscle activity during drop jump performance in adolescent athletes with low back pain. But studies focusing on abdominal muscle activity and its correlation with low back pain especially during drop jump performance among women basket ball and volley ball players were found scarce. Hence the need is to find out the correlation of plank holding time of abdominal muscle activity and low back pain during drop jump performance among women basketball and volley ball players.

METHODOLOGY

The study design was non experimental and the study type was observational. 30 subjects were chosen based on their convenience. The study setting was SRM College of physiotherapy, SRM institute of science and technology. Age group of 18-25 years, only the woman volleyball and basketball players with low back pain during drop jump performance were included in the study. Previous surgical history, recent fracture, ligament injuries and nerve impingement were excluded in the study.

Procedure was clearly explained and the informed consent was obtained. Participants were selected based on the inclusion and exclusion criteria. Procedure was clearly explained to the participants. The players were enquired whether they have a history of low back pain. Based to this, only players with low back pain were included in the study. Plank exercises were taught to the participants and Plank holding time of participants is noted. After explaining all the instructions as per the exercise protocol the participant's ability of holding time was measured. **ELBOW PLANK:** Players were made to get in to a pushup position with elbows under their shoulder and feet apart. From this starting position the players were made to bend the elbows and rest the weight on forearms and toes, keeping the body in straight line. The players were made to hold this position as long as possible and the time is documented. **SIDE PLANK:** Players were made into side lying position, brought the feet together and flexes the elbow on that side under the shoulder. From this starting position the players were made to raise the hips until the body was in a straight line, weights could be rest on the lateral border of foot and the ulnar side of forearm. The players were made to hold this position as long as possible and the time is documented.

DATA ANALYSIS

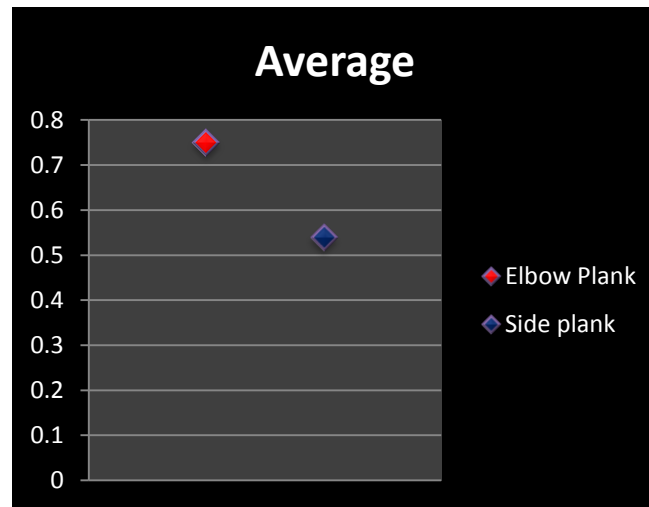
The data obtained from the players were tabulated and entered in MS-Excel spread sheet. The data was analyzed using descriptive statistics and average plank holding time could be measured.

| | Elbow plank holding time | Side plank holding time |
|---------------|---------------------------------|--------------------------------|
| Average value | 1 minute 15 seconds | 0.54 seconds |

This table shows the average value of elbow plank holding time is about 1 min 15 s and side plank holding time is about 0.54 s among women basketball and volleyball players.

GRAPH I

Average value of elbow plank holding time and side plank holding time for women basketball and volleyball players with low back pain during drop jump performance.



RESULTS

The table 1 shows the average value of plank holding time for low back pain players among women basketball and volleyball players during drop jump performance holding time for elbow plank is about 1 minute 15 seconds and the side plank is about 0.54 seconds. It should be <2 minute.

Graph 1 shows that the mean difference between normal plank holding time and women players with low back pain during drop jump performance.

The result shows that the reduced plank holding time for the correlation of abdominal muscle activity and low back pain during drop jump performance among women basket ball and volley ball players.

DISCUSSION

The study was aimed to find out the correlation of abdominal muscle activity and low back pain during drop jump performance among women basket ball and volley ball players.

The objective is to find the correlation of abdominal muscle and low back pain during drop jump performance among women basketball and volleyball players. **Tom K Tong et.al., (2014)** stated that sports specific endurance plank is reliable tool to assess the core muscle function. The plank holding time is very reliable test to assess the abdominal muscle strength. Lot of the studies have documented the abdominal muscle strength using plank exercise.

John et.al., (2014) found that the plank holding time for healthy women players were about 2 minute. With taking this value as the normative data the result of study is compared. This result of study revealed that the average plank holding time among women basketball and volleyball players is about 1 minute 15 seconds for elbow plank and 0.54 seconds for side plank.

The result of this study goes in hand with **Radebold et al., 2001; Maaswinkel et al., 2016** who concluded that when compared to healthy subjects, the low back pain players had altered neuromuscular activity.

Drop jump requires a coordination action of trunk extensor and abdominal muscles. Drop jump consists of series of events such as hip flexion, knee flexion, goal setting for a definite height, coordination action of ankle movement. Various force acts on human body during jumping such as vertical force, ground reaction force. During drop performance there is an increase lumbar lordosis or extension of lordic curve where the compressive load increases, which provides the contraction of hip flexors and lumbar extensors results in anterior pelvic tilt leads to abdominal muscle weakness which results in low back pain.

Ramprasad et al., 2010; Shenoy et al., 2013 suggested that the increased muscle activity in the abdominal and transverse muscle group during drop jumping performance correspond to higher co-contractions of the muscle.

M. Coh , M.Bracic et al., 2011 established that the vertical and drop jump included the takeoff velocity, eccentric-concentric time, eccentric impulse , ground contact time and ankle flexion. The study shows that there is a reduced plank holding capacity due to weakness of abdominal muscles and low back pain of jumping players. Low back pain among players will reduce the performance of players and concentration. The training session also will be not satisfactory when the players is in pain This will indirectly impact their career and over all team victory or performance.

Kibler et al., 2006 ; Hibbs et al., 2008 it has been assumed that the increased muscle activity during drop jump , serves as compensation strategy to enhance the core stability and protect the trunk from further negative loading²².

Liebtrau et al., 2013 concluded that the reduced trunk stability had a delayed abdominal muscle reflex in their musculoskeletal model.

The studies shows that the weak abdominal muscle will decrease the plank holding time. And also this study correlates that players with low back pain during drop jump performance may be decreased abdominal muscle activity which results in postural instability and that will impact on the match due to less effectiveness of the muscle imbalance of abdominals and trunk muscles. Finally it may be sustained to spinal deformity such as increased lordotic curvature. Whether strengthening of the abdominals have the decreased impact on the low back pain during drop jump performance can improves the performance during match.

CONCLUSION

This study concluded that the average plank holding time was less among women basketball and volleyball players with low back pain during drop jump performance may be due to imbalance between the abdominal and trunk muscle activity. This shows that there is a correlation between the abdominal muscle activity and low back pain during drop jump performance among women basketball and volleyball players. The limitations of the study were the study was only done on 18 to 25 years. Study was only done on women players. Abdominal muscle strength was not calculated. Lumbar lordotic curve was not measured. The recommendations of the study are age criteria can be increased. Study also includes the men players. Plank holding time will be measured after the abdominal strengthening exercises it may be increased.

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