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"A STUDY ON PREVALENCE OF CARDIORESPIRATORY ALTERATIONS IN SPORT PLAYERS INVOLVED IN OVERHEAD ACTIVITIES WITH ALTERED POSTURE IN SANGLI DISTRICT"

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ABSTRACT

Introduction: Overhead throwing motion is the highly skilled technique used by the player which can cause postural disabilities over the time. These disabilities may include forward head posture and rounded shoulder posture due to overuse of scapular muscles. This posture in turn can lead to cardiorespiratory alterations in players involved in overhead activities and the prevalence of it has been discussed in this study.

Aim: To find prevalence of cardiorespiratory alterations in players involved in overhead activities having forward head posture in Sangli district.

Objective: To assess VO2 max, PEFR and chest mobility in players involved in overhead activities having forward head posture by using various tests, devices and methods.

Study Design: Observational study.

Materials and Methods : 218 collegiate players both males and females playing player involved in overhead activitiess are included in this study after taking their consent and evaluating them according to the inclusion criteria. Forward head posture is assessed using KINOVEA software. For VO2 max, we used Queens college step test, for PEFR, Peak flow meter has been used and for chest mobility, we used tape method of measuring chest expansion.

Results: The prevalence of cardiorespiratory alterations in players involved in overhead activities having forward head posture is 43%.

Conclusion: The results concluded that there is a significant association of forward head posture and cardiorespiratory alterations in players involved in overhead activities caused as a result of it.

KEY WORDS:

Cardiorespiratory alterations, forward head posture, sports involving overhead activities, VO2 max, PEFR, chest expansion.

INTRODUCTION

The overhead throwing motion is a highly coordinated movement that must be executed at a very high speed. It calls for synchronisation, muscular strength, flexibility as well as neuromuscular coordination. The shoulder joint is put under tremendous strain during the throwing motion. The player involved in overhead activities frequently exhibits postural abnormalities that alter the scapula's resting position. The scapular posture deteriorates when the muscle becomes exhausted, leading to increase in anterior tilting and scapular protraction. [1]

Shoulder instability is widespread in these players due to the accumulated micro-traumatic pressures exerted on the shoulder joint complex, which exceed the physiologic limits of the surrounding tissues and often damage the joint's static stabilisers. Micro-instability of the gleno-humeral joint is considerably more common than major instability in the player involved in overhead activities. Furthermore, it is common for the scapula to appear extended and tilted anteriorly. Loss of gleno-humeral joint IR has been demonstrated to be influenced by an anteriorly inclined scapula. Abnormal scapular position in overhead throwers is linked to weak lower trapezius and pectoralis minor muscles as well as forward head posture. [2]

Thus forward head posture is one of the common comorbidities seen in players involved in overhead activities because of the strained musculatures and a challenging movement affecting joint position. [2]

FHP (forward head posture) puts more compressive strain on the tissues of cervical spine especially the ligaments and facet joints. According to studies, temporomandibular discomfort, headache, neck pain and musculoskeletal problems are among the symptoms associated with FHP. Furthermore FHP significantly affects respiratory function by impairing the respiratory muscles. The forward head posture causes expansion of the upper thorax and contraction of the lower thorax, and these morphological changes result in decreased respiratory function. [3]

Particularly the muscles at the back of the neck and directly below the skull contract when the head comes forward. The Auricularis posterior muscle, the sternocleidomastoid muscle and the intricate anatomy of the scalene muscle are some of these muscles. [4]

The flexors of the neck bones, the scalene and sternocleidomastoid muscles are involved in controlling the position of neck. Additionally, they function as the auxiliary inspiratory muscles that raise the chest wall to facilitate breathing. During inhalation, the muscles specifically work on the chest wall to cause the upward displacement of the chest bones, including the ribs. Hence, these muscles are involved in both breathing and the functional movements of the neck. [4]

Perfect respiratory function is made possible by the alignment of the muscles in the neck and shoulders, which are directly involved in breathing. Normal breathing is hindered by an imbalance of these muscles brought on by stress, weakness, or paralysis. The muscles involved in breathing get weaker and shorter when the head is positioned forward all the time. [4]

Sport performance is impacted by a number of variables, including skill, stamina, and strength. Nevertheless, although being essential to achieving peak performance, postural alignment is frequently disregarded. For

players to maximise their performance and reduce their risk of injury, good posture is crucial. Regrettably, a lot of players experience postural aberrations as a result of a variety of factors, such as overusing specific muscle groups and repetitive motions. [5]

An increased risk of injury and a decline in sports performance can result from postural aberrations, which can also negatively affect respiratory health and physical fitness components. The connection between posture and physical fitness or pulmonary function has not been extensively studied. In contrast to players with a normal sagittal head posture alignment, college players with forward head posture demonstrated less efficient physical fitness as well as impaired sensorimotor processing and integration, according to recent studies. [5]

MATERIALS AND METHODOLOGY

The present study was conducted in Sangli district in the year 2023-24. The study protocol was reviewed and approved by the ethical committee of Miraj Medical centre's College of Physiotherapy, Wanless Hospital. 218 participants, comprising university students volunteered to participate in the study. All participants gave their written, informed consent. Participants had no history of smoking, neck or respiratory diseases or traumas, anamneses of thoracotomy and laparotomy, or obvious spinal and thoracic deformations. All participants showed no addiction to smartphones and they have been playing their sport since minimum of 1 year.

The outcome measures are:

1. Queens college step test
2. Peak flow meter measurements
3. Chest expansion measurements

Inclusion Criteria:

1. Players involved in overhead activities having forward head posture.
2. The player involved in overhead activities playing his/her sport since minimum 1 year.
3. Age group 18-30 years.
4. Male and female players both are included.

Exclusion Criteria:

1. Players who play track and field events.
2. Players who are addicted to smartphone or laptop with score more than or equal to 23 on Smartphone Addiction Scale – Short Version.
3. Players with any other orthopaedic condition around shoulder or neck.
4. Players having any cardiorespiratory condition.

PROCEDURE

ASSESSMENT OF FORWARD HEAD POSTURE

• KINOVEA© is a free 2D motion analysis software that enables the establishment of 13 kinematics parameters. This low-cost technology has been used in sports sciences, as well as 14 clinical field and research work.

• The software helps to measure the cranio-vertebral angle and the gaze angles which are considered in the assessment of forward head posture.

• Reliability is 0.997 ICC value

• First, adhesive markers were placed on the tragus of the ear, canthus of the eye and on the C7 vertebra of the cervical spine to capture images.

• Subjects were instructed to stand with the side of the trunk facing the camera and to look at a target fixed in front.

• Then, photos were taken by the camera from each side and saved to a personal computer for further analysis.

• To assess the severity of FHP, two postural angles were measured: the cranio vertebral angle (CVA) and the gaze angle.

• The CVA was measured as the angle between an imaginary line extending from C7 through the tragus, and the horizontal line.

• Gaze angle is the angle formed between a line drawn through the canthus of the eye and tragus of the ear and a horizontal line through the tragus of the ear.

• Participants having CVA less than 48-50° and Gaze angle more than 15° are considered to have FHP.

1. **Assessment of VO2 max:**
   - We asked the subject to warm up for 10 mins.
   - Then set up the metronome to the required step/minute pace (Male-24; Female-22).
   - After that asked the subject to step up and step down on the given step (about 16 inches in height) on command “GO”.
   - Then ensured that the subject maintains the required pace.
   - Then carried out the test for 3 minutes and calculating the heart rate for 15 seconds.

- Lastly put the calculated heart rate in the equation- VO_2 max = 65.81-(0.1847×HR) and noted down the readings.

2. Assessment of Peak flow rate:

- Asked the subject to stand up straight and take a deep breath. Now hold the breath while placing the mouthpiece of 'Peak flow meter' inside mouth between the teeth and close the lips around it.
- Then ensured that the marker on the Peak Flow meter is at the bottom every time before carrying out the test.
- Then asked the subject to blow out as hard and fast as possible in a single blow.
- Took a note of measurement.

3. Assessment of chest mobility:

- First exposed the subject after getting their consent.
- Then placed the measuring tape at axillary level and asked the patient to inspire deeply and took the measurement.
- Then carried out the same step three times at three different levels: Axillary, mammary, xiphoid.
- Then took the mean of 3 readings to minimize the error.
- And lastly took the note of final reading.

STATISTICAL ANALYSIS AND RESULTS

ANOVA (Analysis of Variance) test has been used in this study to compare the means of groups (forward head posture and outcome measures) and to find the correlation between them.

Independent sample t test has been used in this study to determine whether there is a statistically significant difference between two groups.

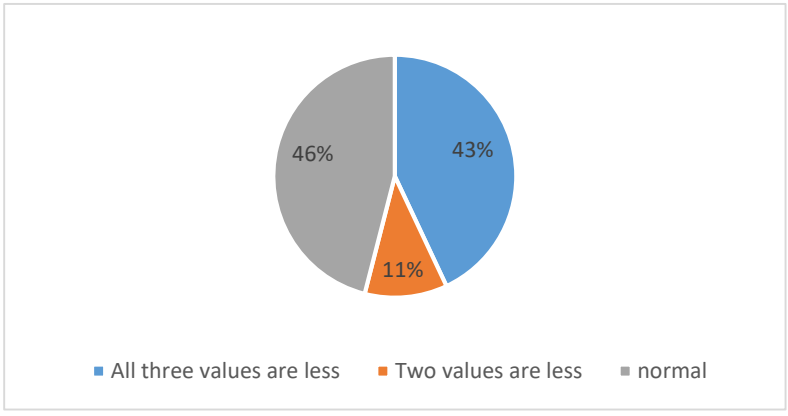
Distribution of different variables like gender, age, VO2 max, PEFR, Chest expansion and gender vs chest expansion has been taken for this study.

We have data of 218 players out of which 93% of players are male and remaining are female. Also, we have their reading of various parameters, like Age, Height, weight, BMI, which sports they play, since how many years they are playing, their VO2 max reading, PEFR reading and chest expansion reading.

In this analysis, we will consider three parameters in our analysis: VO2 max reading, PEFR reading and chest expansion reading. There are thresholds of those values where these values are normal. From those thresholds, we want to find out what percentage of players have all the three values are less. What percentage of players have only two of those values are less.

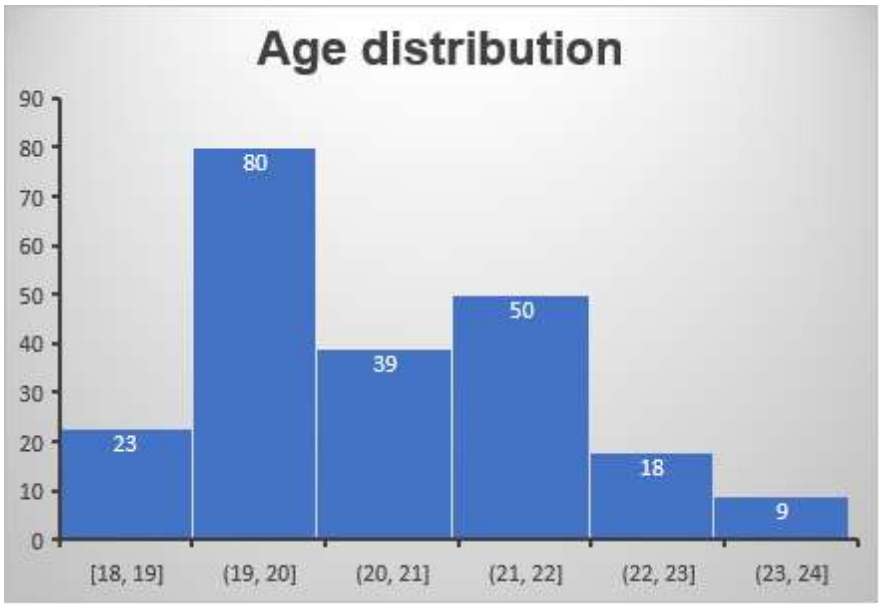
These values can be shown graphically as below:

Graph no. 1: Pie chart showing percentage distribution of outcome measures:

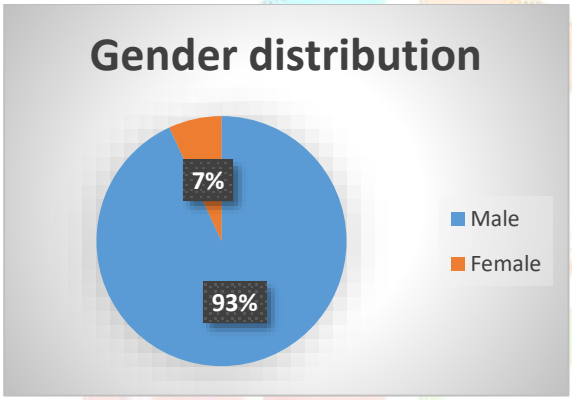


From these data we can say that there are significant number of players have less than normal rating in two or more parameters.

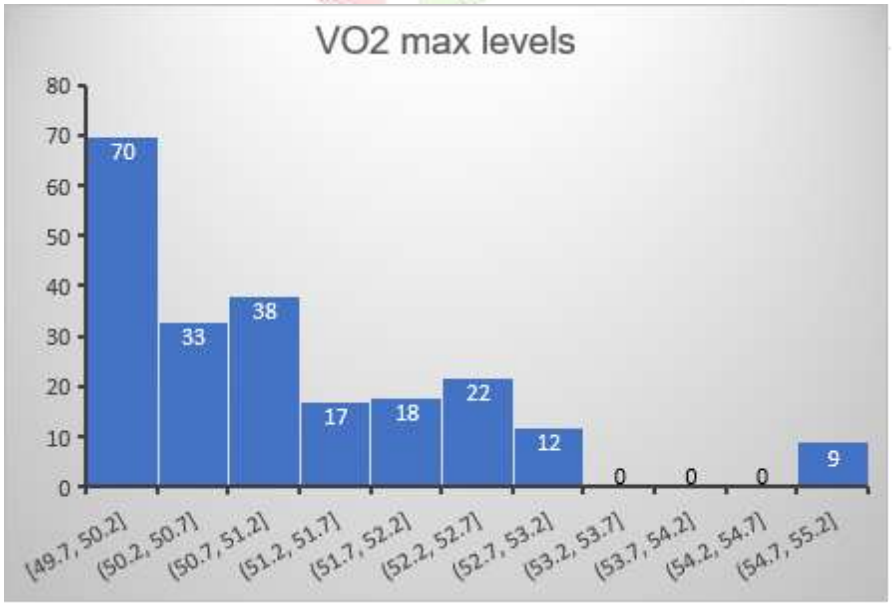
Graph no. 2: Age distribution:



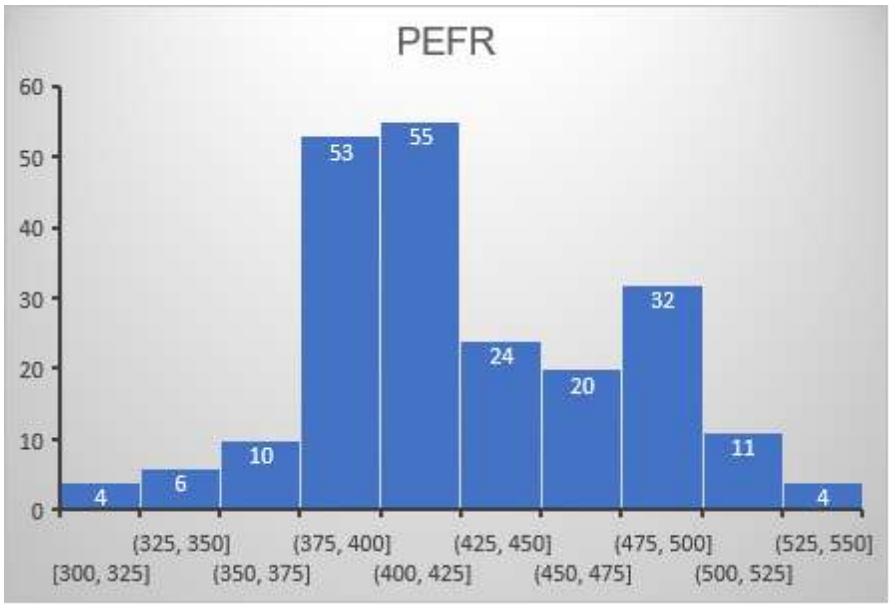
Graph no. 3: Gender distribution:



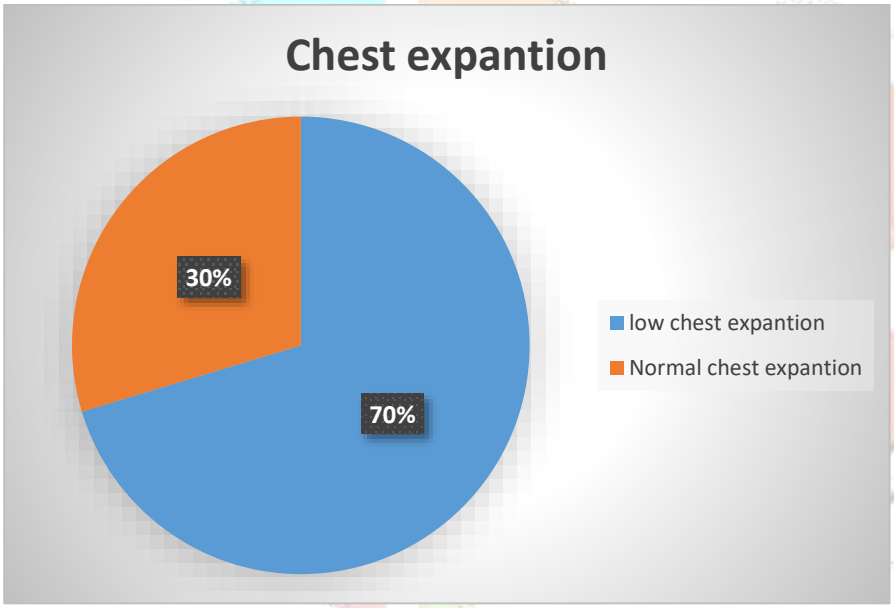
Graph no. 4: VO2 max distribution:



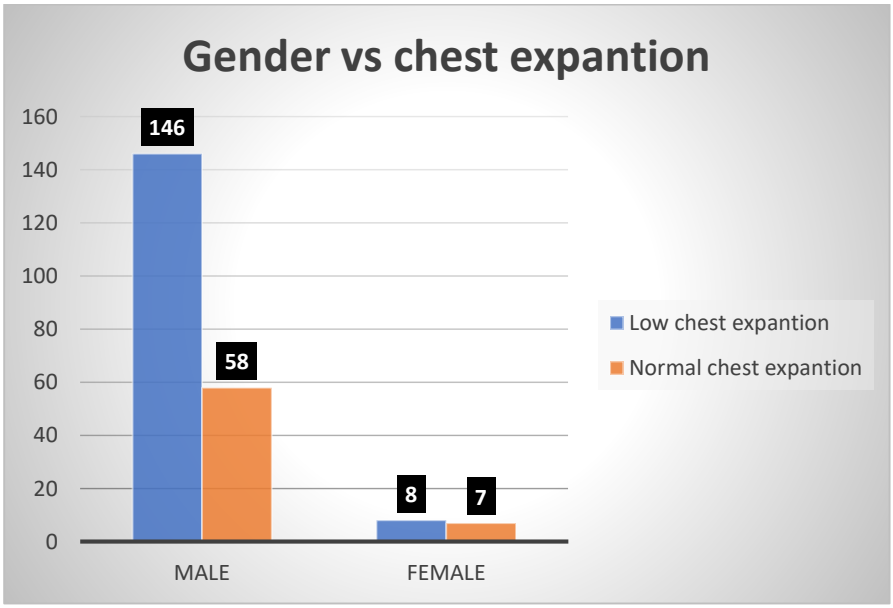
Graph no. 5: PEFR distribution:



Graph no. 6: Chest expansion distribution:



Graph no. 7: Gender vs Chest expansion:



ANOVA TEST:

Table no. 1: p- value for VO2 max:

Particular		**Count**	**Mean**	**SD**	**f-value**	**p-value**
VO2	Badminton	85	51.1368	1.48067	0.171	0.00916
	Basketball	76	51.1561	1.21564		
	Cricket	57	51.1126	1.14802		
	Handball	1	50.2300	0.0		
	Total	219	51.1331	1.30222		

Table no. 2: p-value for PEFR:

Particular		**Count**	**Mean**	**SD**	**f-value**	**p-value**
PEFR	Badminton	85	427.1765	46.28102	0.251	0.00861
	Basketball	76	431.8421	52.45215		
	Cricket	57	433.8596	49.38024		
	Handball	1	420.0000	0.0		
	Total	219	430.5023	49.05739		

As the p-values for both VO2 max and PEFR are less than 0.05, we can say that these variables are reading less than their normal ranges.

INDEPENDENT SAMPLE T TEST:

Table no. 3: p-value using independent sample t test:

Particular	Gender	N	Mean	SD	t-value	p-value
VO2	Male	204	51.1071	1.28946	1.090	0.0277
	Female	15	51.4867	1.46720		
PEFR	Male	204	430.9314	48.40933	0.477	0.00634
	Female	15	424.6667	58.78127		

Since the p-values are <0.05 we can say that these variables are statistically significant in this study.

CONCLUSION

From the results and statistical analysis we can conclude that cardiorespiratory health of players involved in overhead activities is associated with their forward head posture.

The prevalence of cardiorespiratory alterations in players involved in overhead activities having forward head posture is 43%. And after the physiotherapy interventions the prevalence reduced to 37%.

DISCUSSION

This study focuses on finding the prevalence of forward head posture and cardiorespiratory alterations caused because of forward head posture in players involved in overhead activities.

Player's performance is impacted by a number of variables, including skill, stamina and strength. Even though postural alignment is essential to achieving peak performance, it is frequently disregarded. For players to maximise their performance and reduce their risk of injury, good posture is crucial. Regrettably, a lot of players experience postural aberrations as a result of a variety of factors, such as overusing specific muscle groups and repetitive motions. An increased risk of injury and a decline in sports performance can result from postural aberrations, which can also negatively affect respiratory health and physical fitness components. In contrast to players with a normal sagittal head posture alignment, college players with forward head posture demonstrated less efficient physical fitness as well as impaired sensorimotor processing and integration, according to a recent study by Moustafa et al. Additionally, studies have demonstrated that sagittal spinal subluxations can result in a reduction in lung function, indicating a direct connection between the two through the sympathetic nervous system's somato-visceral reflex pathway.

Sports involving overhead motions, such as throwing or hitting a ball, put a lot of strain on the shoulder complex due to repetitive force production, asymmetry in load distribution, or limb use. Players are more prone to shoulder injuries when they develop postural faults such as round shoulder posture (RSP) and forward head posture (FHP).

There are some studied that show that reduced respiratory function results from the expansion of the upper thorax and contraction of the lower thorax which is the result of forward head posture. Hence physiotherapy interventions can reduce the chances of getting various complications in sport performance in future.

Since there were no studies done which focused on finding the correlation between the FHP and cardiorespiratory health in players involved in overhead activities we got the need of it. So we assessed the cardiorespiratory health of players having forward head posture using three outcome measures such as chest mobility, PEFR and VO2 max after taking their written consnts. The forward head posture of the players is assessed using KINOVEA software which is a photogrammetry method. The players are then ruled out from developing FHP due to increased smartphone use with the help of SAS VS – smartphone addiction scale short version.

We assessed chest mobility using tape method for measurement of chest expansion. The chest expansion is measured at three different levels like axillary level, nipple level and xiphisternal level. After which we assessed sport's peak flow rate using peak flow meter. And lastly we assessed sport's VO2 max levels using Queens's college step test of measuring VO2 max.

The final data was then analysed using ANOVA test and Independent sample t test with the help of a professional statistician. We observed that a lot number of players have alterations in their cardiorespiratory health due to postural aberrations like FHP.

The observed cardiorespiratory alterations in players with FHP may have implications for their performance and long-term health. This can affect their performance and anxiety levels. Suboptimal respiratory mechanics can impair oxygen delivery to muscles during exercise, leading to decreased endurance and increased fatigue. As a result the sport can develop burnout and depression in turn. Additionally, altered autonomic function may impact heart rate regulation and recovery, potentially increasing the risk of overtraining and cardiovascular complications.

Hence the assessment and management of postural aberrations and cardiopulmonary complications can be done with the help of physiotherapy interventions with time. Eventually this helps the players in improving their sport performance and decreases fatigability, in turn increasing the duration and quality of their entire carrier.

So, for this the awareness of postural and cardiopulmonary complications among players involved in overhead activities is necessary.

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