

Prevalence of Breathing Pattern Disorders among University Level Players

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Abstract Background: Breathing is fundamental to life and health. To date, the physiotherapy literature on the topic of breathing pattern disorders (BPDs) is sparse and little attention has been paid to the breathing pattern of the university level players. There is no study done to find out the prevalence of breathing pattern disorders among the university level players. **Objective:** To find out the prevalence of breathing pattern disorders among the university level players. **Methodology:** Non-experimental, Cross-sectional study design. 115 players were conveniently selected according to inclusion and exclusion criteria. Study was conducted for 2 weeks at SRM Sports complex, Kattankulathur. 115 players were evaluated using Breath holding test, Simplified Manual Assessment of Respiratory Motion (MARM), Hi-Lo test and the Nijmegen questionnaire. **Results:** The results of this study show that out of 115 university level players, 76 (66%) players were found to have breathing pattern disorders from all the 4 outcomes. **Conclusion:** The study concludes that there is a 66% prevalence of breathing pattern disorders among the university level players according to multidimensional assessment.

Keywords Breathing Pattern Disorders, Breath Holding Test, Simplified MARM, Hi-Lo Test, Nijmegen Questionnaire

1. Introduction

Breathing is fundamental to health. In addition to gas exchange, breathing has been shown to have a variety of other purposes, including spinal decompression, postural stability, fluid dynamics, visceral health, and emotional control [1]. It is one of our most vital functions and is a central aspect of our whole being. A breathing pattern disorder can be the first sign of all dysfunctions, whether it can be biochemical, biomechanical, physiological or psychological dysfunctions [2].

Until recently, little attention has been paid to the breathing pattern of the athletes [2]. Dysfunctional breathing is defined as breathing that does not fulfill its primary or secondary functions of respiration which is less responsive and adaptive to the body's changing needs and conditions than healthy breathing. A range of breathing behaviours and symptoms are termed as dysfunctional breathing [3].

They are as follows: Mouth breathing, unexplained breathing discomfort, difficulty taking a satisfying, deep breath, upper chest breathing, hyperventilation, low CO₂, and various combinations of all these issues. It might be due to consequences of altered respiratory mechanics: Biomechanical factors such as the posture adopted by the athletes in their sport. As a normal ventilatory response to exercise and emotional factors such as anxiety, physiological changes occurs in tidal volume and

respiratory rate [4].

1.1. Biomechanical

The diaphragm plays a key role in the generation of pressure and this pressure determines the length-tension relationship. Because the diaphragm is unable to return to its ideal resting position when there is an apical breathing pattern, the respiratory accessory muscles shorten and the pressure generation of the diaphragm is disrupted. This can lead to dynamic hyperinflation. Alteration in the gas exchange, often leads to arterial hypoxemia.

1.2. Physiological

Hyperventilation, which is defined as breathing more than is necessary to meet metabolic needs and results in hypoxemia, can be caused either temporarily or persistently by altered respiratory patterns. Lower arterial pCO_2 , higher body pH, and a respiratory alkalosis condition are the outcomes.

1.3. Psychological

There were numerous internal and external pressures placed on the players. Studies have demonstrated a strong correlation between respiratory pattern problem and performance anxiety. One of the main causes of anxiety and panic attacks is the dread of dyspnea. Performance is frequently restricted by discomfort in the muscles or a feeling of dyspnea.

The multidimensional approach is needed to assess the breathing pattern among the players [5]. The basic principle is to evaluate biomechanical, biochemical and psychophysiological dimensions. A series of assessments has been carried to find out breathing pattern disorders among the players.

Biochemical assessment: a) Observation and testing b) Breath holds

Biomechanical assessment: a) Hi-Lo assessment b) Simplified Manual Assessment of Respiratory Motion (MARM) assessment

Psychophysiological dimension: Nijmegen questionnaire.

1.4. Need for the Study

To date, the physiotherapy literature on the topic of breathing pattern disorders is sparse. Little attention has been paid to the breathing pattern of the players. There are more studies on the treatment of breathing pattern disorders and no study done for the prevalence of breathing pattern disorders. The prevalence of abnormal respiratory mechanics and breathing pattern disorders in athletes, in the absence of respiratory pathology, has not been reported in the literature. Hence this study has been done to find out the prevalence of breathing pattern disorders among the university level players.

2. Methods

Out of 128 players invited to the study, 10 players declined to be part of the study. So, 118 University level players were screened and from those, 3 players were excluded from the study. Finally, 115 University level players with at least 2 years of professional experience in any sport event, aged 18-25 years, both men and women, with no self-reported pain on the day of testing were conveniently included for the study. Players with recent musculoskeletal injuries and pain and requiring treatment within past 6 weeks, respiratory problems like asthma, COPD, cardiac problems, smokers, neurological problems like epilepsy, migraine were excluded from the study. Study duration was 2 weeks. The study was conducted in the Intercollegiate sports meet in SRM Institute of Science & Technology, Chennai.

The study was approved by the Institutional Ethical Committee. All the subjects were asked to sign the written consent form stating the voluntary acceptance to participate in this study after screening for inclusion and exclusion criteria. The assessment included observation and testing. A multidimensional assessment has been involved to evaluate breathing pattern among the players. We used breath holding time for Biochemical assessment, Hi-Lo & Simplified MARM assessment for Biomechanical assessment, and Nijmegen questionnaire for Psychophysiological dimension.

2.1. Breath Holding Time

Tell the person to inhale and exhale normally. Ask them to hold their breath by closing their nose once they have finished exhaling. Tell them to wait to breathe until they can clearly sense the urge to do so. As soon as the subject holds their breath, start a timer, and when they let go of their nose, stop it. If it lasts less than 20 seconds, consider the possibility of breathing dysfunction.

2.2. Hi-Lo Test

The test was performed with the subject in sitting position. By standing in front of the subject, the therapist instructed him/her to place one hand on the upper abdomen and the other on the sternum. During breathing, if the belly moved in the opposite direction from the thorax, paradoxical breathing may be present. The test will be assessed for up to 5 breath cycles. After starting the test, when the subjects present with upper chest dominant, and if the pattern was paradoxical, it was considered as dysfunctional and the test should be stopped. The instructions were as follows: Natural breath, Spontaneous deep breath, Deep slow breath, Direct breath to abdomen. And dichotomous scoring was done - yes (or 1) No (or 2) OR ordinal scoring – balanced (0), mild/moderate (1), strongly (2) and observed as thoracic or paradoxical breathing.

2.3. Simplified Manual Assessment of Respiratory Motion (MARM) Assessment

The simplified manual assessment of respiratory motion is used to assess and quantify breathing pattern and distribution of breathing motion between upper and lower parts of rib cage and abdomen. By sitting behind the subject, place both hands on the lower lateral rib cage of the subject, such that the hands rest firmly, comfortably, and without impeding breathing. The hands should be comfortably open with the fingers spread such that the little finger is close to a horizontal orientation, and the thumbs should be pointed vertically and parallel to the spine. Keep in mind that the fourth and fifth fingers should be below the lower ribs to feel abdominal expansion. Note how much the hands' total vertical motion feels different from their overall lateral motion. The predominant upper rib cage or lower rib cage movement or abdominal relative balance can also be determined [6]. The instructions given were: Sit naturally and Breathe normally, Sit slump, Sit upright, Take a deep slow breath, Breathe sideways into my hands, Sit naturally and Breathe normally again. And scoring – balanced (0), mild thoracic (1), moderate thoracic (2), strong thoracic (3) [7].

2.4. Nijmegen Questionnaire

The Nijmegen questionnaire (NQ) provides a comprehensive overview of the symptoms linked to abnormal breathing patterns. It serves as a screening tool to identify people who have complaints of hyperventilation. A score of 23 indicates dysfunctional breathing. It is a 16-item questionnaire asking about the frequency of incidence of complaints and indicated on a five-point ordinal scale. Never – 0, Rare – 1, Sometimes – 2, Often – 3, Very often – 4.

3. Results & Data Analysis

Table 1 shows that of 115 players, 80 players were in the age category of 18-21 years, 35 players were in the age category of 22-25 years. Of the 88 men and 27 women players, 76 players had breathing pattern disorder.

Table 1. Demographic data

Age (in Years)	Frequency	Gender	Frequency	Disorder
18-21	80	Men	88	Yes - 76
22-25	35	Women	27	No - 39

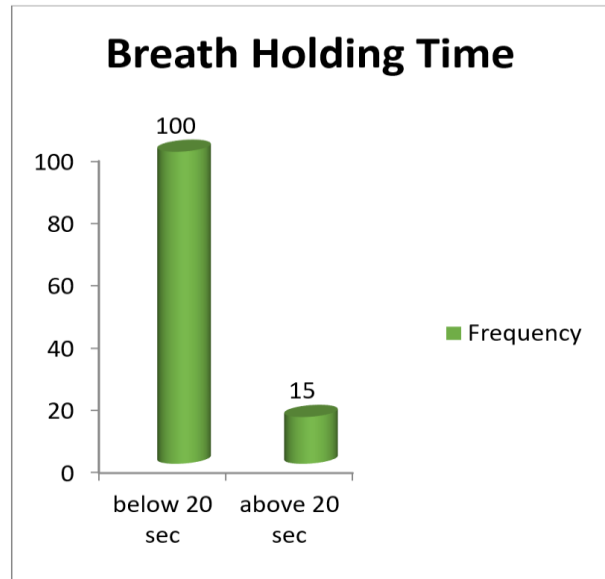


Figure 1. Frequency of university level players with breath holding time below 20 secs and above 20 secs.

Figure 1 shows the breath hold test of the players with frequency of 100 (87%) for below 20 seconds and 15 (13%) for above seconds.

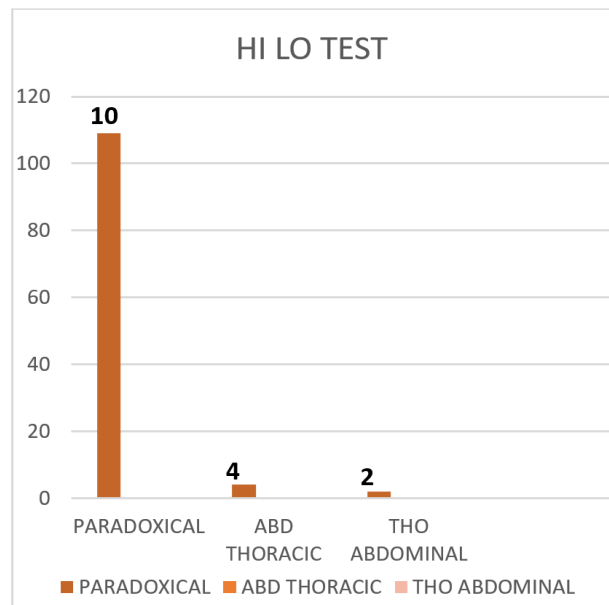


Figure 2. Breathing pattern of University level players in Hi-Lo test

Figure 2 shows the Hi- LO test in which the paradoxical breathing is for 109 (94.8%) players and 4 (3.47%) is for abdominal (ABD) and 2 (1.73%) for thoracic (THO) breathing.

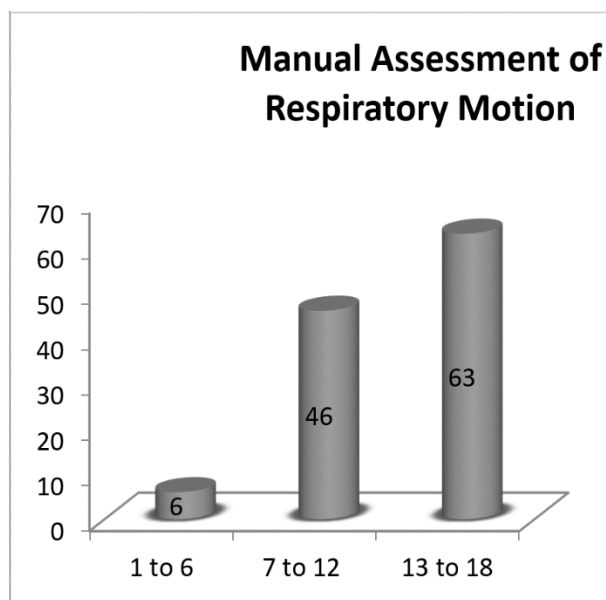


Figure 3. Frequency of university level players with mild, moderate and strong breathing pattern of simplified Manual Assessment of Respiratory Motion (MARM)

Figure 3 shows MARM where 63 (54.8%) players with more dysfunctional breathing, 46 (40%) players with moderate dysfunctional, and 6 (5.2%) players with mild dysfunctional breathing.

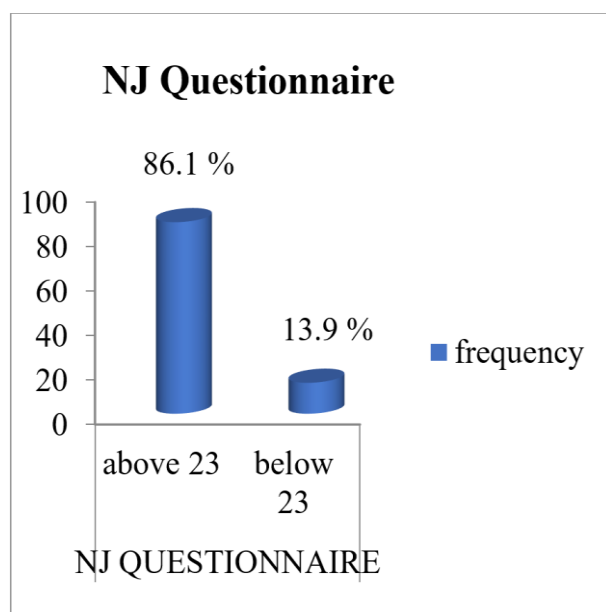


Figure 4. Frequency of university level players with above 23 and below 23 score in Nijmegen questionnaire

Figure 4 shows Nijmegen questionnaire where 99 (86.1%) players were reported score above 23 and 16 players (13.9%) reported below 23.

The results of this study show that out of 115 university level players, 76 (66%) players were found to have breathing pattern disorders from all the 4 outcomes.

4. Discussion

This study is aimed to find out the prevalence of breathing pattern disorders among the university level players by assessing them in multidimensional approach. The prevalence of breathing pattern disorder is as high as 5-11% in the general population, around, 5.3% or more in children with asthma, 30% in asthmatics [8] and up to 83% in anxiety sufferers [9] and there is 8.3% of exercise induced bronchospasm in athletes [3]. This study shows there is a prevalence of breathing pattern disorders among the university level players and out of 115 players, 76 are found to be positive for the breathing pattern disorders.

In this study, the players were assessed for breath holding test. 87% of players can hold their breath for below 20 seconds and 13% of players are able to hold their breath for above 20 seconds. 87% of players who cannot hold their breath for above 20 seconds have increased ventilatory drive due to biomechanical, physiological and psychological dimensions. Buteyko K [10] and Haussen [11] in their study showed that more thoracic dominant breathing pattern correlates with shorter breath holding time.

The thoraco-abdominal relationships in breathing were accurately assessed with the Hi-Lo test and the paradoxical, thoracic or abdominal movements were indicated [12]. In this study 94.8% of players showed paradoxical breathing, 1.7% of players showed thoracic breathing and 3.4% of players showed abdominal breathing. Loring, Mead et al [13] in his study showed that subjects who naturally breathe paradoxically have increased respiratory drive, which causes the accessory muscles of inspiration to contract tonically, producing dominant vertical and upper chest motion during inspiration and dynamic hyperinflation of the lungs.

Simplified Manual Assessment of Respiratory Motion (MARM) was used to quantify breathing pattern and note the examiners impression of general freedom of breathing motion and stiffness of rib cage. Using MARM, 54.8% of players were found to have strongly dysfunctional breathing, 40% of players with moderate dysfunctional breathing and 5.2% of players with mild dysfunctional breathing. The MARM evaluated expansion of the lower lateral rib cage and it was the indicator of inefficiency of diaphragm. While assessing breathing pattern using MARM some of the players were presented with asymmetry between the left and right sides of the body. When the spinal column was deviated sideways, the breathing movements on the left and right sides of the body differed noticeably and were easily discernible with two hands [7]. Courtney R [14] in her study showed that Weakness and hypertonicity of the respiratory muscles, as well as poor coordination, especially of the diaphragm, are symptoms of biomechanical dysfunctions in breathing.

Nijmegen questionnaire is used for assessing hyperventilation syndrome, and is useful to quantify and assess the normality of subjective sensations [15]. In this

study, 13.9% of players were reported below score 23 and 86.1% of players were above score 23 which was suggestive of players with hyperventilation syndrome. There are several problems associated with the administration of Nijmegen questionnaire. It is an ambiguous questionnaire and there is difficulty in interpretation of subjective sensations of the players.

Research has proved that dysfunctional breathing is multidimensional and includes biochemical, biomechanical and psychophysiological aspects of dysfunction. A client with disordered breathing cannot be consistently identified by a single test or screening tool. A thorough evaluation of respiratory dysfunction must take into account all three dimensions as well as the causes and contributing factors. Hence, a single test can only reveal information about one dimension while missing others [5]. Rosalba Courtney [17] indicated that a purely biological understanding of breathing disorders may be constrained since breathing reflects the operation of many different physiological systems. In addition to measuring carbon dioxide, it's important to measure the biomechanical components of breathing patterns and symptom patterns in order to get a whole picture of how patients are breathing. Hence in this study, all the three dimensions were assessed using at least one specific test.

The results of this study show the percentage of dysfunctional breathing in players according to each dimension of breathing and it is found that 66% of University level players were positive in all the tests and were susceptible to dysfunctional breathing. Hence this study reveals the necessity of retraining the breathing pattern along with training strength and conditioning of the players to improve the overall sports performance. Jack S [16] in his study stated that the term "dysfunctional breathing" describes the many connections between psychological and emotional elements and the physiology of breathing behaviours and symptoms. Stress, worry, and fear are psychophysiological drivers that cause generalised hyperarousal in the neurological system which is associated with abnormal breathing patterns.

Though this study considered psychological, biomechanical and biochemical factors, only few specific tests in each factor were assessed in a relatively smaller sample size. Interventional studies can be done in elite athletes with breathing pattern disorder.

5. Conclusions

The study concludes that the majority of players show dysfunctional breathing in individual test in biochemical, biomechanical and psychophysiological aspects. And overall, there is a 66% prevalence of breathing pattern disorder in all dimensions among the university level players according to multidimensional assessment. This data on prevalence may be taken as an indicator to incorporate breathing retraining to players and improve their sports performance.

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