Physiological Adaptations and Vital Capacity: A Comparative Analysis of Tribal and Non-Tribal Players

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Abstract

Aim: The primary objective of this study was to evaluate and compare the vital capacity levels of players from tribal and non-tribal backgrounds within the Sonbhadra district of Uttar Pradesh. By focusing on eighth-grade players, the research aimed to find out the factors on respiratory health and physical capacity. **Methodology:** The methodology employed for this research is a survey approach. The delineation of the selected sample for the investigation is stratified based on tribal and non-tribal secondary school players. A total of one hundred participants (comprising 50 tribal and 50 non-tribal individuals) were selected utilizing a random sampling technique. The sample will be procured from the Sonbhadra District in the state of Uttar Pradesh. The result of the sample is presented in Table 1. **Result:** We perform an independent t-test to compare the vital capacity of tribal and non-tribal players. The t-test result ($t(98) = 3.679$, $p < 0.000$) suggests that there is a significant difference in vital capacity between the Tribal (1604) and Non-Tribal (1484) groups. The mean difference of 120 ml indicates that the Tribal players have a higher vital capacity on average compared to the Non-Tribal players. **Conclusion:** After conducted the whole research process and on the basis of the result of the data gathered throughout the research process the researcher found that the tribal players have the high level of vital capacity as compared to the non- tribal players.

Key Words: Health indicator, Respiratory health, cardiovascular health, Comparative study, Spirometer.

Introduction

Tribal communities in India, which make up a significant ratio of the population, encounter various challenges such as poverty and crises, as clarify in several research articles (**Roy et al., 2023)**. The Sonbhadra district in Uttar Pradesh, where the tribal population is 365601 constituting 19.62% of the total population, illustrates the hardships faced by these communities (**Singh et al., 2010).** In order to tackle these challenges, the Government of India has launched Tribal Development

Projects (ITDP) as part of the Tribal Sub-Plan (TSP) since the Fifth Five year plan, with the objective of diminishing poverty, improving the overall status, and eradicating exploitation within tribal households**. (Pattamajhi et al., 2023).** Acknowledging the significance of sports in the comprehensive advancement of tribal communities, endeavors are being undertaken to uplift scheduled tribe players through these initiatives, in alignment with constitutional mandates and broader developmental objectives. (**Chaudhary et al., 2023).** Sports represent an investment in individuals, aiming to empower them in adapting to the evolving economic and technological landscapes. (**Gonzalez et al., 2016).**However, the provision of sports facilities in tribal settlements poses a significant challenge for governing bodies, given that coaches often exhibit reluctance to operate in such remote locations. (**Roy et al., 2023).**The inclusion of Article 46 in the Indian constitution reflects a definitive commitment to advancing the educational, sporting, and economic well-being of Scheduled Tribes, while also safeguarding them from social inequities and various forms of exploitation. (**Dhal 2023)**.Owing to the unique concerns and requirements of Scheduled Tribes, which are distinct from those of other societal groups, particularly due to the geographical seclusion of tribal regions from the rest of the nation, a targeted and independent strategy was deemed essential in addressing these issues. **(Roy et al.).**

Vital capacity, defined as the greatest volume of air that a person can expel from their lungs after taking the deepest breath possible, plays a critical role in diagnosing lung illnesses and tracking recovery**.** (**Juniati & Fuadi, et al., 2021**)**.** This measurement is crucial for understanding respiratory health and is often assessed using Spiro-meter. Spiro-meter is a widely used pulmonary function test that measures various respiratory flows and volumes, with a particular focus on forced vital capacity (FVC) and forced expiratory volume in one second (FEV1). (**Kameneva & Chushkin at al., 2023).** These specific measurements help determine the presence and severity of lung diseases such as asthma, chronic obstructive pulmonary disease (COPD), and other restrictive or obstructive conditions. (**Fajar & Iman et al., 2020, July).** Advancements in testing equipment have significantly enhanced the accuracy of vital capacity measurements. (**Lia & Muttaqin et al., 2023).** Innovative techniques, such as detecting airflow velocities and pressure differences, provide more precise data, which is important for reliable diagnosis and effective treatment planning. (**Patel & Abowd et al., 2008).** By improving the accuracy of these measurements, healthcare providers can better monitor lung health and the effectiveness of interventions**. (Hafsa & Kanoun et al., 2022 May).** Beyond respiratory health, vital capacity is also a valuable indicator of general health and mortality risk. (**Hafsa & Kanoun et al., 2022 May).** Research has demonstrated that vital capacity is a strong predictor of cardiovascular disease risk, even when

adjusted for height. (**Agrawal, A., 2019).** This measure can outperform traditional risk factors like cholesterol levels in predicting future cardiovascular events. (**Rajai & Lerman et al., 2023).** By incorporating vital capacity assessments into routine health evaluations, medical professionals can gain a more comprehensive understanding of a patient's overall health status and potential risks. (**Agrawal, 2019).** In summary, vital capacity is a key metric in respiratory health diagnostics and general health evaluations. (**Yan, 2020).** Its measurement through spirometry provides essential information for diagnosing lung diseases and monitoring treatment outcomes, while also offering significant insights into cardiovascular risk and overall mortality. (**Bradley & Callister et al., 2023).** As testing techniques continue to evolve, the precision and utility of vital capacity assessments are likely to improve, further enhancing their role in medical practice. (**Agrawal, 2019).**Sports play a crucial role in the advancement of tribal communities. (**Bahir, 2020).** Despite the ongoing progress in tribal development, there exists a notable lack of involvement among tribal youth. (**Singh & Singh et al., 2022).** It is imperative to enhance the accessibility and availability of opportunities for tribal children, thereby integrating them into the economic mainstream. (**Gondane, 2023).**The Government is implementing specialized initiatives such as Khelo-India and schemes for athletes, along with a new project in gram panchayat to enhance communal sports in indigenous communities. **(Nova & Budiono et al., 2022).** The provision of pre-matriculation and post-matriculation coaches for tribal athletes, as well as the distribution of sports equipment, aims to address the unsatisfactory state of sports among tribal players. **Roy & Roy et, al. (2016)**. Research indicates that they exhibit lower enthusiasm for group sports, highlighting the necessity for a shift in their attitudes towards sports for progress. (**Karaca & Bozoğlu et al., 2021).** Consequently, it is crucial to investigate any potential disparities in vital capacity between tribal and non-tribal athletes. (**Das & Saha et al., 2013).** The objective of the study is to analyze the vital capacity disparities among players from tribal and non-tribal backgrounds in the Sonbhadra district. (**Tripathi & Bhatnagar et al., 2022).**

Material and Methods

The methodology employed for this research is a survey approach. The delineation of the selected sample for the investigation is stratified based on tribal and non-tribal secondary school players. A total of one hundred participants (comprising 50 tribal and 50 non-tribal individuals) were selected utilizing a random sampling technique. The sample will be procured from the Sonbhadra District in the state of Uttar Pradesh.

Study participants:

- The group selected for this research consisted of eighth-grade players from Sonbhadra district, located in the state of Uttar Pradesh, India.
- To make results comprehensive and representative, careful attention ensured inclusion of both tribal and non-tribal players.
- The final study group had 100 participants, split equally: 50 tribal players and 50 non-tribal players.
- To study players effects in tribal communities, purposive sampling was chosen as the best approach.
- This strategy enabled selecting participants with specific criteria: tribal affiliation and player's involvement.
- This focused sampling aimed to analyze vital capacity differences between tribal players and non-tribal players.
- All the selected players belong to the tribal communities of Gond, Dhuria, Kharwar, Pahari, Bhuia, Agariya, Pathri, Pankha, Panika, Chero and Nayak of the Sonbhadra district.

Selection of variables:

The study focused on vital capacity, measured with a spirometer, as it's crucial for assessing respiratory health, fitness, and players performance.

In addition to vital capacity, two grouping variables were defined:

1. **Tribal Status** – Difference between tribal players and non-tribal players.
2. **Athletic Participation –** focusing specifically on the engagement of the tribal players and non-tribal players in sports at sonbhadra district.

Criterion Measure: Spirometer was use to measure the Vital Capacity.

Study organization**:** The researcher assessed the vital capacity of 50 tribal players and 50 non-tribal players studying in class 8 in Sonbhadra district through a spirometer. All the selected players were informed about the aims and objectives of the study. The players were explained about the spirometer and given the necessary instructions. They were requested to cooperate. The researcher requested each player to cooperate honestly. Data was collected from each player. The researcher thanked the school principal and teachers and motivated them by promising to send a copy of the research. No time limit was set for assessing the vital capacity of the players. However, the players were requested to assess their vital capacity accurately and carefully through the spirometer.

Statistical analysis: For the purpose of the study, the researcher used descriptive statistics to elaborate the data and the independent sample t-test was used to compare both the groups.

Result

There is significant difference between in vital capacity of tribal players and non-tribal players. In order to verify the hypothesis one, the independent t- test done. The result is presented in Table 2

GROUPS	N	M	SD	MD	df	t-value	Level of significance	2-tailed p value
Tribal Players	50	1604.00	185.11	120	98	3.679	0.05	0.000
Non-Tribal players	50	1484.00	137.55	120	98	3.679		

Mean and Standard Deviation presented in the above table: The sample as a whole was relatively young tribal players and non tribal players (M = 1604, 1484, SD = 185.11, 137.55). The average age of students was 15 years. After conducted the t-test the researcher found that, there was a significant difference among the vital capacity of tribal and non tribal players, t (98) = 3.679, p < .000.

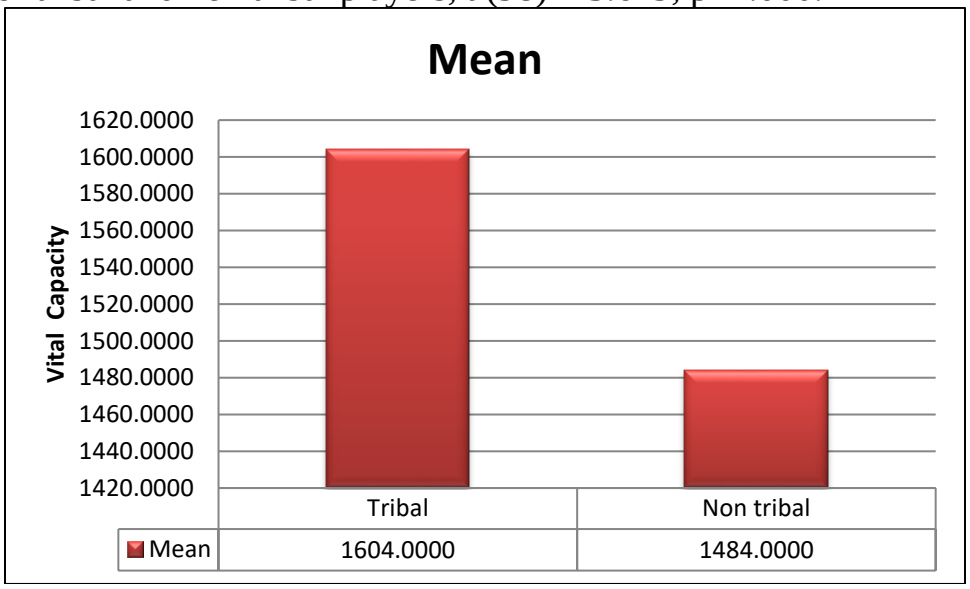

Figure 1: Presents the mean valve of the tribal v/s non tribal players of Sonbhadra district.

We perform an independent t-test to compare the vital capacity of tribal players and non-tribal players. The t-test result (t (98) = 3.679, p < 0.000) reveals that a statistically significant difference exists in vital capacity between the Tribal (1604)

and Non-Tribal (1484) groups. The mean difference of 120 ml indicates that the Tribal group has a higher vital capacity on average compared to the Non-Tribal players.

DISCUSSIONS

The average scores of vital capacity for both tribal and non-tribal players demonstrate that tribal players exhibit a superior vital capacity in comparison to their non-tribal player's counterparts. Specifically, tribal players possess an average score of 1604.00 with a standard deviation of 185.11, thereby indicating their enhanced vital capacity. Conversely, non-tribal players characterized by a diminished vital capacity, present the lowest average scores of 1484.00 with a standard deviation of 137.55, suggesting their reduced vital capacity. An optimal vital capacity serves as a crucial foundation for the positive developmental trajectory and overall well-being of a child. Previous research has indicated that tribal students exhibit superior body composition and cardio respiratory fitness levels when compared to their non-tribal counterparts (Manna et al., 2015). Furthermore, the investigation revealed that tribal players demonstrated enhanced cardio respiratory endurance and upper body strength endurance in comparison to non-tribal students (Sarkar et al., 2015).

The vital capacity of tribal players is often stronger than that of non-tribal players due to several inter relation factors, including physical activity levels, anthropometric characteristics, and environmental influences. Regular exercise, which is more prevalent among tribal athletes, enhances lung function and capacity. This is supported by various studies that highlight the significant differences in pulmonary function between athletes and non-athletes.

Physical Activity and Lung Function

- Tribal players typically engage in more rigorous physical activity, leading to improved lung capacity. Regular exercise strengthens respiratory muscles and increases lung compliance, resulting in higher vital capacity (Wagh et al., 2022) (Warganegara, 2015).
- Studies indicate that athletes have greater lung capacity compared to sedentary individuals, with vital capacity measurements often exceeding 4.2 liters in active population (Warganegara, 2025).

Anthropometric factors

- Vital capacity is influenced by physical characteristics such as height and body surface area. Research shows a strong correlation between these factors and lung function, with taller individuals generally exhibiting higher vital capacities (Chadrashrkhar et at., 2020).

- Tribal players may possess advantageous body compositions that contribute to their superior lung function (Sinha et al., 2012).

Environmental and Genetic Factors

- The geographic and environmental conditions in which tribal players train may also enhance their respiratory efficiency. Adaptations to high physical demands in their environments can lead to improved pulmonary function (Sinha et al.,2012)

IMPLICATIONS

- Teachers should cultivate an environment that is both unencumbered and conducive to health within the educational setting.
- Educators ought to furnish ample opportunities for tribal players that correspond with their individual competencies.
- It is essential for educators to create a platform wherein tribal players are afforded the opportunity to articulate their engagement in sports activities without reservation.
- It is imperative to organize athletic events and supplementary counseling initiatives aimed at enhancing the vital capacity of tribal players.
- Caregivers should demonstrate confidence in their offspring's inherent potential and competencies.
- Caregivers ought to allocate quality time with their children to foster an appreciation for player's activities and games.
- Caregivers should assist their children in cultivating a constructive sense of vital capacity.

Conclusion

After conducted the whole research process and on the basis of the result of the data gathered throughout the research process the researcher found that the tribal players have the high level of vital capacity as compared to the non- tribal players.

Conflict of Interest

There was no declared conflict of interest seen between the authors.

Reference

1- Roy, A. D., Das, D., & Mondal, H. (2023). The tribal health system in India: Challenges in healthcare delivery in comparison to the global healthcare systems. *Cureus*, *15*(6).

2- Singh, P. K., Tiwari, R. K., & Singh, R. H. (2010). Medicinal plants used by tribal inhabitants of 'Nagwa'block of district Sonebhadra, Uttar Pradesh, India. *Vegetos*, *23*(2), 86-104.

3- Pattamajhi, A., & Patra, S. (2023). IMPACT OF TRIBAL SUB-PLAN ON ECONOMIC DEVELOPMENT OF TRIBES: A STUDY OF GAJAPATI DISTRICT. *EPRA International Journal of Multidisciplinary Research (IJMR)*, *9*(5), 355-366.
4- Chaudhary, A. K., & Tigga, A. D. (2023) Role of NGOs in the Upliftment of Tribals in Jharkhand.
5- Gonzalez Hernandez, J., & Valadez Jimenez, A. (2016). Personality and psychological response in athletes. Temporal and adaptive representation of the person-sport process. *RETOS-Neuvas Tendencias en Educacion Fisica, Deporte y Recreacion*, (30), 211-215.
6- Roy, A. D., Das, D., & Mondal, H. (2023). The tribal health system in India: Challenges in healthcare delivery in comparison to the global healthcare systems. *Cureus*, *15*(6).
7- Dhal, S. K. (2023). Mainstreaming Scheduled Tribes through Education. In *Education of Socio-Economic Disadvantaged Groups* (pp. 58-69). Routledge India.
8- Roy, A. G., & Roy, K. G. The state of the Mental Health related conditions among the Scheduled Tribes and the Culture-Specific approaches and methods they apply for the Management of such conditions: A Bibliographic essay catering to the contemporary trends in Mental Health research in India.
9- Juniati, N., Bahri, S., Desimarlina, Y., Robbia, A. Z., Jariah, A., & Fuadi, H. (2021). Comparison of Lung Capacity in Communities in Low Land and High Land. *Jurnal Biologi Tropis*, *21*(1), 95-102.
10- Kameneva, M. Y., Cherniak, A. V., Aisanov, Z. R., Avdeev, S. N., Babak, S. L., Belevskiy, A. S., ... & Chushkin, M. I. (2023). Spirometry: national guidelines for the testing and interpretation of results Interregional Public Organization “Russian Respiratory Society” All-Russian Public Organization “Russian Association of Specialists in Functional Diagnostics” All-Russian Public Organization “Russian Scientific Medical Society of Therapists”. *PULMONOLOGIYA*, *33*(3), 307-340.
11- Fajar, D. T., Wardana, P. S., & Iman, B. N. (2020, July). Medical Spirometer for Diagnosing COPD Base On The Measurement of FVC and FEV1. In *Journal of Physics: Conference Series* (Vol. 1569, No. 3, p. 032061). IOP Publishing.
12- Lia, M. R., Harmadi, H., & Muttaqin, A. (2023). Development of Measuring Instruments for Lung Vital Capacity and Human Respiratory Rate Based on Fiber Optic Sensors. *Jurnal Ilmu Fisika*, *15*(1), 39-47.
13- Patel, S. N., Reynolds, M. S., & Abowd, G. D. (2008). Detecting human movement by differential air pressure sensing in HVAC system ductwork: An

exploration in infrastructure mediated sensing. In *Pervasive Computing: 6th International Conference, Pervasive 2008 Sydney, Australia, May 19-22, 2008 Proceedings 6* (pp. 1-18). Springer Berlin Heidelberg.

14- Agrawal, A. (2019). Developing "vital capacity" in cardiovascular risk assessment. *Circulation*, *140*(16), 1291-1292.

15- Rajai, N., Toya, T., Sara, J. D., Rajotia, A., Lopez-Jimenez, F., Lerman, L. O., & Lerman, A. (2023). Prognostic value of peripheral endothelial function on major adverse cardiovascular events above traditional risk factors. *European Journal of Preventive Cardiology*, *30*(16), 1781-1788.

16- Agrawal, A. (2019). Developing "vital capacity" in cardiovascular risk assessment. *Circulation*, *140*(16), 1291-1292.

17- Yan, W. (2020). *U.S. Patent No. 10,568,543*. Washington, DC: U.S. Patent and Trademark Office.-------- Volta, C. A., Ploysongsang, Y., Eltayara, L., Sulc, J., & Milic-Emili, J. (1996). A simple method to monitor performance of forced vital capacity. *Journal of Applied Physiology*, *80*(2), 693-698.

18- Bradley, C., Alexandris, P., Baldwin, D. R., Booton, R., Darby, M., Eckert, C. J., ... & Callister, M. E. (2023). Measuring spirometry in a lung cancer screening cohort highlights possible underdiagnosis and misdiagnosis of COPD. *ERJ Open Research*, *9*(4).

19- Agrawal, A. (2019). Developing "vital capacity" in cardiovascular risk assessment. *Circulation*, *140*(16), 1291-1292.

20- Bahir, H. (2020). The Role of Sports on the Development of Tribes Unity: Afghan Society, Kabul, Afghanistan. *American International Journal of Social Science Research*, *5*(3), 53-56.

21- Singh, G., Dubey, M. K., Singh, S. R. K., & Singh, R. B. (2022). Factors affecting the involvement of tribal youth in agricultural livelihood activities in Dindori District of Madhya Pradesh, India. *Asian Journal of Agricultural Extension, Economics & Sociology*, *40*(9), 452-459.

22- GONDANE, D. S. P. (2023). Children in Tribal Areas are a At Risk of Malnutrition. *Knowledgeable Research: A Multidisciplinary Journal*, *1*(07), 26-30.

23- Nova, A., Soegiyanto, K. S., Raharjo, B. B., & Budiono, I. (2022). Analysis of the Applied Policy for the Sports Training Achievements in Aceh Province. *Journal of Positive School Psychology*, *6*(3), 6942-6956.

24- Roy, S. K., & Roy, S. (2016). Tribal people and education: the Indian scenario. *ACADEMICIA: An International Multidisciplinary Research Journal*, *6*(7), 30-40.

25- Karaca, Y., & Bozoğlu, M. S. (2021). Investigación sobre las actitudes de los estudiantes de secundaria hacia el deporte. *Apuntes Universitarios*, *11*(4), 515-530.
26- Das, A., & Saha, G. C. (2013). Comparative effect of resistance running on vital capacity between untrained tribal and non-tribal school boys. *Indian Journal of Health and Wellbeing*, *4*(5), 1132.
27- Tripathi, N., Jain, S., Sogani, S., Bhatnagar, S., & Bhatnagar, M. (2022). A Nutritional Study Of Tribal And Non-Tribal Children In The Udaipur Region. *Asian J Pharm Clin Res*, *15*(11), 140-142.
28- Sampa,Sarkar.,Asish,Paul.(2015).Comparative study on helth related physical fitness brtween tribal and non tribal school going boys. International Journal of Advanced Research in Management and Social Science, 4(7):317-323.
29- Purushottam, D., Wagh, V., Kumar, K., Buge, K. B., & Kumar, S. (2022). Study Of Pulmonary Function Tests And Muscle Strength In Sportsmen Of Tribal Region Of Gujarat. *International Journal Of Health Sciences (IJHS)*, *6*(S2), 2172–2182. Https://Doi.Org/10.53730/Ijhs.V6ns2.5259
30- Warganegara, R. K. (2015). The Comparison Of Lung Vital Capacity In Various Sport Athletes. *Jurnal Majority*, *4*(2), 96–103.
31- Chandrashekar, A., Jayalakshmi, M. K., & Prashanth Babu. (2020). Physical Factors Influencing FVC In Indian Adult Males. *International Journal Of Physiology*, *8*(1), 27–31. Https://Doi.Org/10.5958/2320-608X.2020.00006.2
32- Uma, S., Sinha, S. K., & Nag, M. B. (2012). A Comparative Study Of Pulmonary Function Of Urban Tribal And Non-Tribal Boys Of Tripura.

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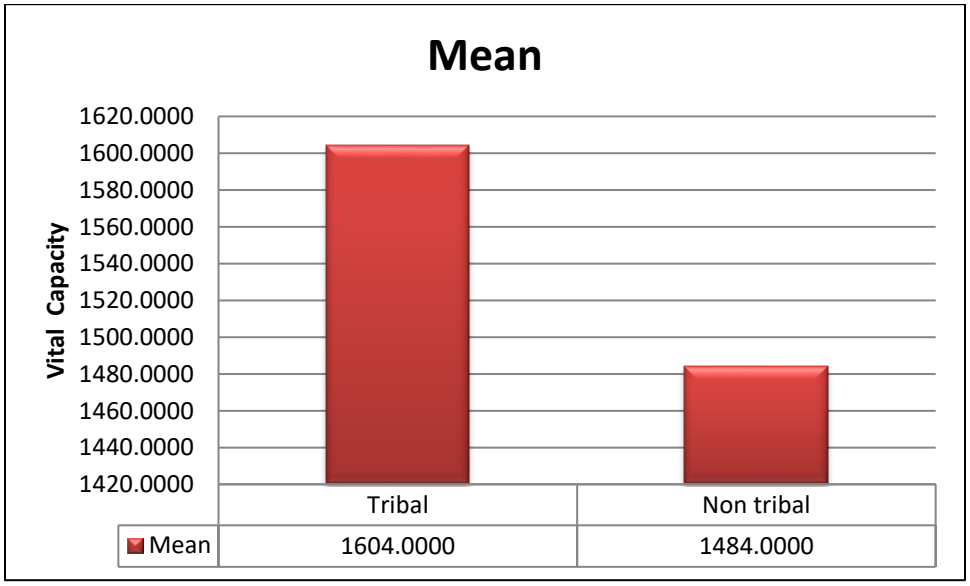

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