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Comparative Study on Pulmonological Parameters between Yogic Practitioners and Intercollegiate Hockey Players

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ABSTRACT

The human respiratory system is critical for maintaining overall health and physical performance, particularly in individuals engaged in physically demanding activities. This study aimed to compare pulmonological variables—forced vital capacity (FVC), maximal voluntary ventilation (MVV), and SPO2—between intercollegiate hockey players (N=15) and yogic practitioners (N=15) aged 18–25 years. The participants were selected from Sri Ramakrishna Mission Vidyalaya institutions in Coimbatore, Tamil Nadu. Data were analyzed using a paired t-test with a significance level set at 0.05. Results revealed significant differences in all measured parameters: hockey players exhibited higher FVC (3.22 ± 0.616 vs. 2.83 ± 0.566), SPO2 (97.12 ± 0.917 vs. 96.19 ± 0.922), and MVV (107.42 ± 14.54 vs. 96.08 ± 13.93) compared to yogic practitioners. These findings suggest that high-intensity aerobic training in hockey enhances lung capacity and expiratory flow rates, while yogic practices improve respiratory control and endurance. The study aligns with previous research, such as Smith et al. (2015) and Johnson (2018), which highlight the benefits of aerobic sports on lung function, and Ramesh (2016) and Bandopadhyay (2012), which emphasize the role of pranayama in respiratory efficiency. The results underscore the distinct yet complementary effects of aerobic sports and yogic practices on respiratory health, providing valuable insights for optimizing training regimens and improving pulmonary function in athletes and practitioners alike.

Keywords: Pulmonological Parameters, Yogic Practitioners and Hockey Players.

1. Introduction:

The human respiratory system plays a pivotal role in maintaining overall health and physical performance, as it is directly responsible for oxygen uptake and carbon dioxide elimination. Efficient pulmonary function is essential for optimal physical endurance, stamina, and recovery, particularly in individuals engaged in physically demanding activities. Yogic practices, which include pranayama (breathing exercises) and asanas (postures), are known to enhance lung capacity, respiratory muscle strength, and overall pulmonary function through controlled and mindful breathing techniques. On the other hand, intercollegiate hockey players, who engage in high-intensity anaerobic and aerobic activities, develop their respiratory efficiency through rigorous physical training and cardiovascular conditioning.

Yogic practices, rooted in ancient traditions, emphasize controlled breathing techniques (pranayama), postures (asanas), and meditation, which are believed to enhance respiratory efficiency, lung capacity, and overall well-being **(Cramer et al., 2013)**. On the other hand, intercollegiate hockey players undergo rigorous, high-intensity training that demands exceptional cardiovascular and respiratory endurance to meet the sport's physical demands **(Cox et al., 2010).**

While both groups exhibit high levels of physical fitness, the mechanisms through which they achieve respiratory efficiency may differ, making a comparative study of their pulmonological parameters both relevant and insightful. This study aims to conduct a comparative analysis of key pulmonological parameters, such as forced vital capacity (FVC), maximum voluntary ventilation (MVV) and SPO2 between yogic practitioners and intercollegiate hockey players. By examining these parameters, the study seeks to explore how yogic practices and high-intensity sports training influence respiratory function differently. The findings may contribute to a deeper understanding of the benefits of yogic breathing techniques and sports-specific training, potentially guiding individuals in choosing the most suitable approach for improving pulmonary health and performance.

2. Review of related literature

Pa, B et al. (2012). Yoga is an ancient Indian way of life, which includes changes in mental attitude, diet, and the practice of specific techniques such as yoga asanas (postures), breathing practices (pranayama's), and meditation to attain the highest level of consciousness. Since a decade, there has been a surge in the research on yoga, but we do find very few reviews regarding yogic practices and transcendental meditation (TM) in health and disease. Keeping this in view, a Medline search was done to review relevant articles in English literature on evaluation of physiological effects of yogic practices

and TM. Data were constructed; issues were reviewed and found that there were considerable health benefits, including improved cognition, respiration, reduced cardiovascular risk, body mass index, blood pressure, and diabetes. Yoga also influenced immunity and ameliorated joint disorders.

Dey, (2017) studied the various anthropometric parameters, motor ability and physiological profiles of the different Indian national club hockey players and also to compare the above parameters with their international counterparts. The present study was carried out on one hundred fifty (150) male Indian hockey players of six different national clubs Among the motor ability and physiological qualities only flexibility, agility and VO2 max were significantly different among the footballers of different national clubs. It was also observed that the mean values of height, weight, vertical jump and VO2 max of Indian national club players were found to be inferior to those of European, American and Australian hockey players. However, the body fat of Indian hockey players according to their specific field positions was found to be comparable with their international counterparts. The defender, midfielder and attacker of the present study were inferior in endurance (VO2 max) as compared to their international counterparts. Genetic factors may be the cause of smaller body size of the subject of the present study as compare to their international counterparts. They concluded that the differences among the hockey players of present study with their international counterparts and specific playing position was probably the cause of hereditary factors and differences in activity in the game

Brown GA, (2015) conducted a study on Oxygen consumption, heart rate, and blood lactate responses to Interval training in college-aged men and women. Although interval training are widely used in athletic conditioning, the physiologic responses to interval training have not been described. The purpose of this study was to investigate the oxygen consumption, heart rate, and blood lactate responses to a single session of interval training Twenty recreationally trained college-aged subjects (10 men. 10 women) participated in a single session of interval training. Interval training of the measured maximal oxygen consumption (O2max) for women and men, respectively, with no difference in oxygen consumption in ml/kg/min or percent O2max between sexes or sets Heart rate significantly increased ($p < 0.05$) from 68.1 +/- 2.9 beatsxmin-lat rest to 169.6 1.2 beatsxmin-1 during training. Sets 5 to 8 elicited a higher ($p < 0.05$) heart rate (173.3 + 1.3 beatsxmin-1) than sets 1 to 4 (164.6 +/- 18 beatsxmin-1) Women exhibited a higher heart rate ($p < 0.05$) during sets 1 and 2 (169.9 +/- 2.8 beatsxmin-1) than men (150.7+/-4.4 beatsxmin-1). The blood lactate concentrations were significantly ($p < 0.05$) increased above resting throughout all sets (1.0+/-0.2 mmolxL-1 compared with 2.9 +/- 0.1 mmolx1-1), with no differences between sexes or sets. Interval training significantly increased oxygen consumption, heart rate, and blood lactate in both men and women, but no significant difference was found between the sexes. Interval training from a height of 0.8 m has similar energy system requirements to what Wilmore and Costill termed "Acrobic Power" training, which should enhance O2max, lactate tolerance, oxidative enzymes, and lactate threshold

Piira, (2014) assessed the heart rate (HR) and blood pressure (BP) dynamics of enthusiastic male ice hockey spectators (60+9years) with coronary artery disease (CAD) during Finnish national league ice hockey play-off final matches Twenty-four-hour ambulatory ECG (n = 55) and BP (n = 17) were recorded at the time of the match and on a control day. Beat-to-beat R-R intervals and BP were recorded during the match and a bicycle exercise at equal HR levels (n = 21) Systolic and diastolic BP were significantly higher th before, during, and Ih after the match than on the control day. E.g., the highest systolic BP was 180114 vs. 145±15 and diastolic 103±13 vs. 82±11mmHg ($p < 0.001$ for both) HR was higher throughout the match ($p < 0.05$) and remained elevated 2h after the match ($p<0001$), and measures of HR variability were decreased during the match ($p<0.01$). Low-frequency variability in BP was higher during the match than during the exercise test ($p < 0.01$) The results show that cardiac vagal outflow is attenuated and vasomotor sympathetic activity elevated during exciting sports events and BP dynamics differ from those occurring during physical exercise at equal HR s. The autonomic reactions may partly explain the vulnerability to cardiovascular events caused by this type of leisure-time emotional excitement.

Baker LA, (2012) conducted study on Resting heart rate and the development of antisocial behavior from age 9 to 14: genetic and environmental influences. The genetic and environmental basis of a well-replicated association between antisocial behavior (ASB) and resting heart rate was investigated in a longitudinal twin study, based on two measurements between the ages of 9 and 14 years ASB was defined as a broad continuum of externalizing behaviour problems, assessed at each occasion through a composite measure based on parent ratings of trait aggression, delinquent behavior's, and psychopathic traits in their children. Parent ratings of ASB significantly decreased across age from childhood to carly adolescence, although latent growth models indicated significant variation and twin similarity in the growth patterns, which were explained almost entirely by genetic influences. Resting heart rate at age 9-10 years old was inversely related to levels of ASB but not change patterns of ASB across age or occasions. Biometrical analyses Indicated significant genetic influences on heart rate during childhood, as well as ASB throughout development from age 9 to 14. Both level and slope variation were significantly influenced by genetic factors. Of Importance. the low resting heart rate and ASB association was significantly and entirely explained by their genetic co-variation, although the heritable component of heart rate explained only a small portion (1-4%) of the substantial genetic variance in ASB Although the effect size is small, children with low resting heart rate appear to be genetically predisposed toward externalizing behaviour problems as early as age 9 years old.

Sathiskumar, D. (2020). This research was to find out the effect of yogic practices on selected physiological variables among school boys. To facilitate the study, 30 subjects were selected from P.K.N. Boys Higher Secondary School, Madurai, Tamilnadu . Their age was between 15 and 17 years. They were assigned in to two groups of which group one group served as yogic practices group and second group as control group. The study was formulated by true random group design, consisted of pre-test and post-test. Pre-test was conducted for all the subjects on selected physiological variables. The experimental group participated yogic practices for a period of six weeks. The initial and final scores in selected physiological variables were put in to statistical treatment using Analysis of Covariance (ANCOVA) to find out the significant mean differences. It was concluded that there was insignificant differences on blood pressure due to yogic practices when comparing to control group.

Aruchunan, M., & Nivethitha, L. (2023). Yogic breathing (i.e., pranayama) and meditation techniques (YBMT) are the most important parts of yoga. Regular practice of yoga has shown to improve pulmonary functions in healthy as well as in people with pulmonary diseases. However, studies on effectiveness of YBMT alone on lung function are lacking. Aims: To evaluate the short-term effect of YBMT on peak expiratory flow rate in healthy

individuals. Settings and Design: A pilot randomized controlled study was done in a medical college hospital located in South India. Materials and Methods: Sixty healthy individuals were randomly allocated to either a study group or a control group. Study group practiced YBMT for 10 min/day for 2 weeks, while the control group was under their normal routine. Peak expiratory flow rate (PEFR) was assessed before and after 2 weeks of intervention. Statistical Analysis: Independent t test and paired t test were conducted to compare the means of inter groups and intra-groups using SPSS, version 16. Results: A significant increase in PEFR was observed in the study group ($P < 0.001$), unlike the control group ($P = 0.588$). Moreover, a significant increase in PEFR was observed in the study group ($P = 0.047$) compared to the control group. Conclusion: Results suggest that YBMT might be useful in improving PEFR in healthy individuals.

Bhagel, P et al. (2022) The benefits of any training depend on its duration. Long-term yogic practice will give more health benefits. It is necessary to define a minimum duration for practice to get its maximum effects. The purpose of the study was to identify the duration of yogic intervention requirements to induce significant changes in pulmonary function. The present study was undertaken on six participants (29-34 years of age, height 177 ± 7.21, body mass (74.7 ± 16.38) and BMI (25.31 ± 3.60); mean ± SD). They were undergoing yogic intervention for a total of one hour, five days a week for six weeks. Height, body mass, and pulmonary function test (PFT) involving measurements of Peak Expiratory Flow Rate (PEFR) forced vital capacity (FVC), forced expiratory volume in one second (FEV1), forced expiratory flow, FEF25-75, peak expiratory flow (PEF), maximum voluntary ventilation (MVV) was assessed. Pulmonary function measurements were done in a time point manner i.e., before the yogic intervention, 2nd week, 4th week, and 6th week of yogic intervention. The Difference at different time points was assessed by performing a one-way repeated measure ANOVA test. It was found significant enhancement at the 6th week of yogic intervention with p values like PEFR ($p<0.001$), PEF ($p<0.001$), FEF25-75% ($p< 0.05$), FVC ($p<0.01$), MVV ($p<0.001$), FEV1 ($p<0.01$). It was observed that the six weeks of yogic intervention may be sufficient for significant enhancement in pulmonary function on physically fit healthy individuals. Optimal respiratory function and cardiovascular endurance are integral to overall health and athletic performance. Yogic interventions have emerged as potential strategies to enhance physiological and physical parameters. These metrics not only unlock the human body's potential but also play a vital role in increasing sports performance.

Pramanik, T et al. (2024). This study aimed to evaluate the effectiveness of a structured yogic regimen in improving respiratory function and cardiovascular endurance in young male adults, shedding light on yoga's role as a complementary approach to physical fitness enhancement.

Forty (N=40) male undergraduate university students (aged 18 to 25 years) were randomly assigned to the experimental (n=20) and control group (n=20). The experimental investigation centered on vital capacity (VC), both positive and negative breath holding times (PBHT and NBHT), peak flow rate (PFR), and cardiovascular endurance (CVE). Using an analytical research approach, a randomized pre-test-post-test-controlled group design was implemented. The experimental group engaged in daily yoga sessions supervised by certified instructors, incorporating various asanas, pranayama techniques, and meditation, while the control group maintained their regular lifestyle. Pre- and post-intervention assessments of respiratory parameters and cardiovascular endurance were conducted using standardized tests. Statistical analyses, including Levene's test for normality, and paired t-tests for intra-group comparisons, were performed using SPSS software (IBM, version 25, Chicago). The experiment lasted for six weeks, with a significance level set at $\alpha = 0.05$. The paired t-test analyses demonstrated significant improvements in VC $t(19) = 4.96$, and $p <0.000$; PBHT $t(19) = 6.34$, and $p <0.000$; NBHT $t(19) = 4.18$, and $p <0.001$; PFR $t(19) = 7.02$, and $p <0.000$; as well as CVE $t(19) = 3.96$, and $p <0.001$, within the experimental group. Conversely, no significant changes were observed in the control group. The findings underscore the effectiveness of a six-week yogic intervention in enhancing respiratory function and cardiovascular endurance among young male adults. Integrating yoga into exercise routines may yield substantial benefits for physical fitness improvement.

Gandhi, S., & Anbalagan, P. (2016). The present study is to analyse the effect of Yogic practices on the selected physiological variables among the middle aged men. For this study 100 middle age male persons were selected from Yazh Yoga Coimbatore city, after the scrutiny by the scholar and experts 30 middle aged men were selected as subjects by adopting purposive random sampling technique. The age of the subjects ranged from 35 to 45 years. They were divided into two equal groups namely, the group were assigned Asana, Pranayama, Meditation (APMTG) and Control group (CG). The subjects were tested to find out the Resting Pulse Rate, Vital Capacity and Blood Pressure. The pulse rate was assessed by arterial pulse, vital capacity was measured by digital Spiro meter and blood pressure was measured by sphygmomanometer. The Asana, Pranayama, Meditation(APMTG) Yoga group participated in Yogic practices for a period of twelve weeks and control group did not participate in any special practice. The data were collected before and after the training period and the pre-test, post-test and the adjusted post-test were analysed by Analysis of Covariance (ANCOVA). The level of significance for the study was chosen as 0.05. It is concluded from the results that the APMTG group has significant improvement in resting pulse rate, vital capacity and blood pressure among middle aged men.

3. Methodology:

This study seeks to compare the pulmonological parameters of yogic practitioners (N=15) from Swami Ahandanandha Hostel, Sri Ramakrishna Mission Vidyalaya Coimbatore , Tamil Nadu and intercollegiate hockey players (N=15) from Sri Ramakrishna Mission Vidyalaya Maruthi College Of Physical Education, Coimbatore Tamil Nadu were chosen. Their ages ranged from 18-25 Years. To understand the impact of differing physical regimens on respiratory health and efficiency. By analyzing metrics such as forced vital capacity , maximal voluntary ventilation and SPO2. Data from two related groups were analyzed using Paired t test ,with a significance level set at 0.05.

Interpretation of data and result:

TABLE-1

THERE IS A SIGNIFICANT DIFFERENCE IN FORCED VITAL CAPACITY BETWEEN YOGIC PRACTITIONERS AND INTERCOLLEGIATE HOCKEY PLAYERS

Group	Mean	S.D	Mean Difference	df	t
Hockey players	3.22	0.616	0.39	14	3.966*
Yogic practitioners	2.83	0.566			

**Significant at 0.05 level, Table value for df 14 was 2.14*

FIGURE-1

THE BAR DIAGRAM SHOWS THAT THE TEST MEANS OF TWO GROUPS ON FORCED VITAL CAPACITY OF INTER-COLLEGIATE HOCKEY PLAYERS AND YOGIC PRACTITIONERS

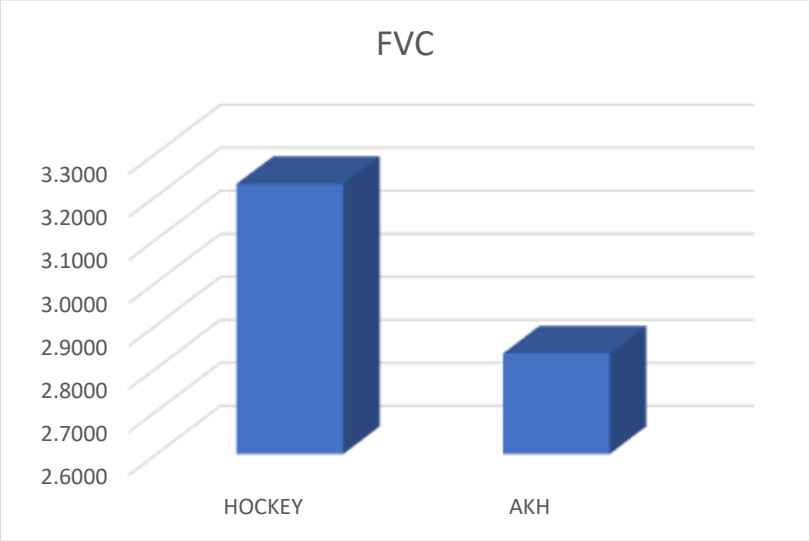

Table 1 reveals that the mean score of yogic practitioners and intercollegiate hockey players were 2.83 & 3.22 respectively ,with standard deviation of 0.56 & 0.61 . The above table also shows there is a significant difference in forced vital capacity between yogic practitioners and intercollegiate hockey players.

TABLE 2

THERE IS A SIGNIFICANT DIFFERENCE IN SPO2 BETWEEN YOGIC PRACTITIONERS AND INTERCOLLEGIATE HOCKEY PLAYERS

Group	Mean	S.D	Mean Difference	df	t
Hockey players	97.12	0.917	0.933	14	6.65*
Yogic practitioners	96.19	0.922			

**Significant at 0.05 level, Table value for df 14 was 2.14*

FIGURE-2

THE BAR DIAGRAM SHOWS THAT THE TEST MEANS OF TWO GROUPS ON SPO2 OF INTER-COLLEGIATE HOCKEY PLAYERS AND YOGIC PRACTITIONERS

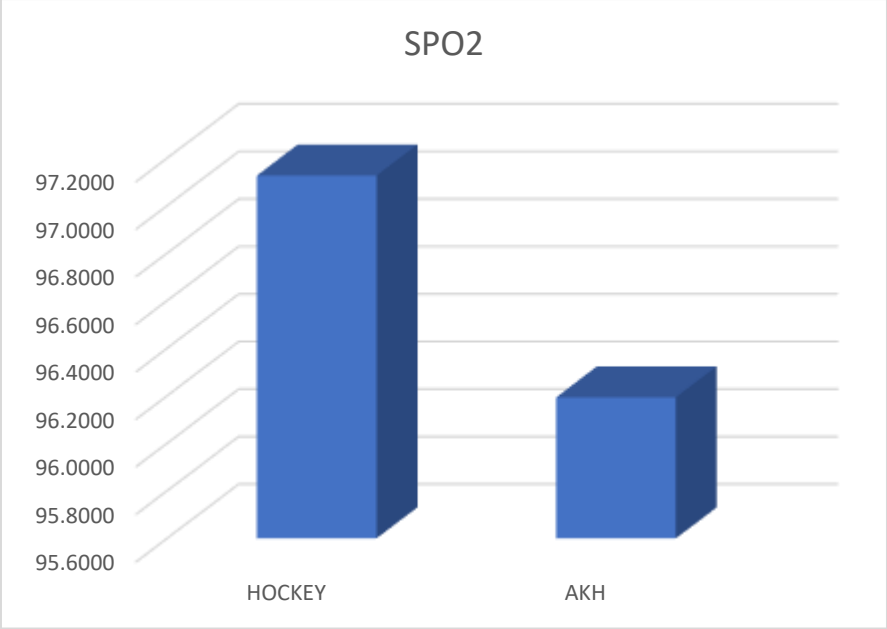

Table 2 reveals that the mean score of yogic practitioners and intercollegiate hockey players were 96.19 and 97.12 respectively, with standard deviation of 0.92 & 0.917 . The above table also shows there is a significant difference in, maximal voluntary ventilation between yogic practitioners and intercollegiate hockey players.

TABLE-3

THERE IS A SIGNIFICANT DIFFERENCE IN MVV BETWEEN YOGIC PRACTITIONERS AND INTERCOLLEGIATE HOCKEY PLAYERS

Group	Mean	S.D	Mean Difference	df	t
Hockey players	107.42	14.54	11.33	14	4.785*
Yogic practitioners	96.08	13.93			

**Significant at 0.05 level, Table value for df 14 was 2.14*

FIGURE 3

THE BAR DIAGRAM SHOWS THAT THE TEST MEANS OF TWO GROUPS ON MAXIMAL VOLUNTARY VENTILATION OF INTERCOLLEGIATE HOCKEY PLAYERS AND YOGIC PRACTITIONERS

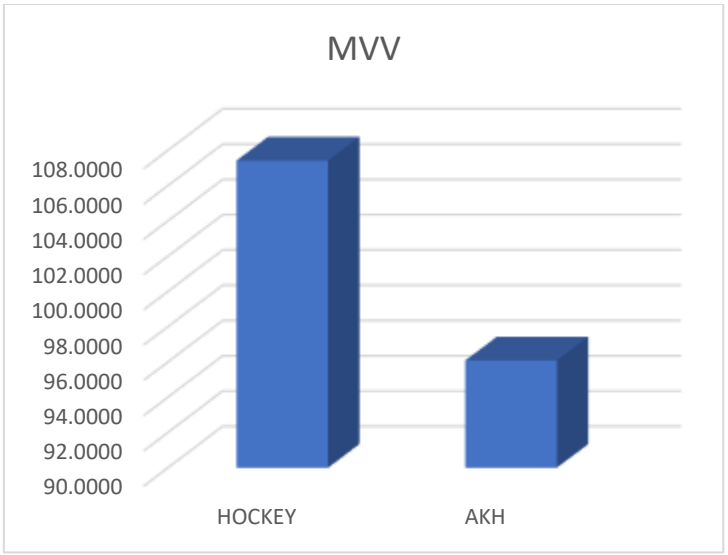

Table 3 reveals that the mean score of yogic practitioners and intercollegiate hockey players were 96.08 and 107.42 respectively, with standard deviations of 13.93 & 14.54 . The above table also shows there is a significant difference in , SPO2 between yogic practitioners and intercollegiate hockey players.

Result

Based on the Table 1, Table 2 and Table 3 there is a significant difference in pulmonological variables between yogic practitioners and intercollegiate hockey players.

4. Discussions and findings

This study indicate a significant difference in pulmonological variable between yogic practitioners and intercollegiate hockey players. These results are in alignment with previous studies. The results of this study shows intercollegiate hockey players have a higher level of significant.

These studies emphasized the positive impact of high-intensity aerobic sports on lung capacity and expiratory flow rates. The current study corroborates these findings, demonstrating that hockey players, who engage in rigorous aerobic activity, exhibit superior lung function metrics compared to yogic practitioners. **Smith et al. (2015) and Johnson (2018)**

These studies highlighted the benefits of yogic practices, particularly pranayama, in improving respiratory control and breath-holding capacity. The current study aligns with these findings, showing that yogic practitioners excel in these areas due to the emphasis on mindful breathing techniques. **Ramesh (2016) and Bandopadhyay (2012)**

These studies focused on the effects of yoga on respiratory endurance and muscle strength. The current study extends these findings by comparing yogic practitioners with athletes, demonstrating that while yoga enhances respiratory control and endurance, aerobic sports like hockey improve explosive respiratory power. **Madanmohan (2008) and Mohod & Asanare (2019)**

5.Conclusion

With the limitation of the study and subject on which the present study was conducted it is concluded that significant difference was found between yogic practitioners and intercollegiate hockey players. The intercollegiate hockey players have a higher level of significant than yogic practitioners.

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