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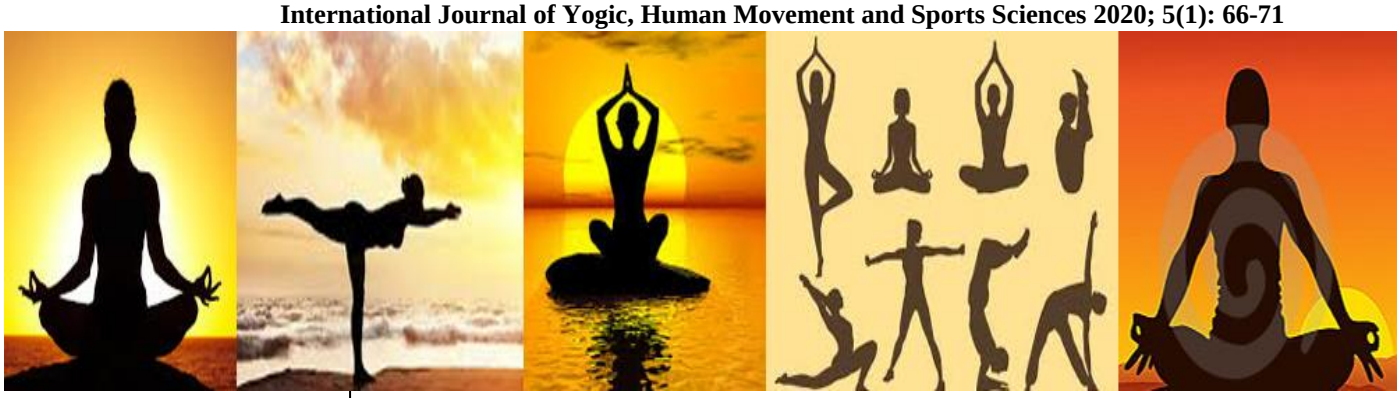

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Study of training induced physiological changes in different training phases of Indian junior hockey players

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Abstract
The study aimed to find out the effect of training on physiological parameters of Indian hockey player. 33 hockey players (age: 19.22±1.58, height: 173.4±5.51, weight: 64.7±5.63kg) who were trained in SAI, NSSC, Bangalore were volunteered for the present study. These athletes were given training according to the scientific training principles and technique of program design. At the two different phases of training i.e., preparatory phase and competitive phase the physiological parameters viz., VO_2max, Heart Rate (HR) @ 8km/ speed, HR @ 10 Km per speed, HR maximum, Recovery HR (after 3 min), back strength, grip strength, flexibility, fatigue index, anaerobic peak lactate after 3 minutes recovery, body fat percentage, muscle mass and bone mass were measured with all safety precautions. The data were statistically analyzed by pooled "t"-test comparing preparatory and competitive phase values of selected variables using SPSS software. The results revealed that there was a significant increase (P<0.001) in the back strength, grip strength (left and right hand), flexibility and fatigue index in competitive phase compared to the preparatory phase. Whereas, significant decrease was observed in HR @ 8Km /hr speed in competitive phase compared to preparatory phase. Study results indicate that the systematic training protocol will lead to enhance the performance related parameters of athletes by adopting training induced physiological changes.

Keywords: Physiological, training phases, junior hockey players

Introduction
Modern trends of elite sport require systematic and prolonged approach to sportsmen, with gradation of efficiency on control and operation of microcycles, mesocycles and on match situations (competition phase). Field hockey is a team sport that offers a total body workout that includes both aerobic and anaerobic components [2, 3]. The development of motor skills, speed, body balance, stamina, and strength are possible outcomes of effective instruction in the sport of field hockey [4, 9, 11]. All the major muscle groups are activated during the game [10]. Aerobic exercises stimulate both the respiratory frequency and the heart beat [7, 8]. Due to aerobic and anaerobic component of training there will be a physiological and anthropological adaptation will occur in the body. The systematic training program can bring about desirable changes in the physiological and anthropometry parameters to enhance the performance outcomes in sport. This study was focused on the field hockey players as the game is popular and played throughout the world. It's necessary to know individual reaction on the body composition and physiology to training program and to analyze rate of breaching of internal organs balance. The anthropometry, physiological variables have important role for the evaluation of training of the athletes. Studies on these parameters of field hockey players particularly in the junior elite age group are lacking in India. In view of it the above study was undertaken to investigate the effect training on selected physiological and anthropometry variables of junior elite Indian male field hockey players.

Material and methodology

Training Protocol

Subjects

Total 33 senior elite Indian male field hockey players (age: 19.22±1.58) represented India volunteered for this study. The selected physiological and anthropometrical parameters were measured in the laboratory at the Preparatory Phase and Competitive Phase of the training. All the tests were conducted at 25 ± 1 ºC, with relative humidity of 60 - 65%. The athletes were informed about the possible complications of the study and gave their consent. The study was conducted at Sports Authority of India, NSSC, Bangalore and was approved by the Ethical Committee of the Institute.

Training Protocol

The players were given training program which involves (i) Preparatory Phase (PP, 8 weeks), and (ii) Competitive Phase (CP, 4 weeks). The volume and intensities of the training components also varies in each phase of training. In the preparatory phase, the volume and intensity of training increased gradually. On the other hand, in the competitive phase the training volume and intensity was changed according to the competition schedule. At the same time highly specified training related to field hockey and practice match play was followed in the competitive phase. The players completed an average of 2 hours of training in morning sessions, which was mostly performed to improve the physical fitness of the players. On the other hand, in the evening sessions 2 hours of technical and tactical training, which included dribbling, tackle, set up movements, penalty corner, penalty shootout and match practice. The training sessions were followed 5 days per week, according to the requirement of the game and competitive demand.

Measurement of Anthropometry Variables

The athletes were tested for their body composition viz., Height, breadth and girth measurements was taken in centimeter (cm) and the skin fold measurements in millimeter (mm).

Bone mass: Players height was measured by stadiometer and humerus bicondylar, femus bicondylar, wrist diameter and ankle length was measured by sliding calliper. Bone mass was calculated using “Matiegka's Bone Mass Formula”.

Skeletal Muscle mass: Players height was measured by stadiometer rod and circumference of upper arm, forearm, thigh and calf was measured by anthropometry tape. The Skeletal muscle mass was calculated using “Matiegka's Skeletal Muscle Mass Formula”.

Percent body fat: Players bicep, triceps, subscapular and supraspinale skin fold was measured for the estimation of fat percentage and calculation was done by “Siri's Body Fat Percentage Equation”.

Measurement of Physiological Variables

The direct assessment of maximal aerobic capacity was carried out using a portable gas analyzer (Metamax 3B, Germany) and a treadmill (Jaeger LE 500; Jaeger, Germany). Subjects were asked to run on treadmill at 0% gradient and at 4-km h-1, 6-km h-1, 8-km h-1, and 10-km h-1 for 2 minutes at each speed, with the face mask attached to the mouth-piece. Then the subject was told to stand on the treadmill with the face mask attached to the mouth-piece, while the treadmill was stationary. Expired gases were sampled breadth-by-breadth and the heart rate, maximum oxygen consumption (VO2 max), carbon dioxide production, pulmonary ventilation and respiratory quotient (RQ) were measured from a mixing chamber using a computerized metabolic analyzer. The back strength was measured by back dynamometer usually composed of a cable tensiometer. To know the maximum isometric strength of the hand and forearm muscles of athletes the hand grip strength was measured by the instrument Handgrip dynamometer. Anaerobic power was measured using cycle ergo-meter (Jaeger, LE 900, Germany) following the Wingate anaerobic test. Strength of the grip and back was measured with the help of dynamometers following standard procedure. The physiological parameters viz., VO_2max, Heart Rate (HR) @ 8km/ speed, HR @ 10 Km per speed, HR maximum, Recovery HR (after 3 min), back strength, grip strength, flexibility, fatigue index and anaerobic peak lactate after 3 minutes recovery were measured at preparatory and competitive phase of training with all safety precaution.

Statistical Analysis

All the values of physiological and anthropometry variables were expressed as mean and standard deviation (SD). The selected anthropometry, physiological variables were compared between preparatory and competitive training phases using Pooled t-test analysis. In each case the significant level was chosen at 0.05 levels. Accordingly, a statistical software package (SPSS-12 version) was used.

Result and Discussion

Differences in Physiological variables i.e., sub maximal HR1 (p<0.01), Back strength (p<0.001), flexibility (p<0.05), Anaerobic Fatigue Index (p<0.05) and Grip strength of Right hand (p<0.001) & left hand (p<0.01) was found significantly higher in Jr. Hockey players, but no significant difference was observed in VO_2max , Sub maximal HR, HRmax, Recovery HR and Anaerobic peak lactate. Cardiovascular parameters such as VO_2 max, HR Max, Recovery does not show much significant change in the current study. Similar results were found in the study done by Idranil Manna et.al., in 2016 i.e., there was no significant changes in VO_2 max and HR max parameters after 12 weeks of training in hockey players. This study results also shows the significant decrease in VO_2 max, HR @8km/hr speed along with insignificant increase in the HRmax and anaerobic peak lactate values. This indicates that the athletes adopted the training and their lactate threshold level is improved in a better way. The lactate threshold is the maximum effort or intensity that an athlete can maintain for an extended period of time with little or no increase in lactate in the blood (5).

The anthropometry parameters shows significant decrease in Body fat percentage and insignificant decrease in bone mass and muscle mass. Indannil manna et. al., also found similar results in hockey players in 2016 after 12 weeks of training (6). The possible reason for reduction in body fat might be due to endurance training which increases greater utilization of fat (7). Similar findings were also noted by some researchers, who studied on field hockey players and reported that percent body fat was significantly lower in-season and postseason vs. preseason (1). Therefore, it can be stated that field hockey players can accumulate body fat in the pre-season and lose body fat during preparatory phase and competitive phase of training. This might be due to intensive training during preparatory phase and high level of performance during the competitive phase. In this study no

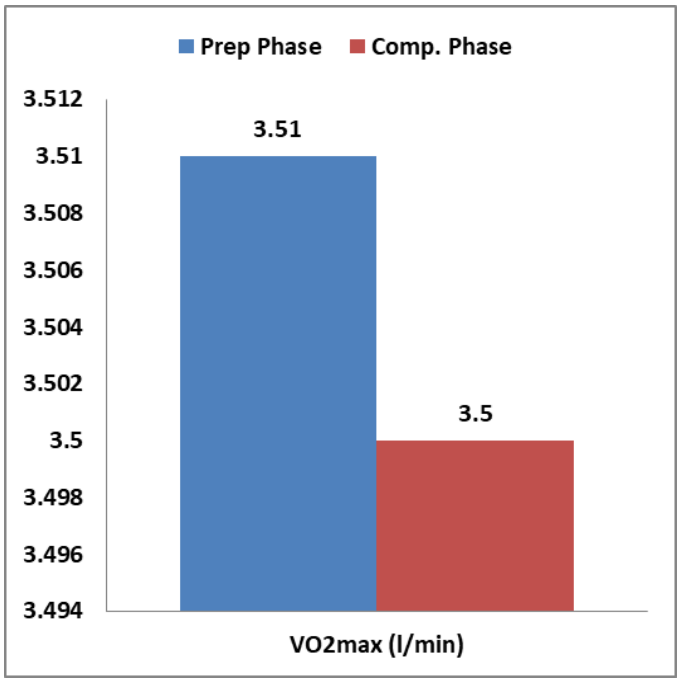
significant difference was observed in stature, body mass and bone mass of the field hockey players after the training program. It might be due to the shorter duration of the training. It has been reported that short term exercise training has no significant effect on body mass of the sports persons (7).

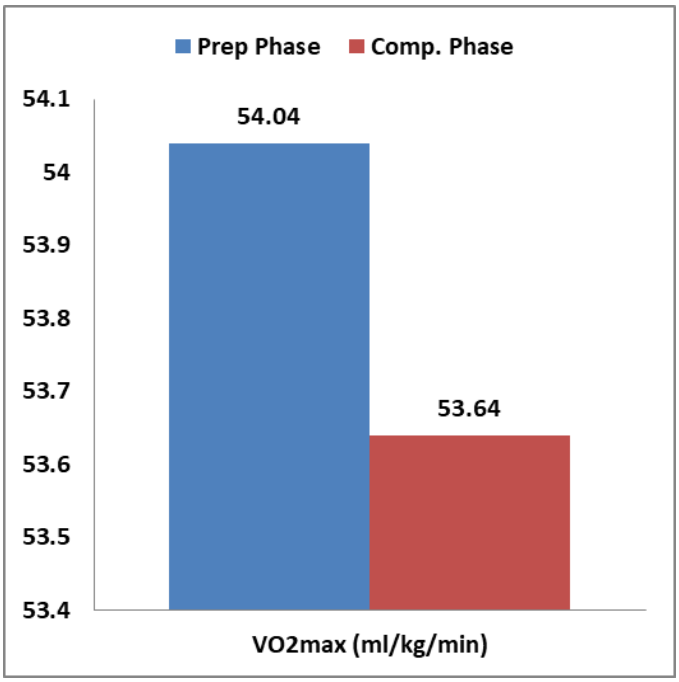
Table 1: Effect of training on Physiological Variables of Jr. Hockey players. Values are expressed as mean ±SEM. $p<0.05$, $p< 0.01$, $p<0.001$ was considered to be statistically significant.

Parameter		Preparatory Phase (n=29)	Competitive phase (n=29)	P-Value	Significance level
VO_2max (l/min)		3.51±.370	3.50±.332	0.816	Ns
VO_2max (ml/kg/min)		54.04±4.04	53.64±2.93	0.495	Ns
HR at 8km/hr speed (bpm)		135±8.98	130±9.92	0.004	$p<0.01$
HR at 10km/hr speed (bpm)		150±9.01	147±8.91	0.069	Ns
HRmax (bpm)		187±7.38	188±6.57	0.226	Ns
Recovery HR (bpm) (after 3min)		106±13.69	107±12.13	0.442	Ns
Back Strength (kg)		140±16.23	152±14.50	0.000	$p<0.001$
Grip strength (kg)	Right hand	45±4.91	48±5.07	0.000	$p<0.001$
	Left hand	46±5.28	49±4.98	0.001	$p<0.01$
Flexibility (inches)		16.54±4.55	18.14±4.23	0.000	$p<0.001$
Fatigue Index		5.6±1.62	7.1±2.02	0.019	$p<0.05$
Anaerobic peak lactate (mmol/l) after 3rd minutes recovery		12.17±2.22	12.68±2.15	0.248	Ns

Table 2: Effect of training on Anthropometry parameters of Jr. Hockey players. Values are expressed as mean ±SEM. $p<0.05$, $p< 0.01$, $p<0.001$ was considered to be statistically significant

Parameter	Preparatory Phase (n=25)	Competitive Phase (n=25)	P-Value	Significance level
Body composition				
Body fat%	11.54± 1.88	10.28 ±1.5	.000	$p<0.001$
Bone Mass (kg)	10.69±1.04	10.5±1.01	.640	Ns
Muscle mass (kg)	31.93±3.22	31.6±6.34	.786	Ns
Somatotype				
Endo	1.85±.397	1.67±.345	.000	$p<0.001$
Meso	4.23±1.00	4.41±.954	.001	$p<0.01$
Ecto	3.09±.946	3.09±.902	1.000	Ns





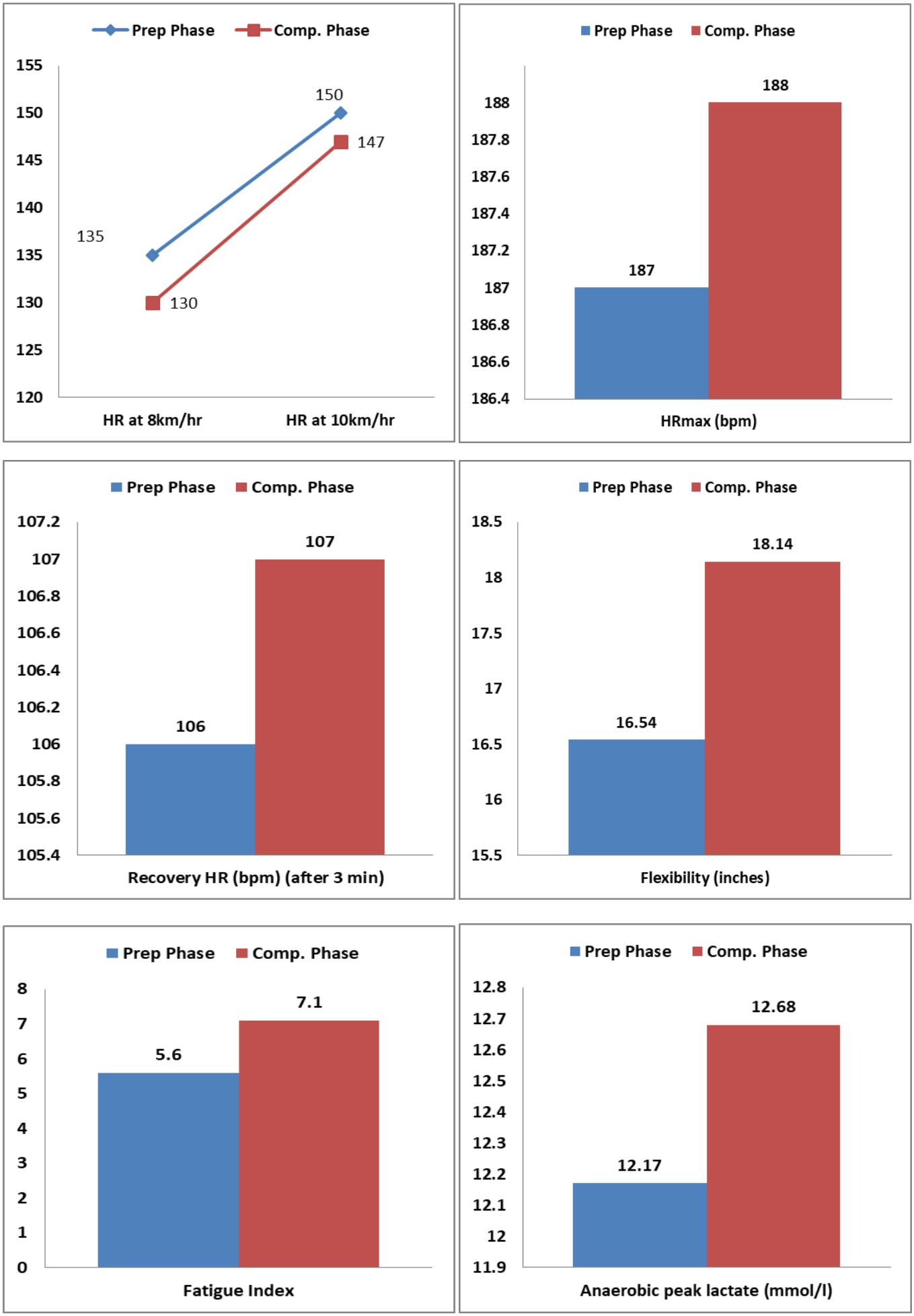


Fig 1: Effect of Physiological variables of Jr. Hockey players. Data are represented as mean ± SEM. *=p<0.05; **=p<0.01; ***= p<0.001 when compared between two phase.

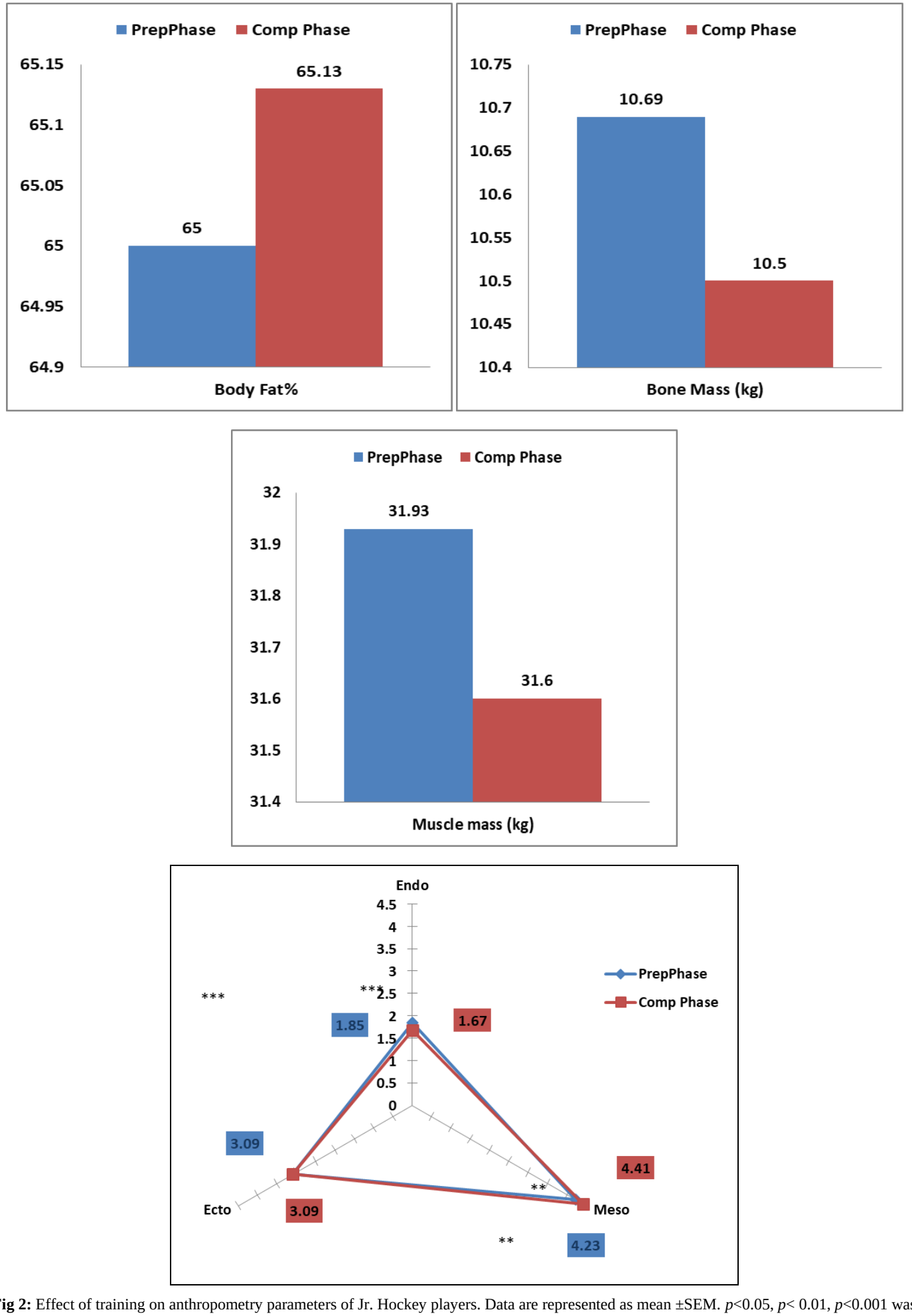


Fig 2: Effect of training on anthropometry parameters of Jr. Hockey players. Data are represented as mean ±SEM. $p<0.05$, $p< 0.01$, $p<0.001$ was considered to be statistically significant.

Conclusion

The present study concludes that the specific training including speed, strength and endurance will enhance the physical fitness and performance of the athletes by adopting training induced physiological changes. Current study will help to understand the player's physical fitness and their predisposition to handle aerobic and anaerobic exercise.

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Reference

1. Astorino TA, Tam PA, Rietschel JC, Johnson SM, Freedman TP. Changes in physical fitness parameters during a competitive field hockey season. J Stren Cond Res, 2004; 18:850-854.
2. Calo CM, Sanna S, Piras IS, Pavan P, Vona G. Body composition of Italian female hockey players. Biology of Sport. 2009; 26:23-31.
3. Carling C, Reilly T, Williams AM. Performance assessment for field sports. Routledge, 2009.
4. Elferink-Gemser MT, Visscher C, Lemmink KAPM, Mulder T. Multidimensional performance characteristics and standard of performance in talented youth field hockey players: A longitudinal study. Journal of Sports Sciences. 2007; 25:481-489.
5. https://www.lactate.com/lactate_threshold_definitions.html
6. Indranil Manna F, Gulshan Lal Khanna, Prakash Chandra Dhara, Effect of Training on Anthropometry, Physiological and Biochemical Variables of Elite Field Hockey Players. International Journal of Sports Science and Engineering. 2010, 2016; 04(04):229-238.
7. Katch VL, McArdle WD, Katch FI. Essentials of exercise physiology, 4th ed. Baltimore, MD: Lippincott Williams & Wilkins, 2011.
8. Kraemer WJ, Fleck SJ, Deschenes MR. Exercise physiology integrating theory and application, 1st ed. Baltimore: MD: Lippincott Williams & Wilkins, 2012.
9. Macutkiewicz D, Sunderland C. The use of GPS to evaluate activity profiles of elite women hockey players during match-play. Journal of Sports Sciences, 2011; 29:967-973.
10. Manna I, Khanna GL, Dhara PC. Effects of training on anthropometry, physiological and biochemical variables of elite field hockey players. International Journal of Sports Science and Engineering, 2010; 4:229-238.
11. Podgorski T, Pawl M. A half century of scientific research in field hockey. Human Movement, 2011; 12:108-123.