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Research Article

COMPARING THE EFFECTS OF CARDIOVASCULAR RESPONSES ON AGILITY DRILLS IN HIGH ALTITUDE BASKETBALL PLAYERS VERSUS SEA-LEVEL BASKETBALL PLAYERS

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A R T I C L E I N F O

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A B S T R A C T

Backround: Basketball is a very demanding and challenging game which requires sustenance of maximum performance in the game. Agility is defined as an effective and quick coupling of braking, changing directions. The higher you go in the atmosphere, thinner the air (less resistance). At high altitudes, however, the density of air changes and becomes thin. Thin air is not nearly as rich in oxygen as the dense, more compressed air found at sea level. **Objective:** The main objectives are to find the extent of cardiovascular responses on Agility Drills, in High Altitude and Sea Level Basketball Players on performing agility drills. **Study Design:** Quasi-Experimental Design. **Procedure:** 36 Sea level and High altitude Basketball players were taken to find the differences in cardiovascular responses, on training with Agility drills, age group of 12 – 18 years, with players who are in offseason. **Results:** High Altitude Basketball Players difference of Pre Test and Post Test Mean values of Heart Rate, Oxygen Saturation and Agility T Test values are 64.38, 61.88, 97.38, 99.05, 12.55 and 11.29 respectively. Sea Level Basketball Players difference of Pre Test and Post Test Mean values of Heart Rate, Oxygen Saturation and Agility T Test values are 67.38, 64.27, 98.83, 99.11, 12.31 respectively. There was significance in the post test values of Agility T Test which is a functional scale for agility drills in between group A and group B. **Conclusion:** In this study we conclude that there was no significant difference in the Cardiovascular Responses in High Altitude Basketball Players and Sea Level Basketball players.

INTRODUCTION

Basketball has extended worldwide popularity and fascinated players and spectators with its dynamic characteristics as a team sport[1].

Basketball is a very demanding and challenging game which requires sustenance of maximum performance throughout the game. The basic requirement of the basketball play is the ability to create lower body power that will include the adequate strength of the muscles, endurance of the muscles in the sustenance of activity, speed of movement and power of the muscles in bringing the movement[2].

The body reacts in differing ways at varying levels of altitude. This will be extremely important to know when traveling to altitude and exercising at altitude. There are different classifications of altitude, and each has its own effects on the human body[5, 6].

- High altitude is classified as 1,500 m-3,500 m. (Kodaikanal 2133 m)
- Very high altitude is classified as 3,501 m-5,500 m
- Extreme altitude is at 5501 m or greater

In high altitude air density decreases, progressively with above sea level. For example, barometric pressure at sea level averages 760mm Hg; at 3048 m, the barometer drops to 510mm Hg. At an elevation of 5486 m, the pressure of a column of air at the Earth's surface equals about one-half of its sea-level pressure. An increase in the blood's oxygen-carrying delivers the most important longer-term adjustment to altitude exposure. Two factors account for this adaptation are an initial decrease in plasma volume followed by an increase in erythrocytes and hemoglobin synthesis.

The depth of respiration increases, pressure in pulmonary arteries is increased, "compelling" blood into portions of the lung which are normally not used during sea level breathing, the body produces more red blood cells to transport oxygen, and the body produces more of a specific enzyme that facilitates the release of oxygen from hemoglobin to the body tissues.

The depth of respiration increases, pressure in pulmonary arteries is increased, pushing blood into portions of the lung which are normally not used during sea level breathing, the body produces more red blood cells to carry oxygen, and the

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body produces more of a particular enzyme that facilitates the release of oxygen from hemoglobin to the body tissues.

Agility is commonly defined as an effective and quick coupling of braking, altering directions and accelerating while upholding motor control in either a vertical or horizontal direction. An athlete who displays good agility will most likely possess other qualities such as, dynamic balance, spatial awareness, rhythm, as well as visual processing 3. Mounting agility in children is a process that continues over a long period of time. The basic methodology of agility training implies the learning of a basic walking technique, running technique, change of direction, jumps, and landings (Wroble & Moxley, 2001).

To improve agility, the players must perform eminence repetitions of a variety of agility drills that mimic the movements required during the game. Agility drills train the body to react more quickly and under control. By performing drills constantly in a practice setting, players become better when the skill is needed during the game. As jump shots and free-throws help the players to become a better shooter, practicing agility will thereby make a better and well-organized all-around player4.

So this study aims for comparing the effects of cardio vascular responses on agility drills in high altitude basketball players versus sea-level basketball players.

METHODOLOGY

Study Design :Quasi Experimental
Study Type :Pre and Post Test
Sampling Method : Convenient Sampling
Sample Size : 36
Study Duration :6 weeks
Study Setting :Vidyodhaya Higher Secondary School, T.Nagar
Santhome Higher Secondary School,
Santhome St Peters Higher Secondary School,
Kodaikanal (2100 m)

Materials Used

1. Fit Bit Wrist Band
2. Pulse Oxymeter
3. Agility Ladder
4. Space Marking Cones
5. Dot Drills Markers
6. Stop Watch

Figure 1 Fit Bit Wrist Band

Figure 2 Pulse Oxymeter

Figure 3 Agility Ladder

Figure 4 Space Marking Cones

Figure 5 Dot Drill Markers

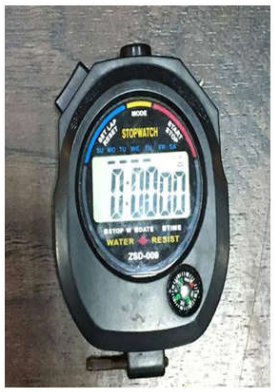


Figure 6 Stop Watch

Procedure

An approval from the Institutions Ethical Committee was taken and the players were selected based on inclusion and exclusion criteria, then informed consent was taken from them.

Pre-Test assessments were taken and explained about the procedures that were followed for duration of 6 weeks.

- Group A with High altitude basketball players
- Group B with Sea-level basketball players

Warm up exercises were given prior to the training sessions for 10 minutes, this includes

- Mild dynamic stretches, Running, Free exercises

Cool down sessions were followed for 5 minutes; here performance was reduced to prevent from delayed onset of muscle soreness.

- Slow and relaxation training was encouraged.

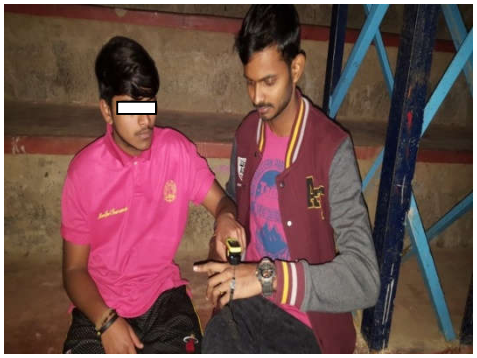


Figure 7 Assessing Oxygen saturation with Pulse Oxymeter

Agility Drills: Dot drills (Week 0-1)

S.no	Dot drills	Sets	Repetitions
1.	"X"	10	2
2.	Hour Glass	10	2
3.	One foot Hops	10	2
4.	Dance dance revolution	10	2
5.	Lateral Hops	10	2
6.	X with Spin	10	2

Dot drills (Week 0-1) 10 Sets and 2 Reps Recovery period 15 min

- **"X"** Start with feet apart at the bottom of the mat. Hop to the middle dot with feet together. Then hop to the top two dots with feet apart. Then hop backwards in the same pattern. Face the same direction the whole time.
- **Hour Glass** Begin with feet together at the bottom right, hop to the middle, then the top right, hop across to the top left dot, back to the middle, then to the bottom left dot, and then back to the beginning. Face the same direction the whole time, and keep your feet together the whole time.
- **One foot Hops**For the right foot use the right side of the mat and for the left foot the left side. Begin at the bottom of dot of the mat, hop to the middle, then to the top, and back in the same pattern. Face the same direction the whole time.
- **Dance dance revolution** Start with your feet together on the middle dot, jump to the opposing corners with feet apart, return to the middle, and then switch to the other corners. Make sure you face the same direction the whole time.
- **Lateral Hops** Feet together facing the same direction the whole time, jump side to side between the two dots that are farther apart.
- **X with Spin** With the feet apart at the bottom of the mat, then hop to the centre dot with feet together. Now hop to the top two dots with feet apart. Followed by hopping backwards in the similarform. On same direction the whole time, and make 180 degree turn at the top and bottom of the marker.

Figure 8 Performing Dot Drills by a Basketball Player

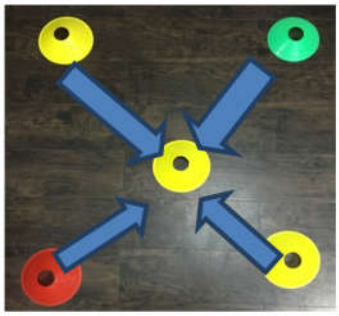


Figure 9 "X" Dot Drill

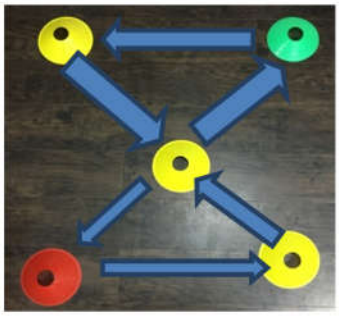


Figure 10 Hour Glass

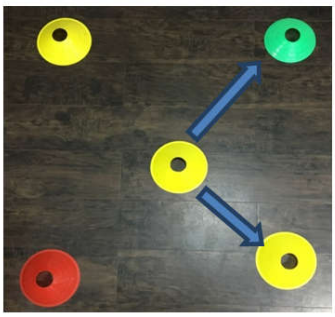


Figure 11 One foot Hops

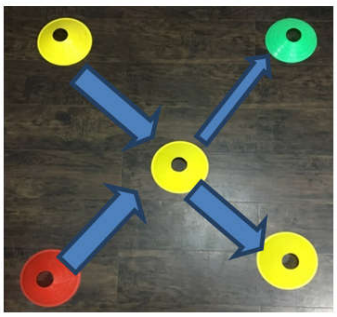


Figure 12 Dance dance revolution

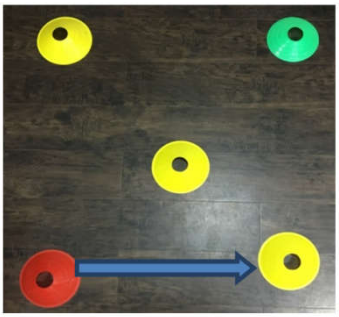


Figure 13 Lateral Hops

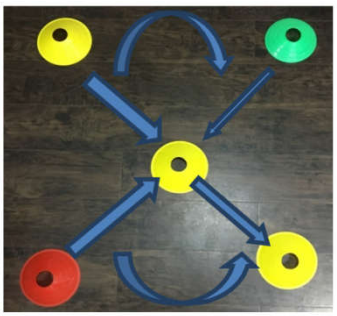


Figure 14 X with Spin

Ladder Drills (Week 2-3) 10 Sets and 2 Reps

Recovery period is given for 15 min post exercises

S.no	Ladder drills	Sets	Repetitions
1.	2 Feet In, 1 Foot Out	10	2
2.	2 Feet In, 2 Feet Out	10	2
3.	Lateral 2 Feet In, 2 Feet Out	10	2
4.	90 Degree Jumps	10	2
5.	Single Leg Jumps(Forward / Backward)	10	2
6.	Single Leg Lateral Jumps (Left / Right)	10	2

Feet In, 1 Foot Out

Move onward through the ladder with the spacing of two feet within each box, and then move one foot outside each box spaced equally.

Feet In, 2 Feet Out

Move onward through the ladder placing with a space of two feet inside each box, then one foot outside each box spaced equally, and then the second foot that steps out is stepping right back in on the same box placed.

Lateral 2 Feet In, 2 Feet Out

Moving side way, shifting the steps spaced two feet in each box equal, then move two feet out of each box. Then moving to the left, the left foot should lead the footwork in lateral way movement.

90 Degree Jumps

Start with both the feet in the first box with remaining boxes to your right equally, then jump out of the box turning 90 degrees rotation, so that the ladder will be beside the foot. Next quickly jump into the next box turning 90 degrees rotation, now the ladder will be on the left side. Proceed in this pattern through each box.

Single Leg Jumps (Forward / Backward)

Jump side to side through the ladder on one leg moving forward to each box equally. At the end of the ladder completed one set, and then moving backwards similarly to the other end.

Single Leg Lateral Jumps (Left / Right)

Jump forward and backwards on one leg moving laterally left through the ladder equally, then do the same then moving back to the right, similarly to the other end.

Figure 15 2 Feet In, 1 Foot out

Figure 16 2 Feet In, 2 Feet Out

Figure 17 Lateral 2 Feet In, 2 Feet Out

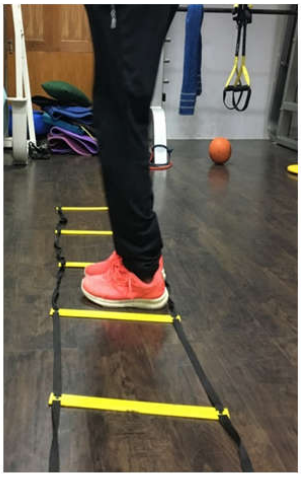


Figure 18 90 Degree Jumps

Figure 19 Single Leg Jumps (Forward / Backward)

Figure 20 Single Leg Lateral Jumps (Left / Right)

Cone drills (Week 4-5) 10 Sets and 2 Reps

Recovery period is given for 15 min post exercises

S.no	Cone drills	Sets	Repitations
1.	X Lane Drill	10	2
2.	Madison Drill	10	2
3.	ZigZag Drill	10	2
4.	4 Cone Diagonal Drill	10	2
5.	T Cone Drill	10	2
6.	Figure 6 Drill	10	2

X-Lane Drill

Set-up Procedures:

1. Using four cones, separate cones each by 10 yards.
2. Begin at cone one (1) and end with cone one (1).
3. Drill: Sprint from cone 1-2; shuffle from cone 2-3; sprint from cone 3-4; and shuffle from cone 4-1.

Madison Drill

Set-up Procedures

1. Place cones (1), (3), (5) five yards apart in a straight line. Place cone two (2), (4) ten yards in front of cone (1), (5)

Drill: Begin at cone 1 and sprint to cone 2; Backpedal from cone 2 to cone 3; Sprint from cone 3 to cone 4; Backpedal from cone 4 through cone 5.

ZIG-ZAG

Set-up Procedures:

1. Using four cones, separate 5 yards apart and arrange equally.
2. Begin at cone one (1) and finish the drill 10 yards past cone four (4).
3. 3. Drill: Sprint from cone 1-2; shuffle from cone 2-3; sprint from cone 3-4; and shuffle from cone 4 to 10 yards beyond it

Four (4) Cones

Set-up Procedures:

1. Using four cones, separate each cone by 10 yards.
2. Drill: Sprint from cone 1-2; shuffle fromcone 2-3; back pedal from 3-4; and sprint from 4-1

T Cone Drill

Set-up Procedures

1. Place cone one (1) 10 yards away from cone two (2), keep the cone three (3) five yards to the left of cone two (2). Place cone four (4) five yards to the right to the cone two (2).
2. Drill: Sprint from cone 1 to cone 2; shuffle from cone 2 to cone 3; shuffle from cone 3 to cone 4; shuffle from cone 4 to cone 2 and backpedal from cone 2 to cone 1

Figure 6 Drill

Set-up Procedures

1. Using four cones, separate cones each by 10 yards.
2. 2. Drill: Sprint from cone 1-2, shuffle from cone 2-3, sprint from cone 3-4, and shuffle from cone 4-1

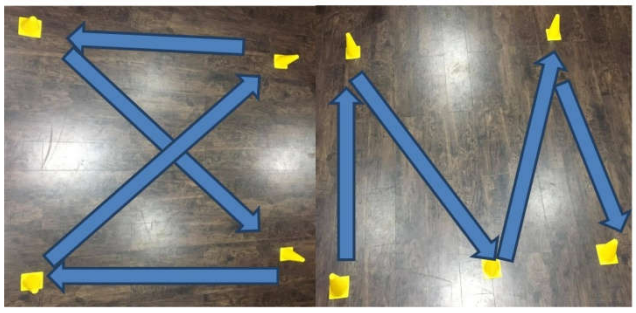


Figure 21 X Lane Drill

Figure 22 Madison Drill

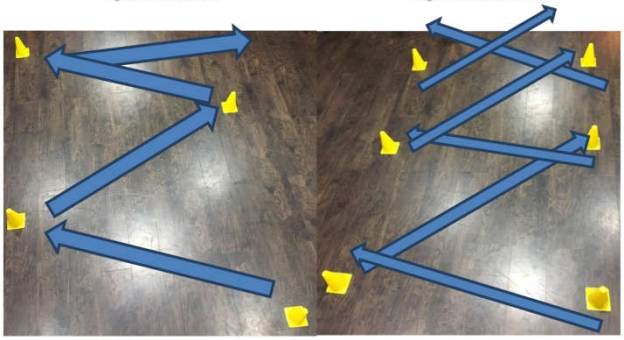


Figure 25 ZigZag Drill

Figure 26 Figure 6 Drill

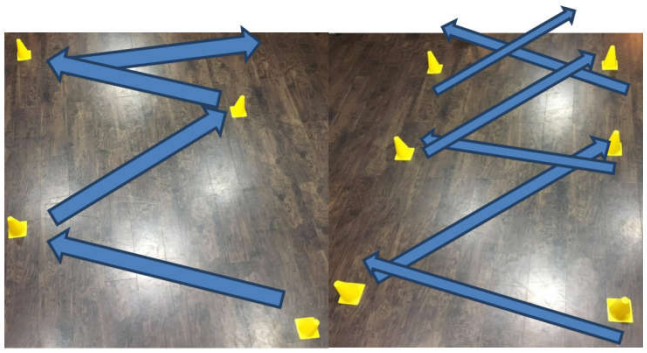


Figure 25 ZigZag Drill

Figure 26 Figure 6 Drill

Outcome Measures

- Agility T test
- Heart Rate
- Oxygen Saturation (Pulse Oxymeter)

Agility T Test

The subject starts at cone A. On the command, the subject sprints to cone B and touches the base of the cone with their right hand. They then turn left and shuffle sideways to cone C, and also touch its base, this time with their left hand. Then shuffling sideways to the right to cone D and touching the base with the right hand. Then shuffle back to cone B touching with the left hand, andrun backward to cone A. The stopwatch is at a standstill as they pass cone A. (5 yards = 4.57 m, 10 yards = 9.14 m).

Scoring: The trial will not be counted if the subject crosses one foot in front of the other while shuffling, fails to touch the base of the cones, or fails to face forward throughout the test. Take the best time of three successful trials.

Figure 27 Agility T Test Setting

Data Analysis

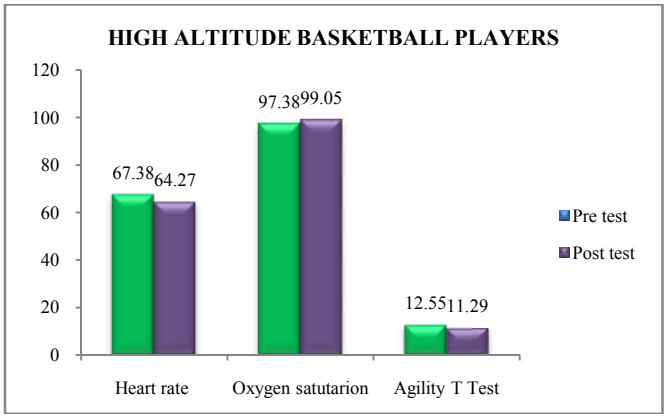
The recorded data were tabulated and the data was analysed using statistical package for social science (SPSS) to present the findings of comparing the effects of cardiovascular responses in sea level basketball players versus high altitude basketball players.Data analysis was done using IBM SPSS Software version 21.0. “P” value was set at less than 0.05 as significance for all analysis; “Paired T” test was done”.

Table 1 Pre Test and Post Test values of Heart Rate, Oxygen Saturation and Agility T Test among Group A Players after AgilityDrillsTraining for 6 weeks

High Altitude Players		Mean	DF	SD	Paired T Test	P Value
Heart Rate	PRE TEST	67.38		4.16	4.33	
	POST TEST	64.27	35			.00
Oxygen Saturation	PRE TEST	97.38		1.81	-4.730	.000
	POST TEST	99.05	35	2.12		
Agility T Test	PRE TEST	12.55		0.71	10.449	.000
	POST TEST	11.29	35	0.88		

1. There is significant difference ($p<0.05$) between pre-test and post-test Heart Rate values after Agility Drillsamong Group A players which indicates a reduction of heart rate post Agility Drills training for a period of 6 weeks.
2. There is significant difference ($p<0.05$) between pre-test and post-test Oxygen Saturation values after Agility Drillsamong Group A players which indicates an increase of oxygen saturation post Agility Drills training for a period of 6 weeks.
3. There is significant difference ($p<0.05$) between pre-test and post-test Agility T Test values after Agility Drillsamong Group A players which indicates a

reduction of time in Agility T test post Agility Drills training for a period of 6 weeks.

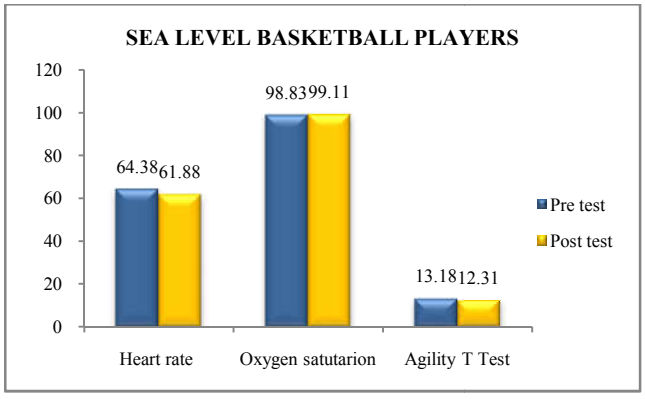


Graph 1 Pre Test and Post Test values of Heart Rate, Oxygen Saturation and Agility T Test among Group A Players after Agility Drills Training for 6 weeks

Table 2 Pre Test and Post Test values of Heart Rate, Oxygen Saturation and Agility T Test among Group B Players after Agility Drills Training for 6 weeks

Sea level players		Mean	DF	SD	Paired T Test	P Value
Heart rate	Pre test	64.38	35	4.42	4.198	.001
	Post test	61.88		4.32		
Oxygen saturation	Pre test	98.83	35	1.54	-1.42	.172
	Post test	99.11		1.45		
Agility T test	Pre test	13.18	35	1.11	7.90	.000
	Post test	12.31		1.13		

1. There is significant difference ($p<0.05$) between pre-test and post-test Heart Rate values after Agility Drillsamong Group B players which indicates a reduction of heart rate post Agility Drills training for a period of 6 weeks.
2. There is no significant difference ($p<0.05$) between pre-test and post-test Oxygen Saturation values after Agility Drillsamong Group B players which indicates an increase of oxygen saturation post Agility Drills training for a period of 6 weeks.
3. There is significant difference ($p<0.05$) between pre-test and post-test Agility T Test values after Agility Drillsamong Group B players which indicates a reduction of time in Agility T test post Agility Drills training for a period of 6 weeks.

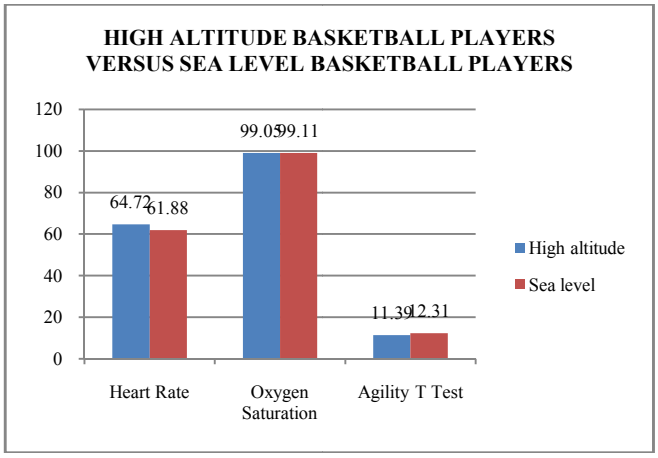


Graph 2 Pre Test and Post Test values of Heart Rate, Oxygen Saturation and Agility T Test among Group Statistics Group B Players after Agility Drills Training for 6 weeks

Table 3 Comparison of Post Test values of Heart Rate, Oxygen Saturation and Agility T Test among Group A (High Altitude Basketball Players) and Group B (Sea Level Basketball Players) after Agility DrillsTraining for 6 weeks

Group Statistics						
	Group	N	Mean	SD	Independent T Test	P Value
Heart Rate	High Altitude Basketball Players	34	64.27	5.06	1.522	.137
	Sea Level Basketball Players		61.88	4.32		
Oxygen Saturation	High Altitude Basketball Players	34	99.05	2.12	.092	.928
	Sea Level Basketball Players		99.11	1.45		
Agility T Test	High Altitude Basketball Players	34	11.29	0.88	3.025	.005
	Sea Level Basketball Players		12.31	1.13		

1. There is no statistically significant difference ($p>0.05$) between post-test Heart Rate values of Agility Drills between Group AHigh Altitude Basketball Playersand Group BSea Level Basketball Players, who underwent Agility Drills training for 6 weeks.
2. There is no statistically significant difference ($p>0.05$) between post-test Oxygen Saturation values of Agility Drills between Group AHigh Altitude Basketball Playersand Group BSea Level Basketball Players, who underwent Agility Drills training for 6 weeks.
3. There exist a statistically significant difference ($p<0.05$) between post-test Agility T Test values of Agility Drills between Group AHigh Altitude Basketball Playersand Group BSea Level Basketball Players, indicating there was a better outcome in Reduction in time among subjects who underwent Agility Drills training for 6 weeks.



Graph 3 Comparison of Post Test values of Heart Rate, Oxygen Saturation and Agility T Test among Group A (High Altitude Basketball Players) and Group B (Sea Level Basketball Players) after Agility Drills Training for 6 weeks

RESULTS

According to Table 1 and Graph 1, Group A (High Altitude Basketball Players): There was a difference of Pre Test and Post Test Mean values of Heart Rate, Oxygen Saturation and Agility T Test the values were 67.38, 64.27, 97.38, 99.05, 12.55 and 11.29 respectively. The Standard Deviations are 4.16, 5.06, 1.81, 2.12, 0.71 and 0.88. Hence, the mean value of

Heart Rate, Oxygen Saturation and Agility T Test are statistically significant which shows improvement in the exercise regime for cardiovascular responses and agility performance.

According to Table 2 and Graph 2, Group B (Sea Level Basketball Players):There was a difference of Pre Test and Post Test Mean values of Heart Rate, Oxygen Saturation and Agility T Test the values were 64.38, 61.88 98.83, 99.11 and 12.31 respectively. The Standard Deviations are 4.42, 4.32, 1.54, 1.45, 1.11, and 1.13. Hence, the mean value of Heart Rate and Agility T Test are statistically significant which shows improvement in the exercise regime for cardiovascular responses and agility performance.The mean value of Oxygen Saturation is statistically not significant which stated that the oxygen levels are unchanged.

According to Table 3 and Graph 3, Group A Vs Group B (High Altitude Basketball Players Vs Sea level Basketball Players): Difference of Post Test Mean values of Heart Rate, Oxygen Saturation and Agility T Test the Mean values are 64.27, 61.88, 99.05, 99.11, 11.29 and 12.31 respectively. The Standard Deviations are 5.06,4.32,2.12, 1.45, 0.88 and 1.13. Hence, the mean value of Agility T Test is statistically significant which shows improvement in the exercise regime for agility performance. The mean value of Heart Rate and Oxygen Saturation is statistically not significant which stated that the cardiovascular response and oxygen levels are unchanged.

In this study, it was found out that there was significance in the post test values of Agility T Test which is a functional scale for agility drillsfor basketball players in between group A and group B. There was no significance in Oxygen Saturation. There was significance in Heart Rate, Oxygen Saturation and Agility T Test in Group A (High Altitude basketball Players) and there was significance in Heart Rate and Agility T Test in Group B (Sea level basketball Players).

DISCUSSION

This study has been designed to compare the cardiovascular responses on agility drills in high altitude basketball players and sea level basketball players.

Here in this study, we had measured Heart Rate, Oxygen Saturation, and Agility among Sea level Basketball players and High altitude Basketball players in the age group of 12-18 years. The samples selected are the resident of High Altitude and Sea level and were residing there for past 6 years. Pretest reveals that there was a higher mean Heart rate among High altitude Basketball players (67.38) than sea level players (64.38) also there found to be a Lower mean Oxygen saturation level among High altitude Basketball Players (97.38) than Sea level players (98.83).

This can be explained by the fact that Oxygen saturation of hemoglobin is higher in sea level than in high altitude. So this causes reduced oxygen transport to working muscles, during exercises. The body's response to the above is to produce additional Red blood cells to compensate the hemoglobin desaturation.Thus providing more oxygen molecules per unit of blood (Grover, Weil, Reeves 1986). As each litre of blood is carrying less oxygen, more blood must be pumped to meet the requirement which is achieved through an increase in heart rate as stroke volume has already reached its maximum.

Then the selected subjects of both the groups underwent agility training for a period of six weeks at their respective places following which the post-test measurements were taken.

In this study, there is a significant reduction of heart rate post agility drills training for 6 weeks, among Group A (High Altitude Basketball Players) $p<0.05$. This can be explained by the effect of training on stroke volume and Heart rate. After a period of training, stroke volume is increased at rest, during submaximal and maximal exercise; conversely, post training heart rate is decreased at rest and during submaximal exercise. This goes in hand with Epthorp. J *et al* 2014 who concluded that athletes, when trained at extremely high altitude, reports hypoxemia and alkalosis26.

Grover RF, Weil JV, Reeves JT stated that the hypoxia of high altitude produces sustained stimulation of the sympathetic nervous system and this increases heart rate.

The results reveal a reduction of Resting Heart rate post agility training for a period of 6 weeks among sea level Basketball players also which can be due to a complex network and interaction of nerves and chemicals that accommodate the distribution of blood throughout the body. The resting heart rate is under the influence of the autonomic nervous systems-sympathetic (accelerator) and parasympathetic (depressor) nerves.

This is supported by Katona, McLean, Dighton, & Guz, 1982; Smith, Hudson, Graitzer, & Raven, 1989 who stated that the lowered resting heart rate from exercise training is proposed to be primarily due to an increase in the parasympathetic activity with a minor decrease in sympathetic discharge. The result of this study is in contradictory to Vogel and Harris, 1965 who stated an increase in the cardiac output after exercise training.
This study shows an increase in Oxygen Saturation post agility drills training for a period of 6 weeks training among high altitude basketball players, which can be explained by the amount of hemoglobin in blood increases at high altitude. The results are in contradictory with Moazami, *et al*., 2013; Barcroft, 1975 who indicated that there was a decrease in oxygen saturation of arterial blood during exercise whereas the above results go in hand with Penaloza *et al* 1962 and friends similarly reported that they obtained a decrease in the oxygen saturation with exercise.

The results details an increase in Oxygen saturation as measured by pulse Oxymeter post 6 weeks of agility training among High altitude level basketball players that can be explained by the physiology of exercises that increase the capacity of the heart to pump blood and increases the capacity of the lungs.

The results of this study indicates no difference between pre-test and post-test Oxygen Saturation values after agility drills training among sea level basketball players, Although there was a mild reduction in oxygen saturation during agility training and this decrease is due to the sudden need for oxygen in the skeletal working muscles and when the oxygen saturation was taken by Pulse Oxymeter after a ten minutes of cool down phase it was found to be similar to the pretest values.

There was a significant reduction in time for Agility T Test among high altitude basketball players post agility drills training for a period of 6 weeks, which can be explained by adequate tissue oxygenation in healthy skeletal muscle,

physiological adaptations that have been subsequently implicated in the improvement in exercise performance during altitude acclimatization.

Also, the performance often improves because of low air density at altitude than at sea level and the fact goes like the density of air at altitude offers less resistance to movements at high speeds which may have indirectly improved the performance.

Similarly, there was an improvement in time for Agility T Test among sea level basketball players, which has an evidence with that short- or long-term altitude exposure does not affect maximal force output, fast-to-slow fiber motor unit ratio, or motor activation pattern during isometric exercise.

However, it was not until half a century later that scientists suggested that the additive stimulus of environmental hypoxia could potentially compound the normal physiological adaptations to endurance training and accelerate performance improvements. A lot of studies supports that aerobic training has been shown to improve performance at altitude, whereas no unequivocal evidence exists to support the claim that performance at sea level is improved. Furthermore, no studies exist on the effect of agility training on altitude and sea level players and also very few studies prevail on this young age group on 12-16 years.

Altogether this study found a decrease in heart rate, improvement in agility, post agility training for a period of six weeks in high altitude and sea level basketball players. But on comparing this study found that agility training had a better effect and a great significant improvement when trained in High altitude and also a reduction in heart rate and increase in oxygen saturation may be an added advantage. It would seem logical to assert that basketball players may benefit from altitude training especially in improving their agility skills.

This study concludes that there was no significant difference in Heart Rate and Oxygen Saturation in High Altitude Basketball Players and Sea Level Basketball Players but there were significant differences in agility levels of high altitude players were found to have a better agility outcome than the sea level players.

CONCLUSION

This study concludes that there wasa significant reduction in Heart Rate and increase in Oxygen Saturation and improvement in Agility Drills Training among both high altitude basketball players and sea level basketball players.

On comparison, there was no significance difference in Heart Rate and Oxygen Saturation betweensea level basketball players and high altitude basketball players.Whereas there was an improvement in Agility Drills Training among high altitude basketball players than in sea level basketball players.
Thus, exercises involving Agility Drills can be incorporated as part of training protocols when the players are in need of Agility in spite of altitude levelsthese training protocolsarebeneficial.

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