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ORIGINAL

THE INFLUENCE OF ALTITUDE TRAINING ON ENDURANCE PERFORMANCE: A SYSTEMATIC REVIEW

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ABSTRACT

In this systematic review, we review the evidence for the effects of altitude training on endurance performance, the physiological mechanisms behind its effects, successful and unsuccessful methods of altitude training, and important factors associated with its effectiveness. The purpose of altitude training is to build fitness based on the premise that altitude training will increase aerobic capacity through adaptation, such as increased red blood cell production and improved mitochondrial efficiency. The review summarizes disparate findings from different sports and training regimens, yet, provides both positive and liability of the benefits of such approaches. Altitude training outcomes are influenced critically by the factors of altitude level, training duration, intensity and individual acclimatization. A promising approach discussed is 'live high train low' where athletes have the advantage of hypoxia benefits while continuing high intensity training at lower altitudes. Even with all that evidence of altitude training, the review recommends more work be done to find optimal protocols and produce more consistent, long-term results about how altitude training affects endurance performance. Additionally, a number of studies point to a positive benefit of training at high altitude but living at low altitude (called 'live high, train low') in which athletes can optimize their altitude adaptive advantages while continuing intense training at sea level. Finally, the review calls for more research on optimal protocols of altitude training and its long-term effect on endurance performance, since the evidence is contradictory on different sports and training regimens.

KEYWORDS: Altitude Training (AT), Endurance Performance (EP), Physiological Mechanisms (PM)

1. INTRODUCTION

The word altitude Training means those training which are provided at high elevations mostly above 1500 meters for the objective of improvement of athletic performance. There are variety of benefits of high-altitude Training for athletes. These are some particular adaptations related to physiology, anatomy, psychology, and others. If we talk about physiological adaptations, we may come to know that the most important adaptation is the aspect of increased red blood cell production. As we know red blood cells are directly involved in the transportation of oxygen in the body so when there is an increased number of red blood cells in the body, there will be better aerobic activity in athletes(Baranauskas et al., 2021). Recent studies have shown that altitude Training results in the production of erythropoietin in the body which is mainly responsible for the increased production of red blood cells. The other important physiological adaptation related to high altitude Training is the aspect of better utilization of oxygen in muscles. It has been seen that at high altitudes there is less concentration of oxygen so the body becomes adapted to low levels of oxygen, in this way, there is efficient utilization of oxygen in muscles(Flaherty et al., 2016). The next most important physiological adaptation is the aspect of increased mitochondrial density. As we know mitochondria is the powerhouse of cells because it is involved in energy production. The greater number of mitochondria per cell, the more energy production there. Recent studies have shown that high-altitude Training helps in increasing the number of mitochondria per cell. The other important aspect of physiological adaptation is related to the buffering capacity of the body. There is production of lactic acid in the body because of anaerobic respiration. This production of lactic acid may result in fatigue in the body. By high altitude Training, there is enhanced buffering capacity in the body and this buffering capacity helps to buffer lactic acid so there is a delay in fatigue(Płoszczyca et al., 2018). There are also some important benefits of high-altitude Training on cardiovascular health in athletes. The first important benefit is that high-altitude Training enhances the cardiac output in athletes. It means that the heart is enabled to pump more blood per minute to muscles. As we know when there is better vasodilation, there is an efficient flow of blood to muscles for nutrient exchange. This can also be gained by high altitude Training because it is useful for vasodilation. Vasodilation means dilation of blood vessels for efficient blood flow. Recent studies have shown that the more number of capillaries in muscles, the better blood flow takes place(Prosper et al., 2023; Saunders et al., 2009). In this regard, high-altitude Training helps in more capillarization as well. Because of high altitude Training, there is increased production of nitric oxide in the body and this nitric oxide helps in vasodilation thus effective blood flow. If we talk about biochemical adaptations in athletes because of high altitude Training, we may come to know that because of high altitude Training, there is an increased amount of myoglobin in muscles(Hamlin et al., 2018). Myoglobin is responsible for oxygen storage and oxygen delivery in muscles. It has also been seen that there are

some metabolic changes in athletes because of high-altitude Training. In athletes, there is more uptake and utilization of glucose in the body as a result of high-altitude Training. Not only this but there are some important psychological adaptations in athletes as well. The first important psychological adaptation is the aspect of improved mental toughness. We can define mental toughness as the ability to process and adapt to any change in the environment(Mujika et al., 2019). It has been proved that high altitude Training helps to enhance mental toughness in athletes because they become habitual of living in drastic environment. It is very important for athletes because mental toughness may lead to success and in some cases, if there is no success, athletes will be able to confront failure as well. The aspects of concentration and focus are essential for improvement in the performance of athletes. These aspects are mostly dependent upon better cognitive functions in athletes(Rusko et al., 2004). When there is improvement in cognitive functions in athletes because of high altitude Training, there will be betterment in concentration and focus as well. Teamwork is the key to success for athletes because teamwork helps in better interaction and highlighting the areas for improvement. Teamwork will be better when there is effective team cohesion. For effective team cohesion, there is a need for continuous communication. Recent studies have shown that high-altitude Training provides an opportunity for communication among team members(Chen et al., 2023). This will lead to better team cohesion and overall improved performance of the whole team. There is a need for flexibility and adaptability in athletes so that they can adapt to changing environmental conditions. These aspects can only be gained by high altitude Training in athletes. There are also some other adaptations in athletes as a result of high-altitude Training. The first and foremost adaptation is changes in body composition. As we know the better performance of an athlete is dependent upon muscle mass and muscle power. With the help of high altitude Training, there is an enhancement in muscle mass that will ultimately improve muscle power as well(Bailey & Davies, 1997). For better performance in athletes, there is a demand for a low amount of body fat. High altitude Training helps in decreasing the amount of body fat as well. The immune system of the body is the first defense against diseases. So, we can say that when there is a powerful immune system, the athletes will be less susceptible to diseases. High altitude Training helps in the improvement of the immune system in various ways. The other important Adaptation is related to the aspect of increased human growth hormone production. Human growth hormone is produced throughout the whole life but the amount of this hormone varies. The production of this hormone can be enhanced by high-altitude Training in athletes. This human growth hormone will work for the growth of muscles. In most cases, athletes may become injured because of high-intensity activities. These injuries may take time to repair and recover. In this regard, it has been seen that high-altitude Training will help in the enhancement of the process of recovery and repair in athletes. Although there are many benefits of

high-altitude Training for athletes there are some negative aspects related to it. For example, in some cases, it has been seen that blood volume decreases because of high-altitude Training(Jones et al., 2014; Li et al., 2024).

1.1 Research Objective

The main objective of this research is to discuss the influence of high-altitude Training on the endurance performance of athletes. These studies have effectively explained about benefits of high-altitude Training for the physical and mental health of athletes.

2. Literature Review

A type of training that is specific for athletes in which exercise is involved which is usually performed at very high altitudes to bring improvement in the performance comes under the category of altitude training. Other names which are generally used for this training are high altitude training and hypoxic training. Let's talk about its way of working. At the place where is altitude is very high the layer of air will become very thin to bring a reduction in the level of oxygen. It will become the reason for the production of high amounts of red blood cells(Stellingwerff et al., 2019). More red blood cells will become very helpful for the body to utilize oxygen in a very effective manner. All such benefits will bring improvement in endurance, bring an increment in the capacity of the lungs. They can also become the reason to enhance the level of lactic acid threshold. It can also bring an improvement in the delivery of oxygen(Ramchandani et al., 2024). The capacity which is all about aerobic activity can also be enhanced due to the activity of this factor. Let's discuss the way by which it can be carried out. In order the gain the results of desired quality, an athlete should be trained at an altitude which is usually found at the height of about 2500 meters above the level of sea for the period of three to six weeks. To prevent the sickness which is all about the altitude, climb up at a slow speed and bring a reduction in the intensity at the distance which is usually found at very high altitudes(Lundby & Robach, 2016). Let’s talk about the symptoms that are associated with altitude sickness are headache, tiredness, nausea, and vomiting. Here are certain points that are all about the criticism that is usually associated with altitude training. According to certain critics, the training which is usually performed at high altitudes can prove very dangerous as it can bring disturbance the natural procedures of the body. According to them, the gains that are short-term in nature can make it very hard to do the readaptation at the level of the sea(Bonato et al., 2023). The ability to bring maintenance at a consistent level which is about the physical activity for a period that is extended in nature without any signs of fatigue comes under the category of endurance performance. Complete dependence on the factors like effective functions which are all about cardiovascular also comes in this category(Bailey et al., 1998). The strength of muscles and Efficiency of respiratory functions to bring

consistency in the efforts over the long period. Moreover, it is the ability to stay during the period when the exercise is extending for a long period or the activity. Let's talk about all the essential points which are all about the performance which is associated with endurance. Here is a discussion that is all about the psychological basis(Böning, 1997). There are certain factors like the VO2 max which can also be described as the maximum uptake of oxygen, the threshold of lactate, and the economy of exercise will play an important role in the phenomenon of determination of endurance performance. Let's discuss the examples which are all associated with endurance activities running at a very long distance, swimming, and cycling. Hiking and brisk walking is also one of the(Vargas Pinilla, 2014). Muscle endurance is also an important point which is all about endurance performance. Let's discuss one of the aspects that is very important and is all about endurance which is putting a Great focus on the ability of muscles to contract after regular periods without any activity tiring speedily. A type of review that is all about literature and can utilize a rigorous approach that is very well structured to identify and then appraise it critically and then synthesize all the shreds of evidence that are available which is about the specific question of research(Billaut et al., 2012). It aims to provide such a type of answer that can be comprehensive and unbiased by bringing reduction in the bias with the application of explicit methods and the protocols that are detailed in their type. Their application can be seen in healthcare and research to provide such types of decisions that are evidence-based(Bishop & Girard, 2013; Salgado et al., 2025). Let's discuss certain points which are of great significance and are all about systematic reviews. One of them is the focused question that can be elaborated as the review which is systematic type usually begins with the question which is research type and is defined clearly. One of the methods is the explicit methodology. In this method, a procedure is involved which is all about the conduction of a systematic review that is outlined very clearly and is well documented. The following things are involved in it, search strategies, the criteria which are all about the inclusion or the exclusion, and the extraction of data(Hahn & Gore, 2001). Let's discuss one another factor which is all about the assessment of quality. Every study in which review is involved is of critical type and appraisal is given to it on the behalf of its quality of methods to have access on the behalf of their potential. The synthesis of data is also one of the important factors in which findings are involved which are usually taken from all those studies which are usually involved(Lundby et al., 2012). All of such factors are combined and are usually observed to provide a summary that is associated with the evidence(Rodríguez & Àvila, 2018). The procedure of review should be transparent which can give this permission to all the researchers to provide replication to all the outcomes of the researchers. A method that is all about the literature review of the research in which there is a requirement of equivalent standards that are rigor in nature and are associated with the primary research(Park et al., 2016). All the rationales that are received should be clear and logical which usually undergo the review of the reader(Girard et al., 2017).

Table 1: Result of ANOVA

ANOVA						
		Sum of Squares	Df	Mean Square	F	Sig.
ALTITUDE TRAINING 1	Between Groups	.043	2	.022	.050	.951
	Within Groups	20.702	48	.431		
	Total	20.745	50			
ALTITUDE TRAINING 2	Between Groups	.719	2	.359	.989	.379
	Within Groups	17.438	48	.363		
	Total	18.157	50			
ALTITUDE TRAINING 3	Between Groups	.795	2	.398	1.078	.349
	Within Groups	17.714	48	.369		
	Total	18.510	50			
ENDURANCE PERFORMANCE 1	Between Groups	1.319	2	.660	1.438	.247
	Within Groups	22.014	48	.459		
	Total	23.333	50			

The above result of table 1 demonstrate that ANOVA test analysis result describe sum of square values, the mean square values also that explain the F statistic and significant values of each variables included dependent and independent variables. the altitude training 1 is main independent variable result demonstrate that its sum of square value is 0.043 the mean square rate is 0.022 the F statistic value is 0.05 also that its significant rate is 0.95 result shows that positive and 95% significant rates between them. the endurance performance 1 is main dependent variable result represent that its sum of square values is 1.319, 22.014 and 23.333 the F statistic value is 1.438 the significant rate is 0.247 result shows that 24% significant levels between them.

Table 2: Result of Coefficients

COEFFICIENTS						
MODEL		**UNSTANDARDIZED COEFFICIENTS**		**STANDARDIZED COEFFICIENTS**	**T**	**SIG.**
		B	Std. Error	Beta		
1	(Constant)	1.648	.465		3.544	.001
	Altitude Training 1	-.113	.154	-.107	-.734	.466
	Altitude Training 2	.105	.169	.092	.618	.540
	Altitude Training 3	.031	.169	.027	.182	.857
A. Dependent Variable: Endurance Performance 1						

The above result of table 2 demonstrate that linear regression analysis result describes unstandardized coefficient included beta values and standard

error values the result also represents the t statistic value and significant rates of each independent variables. the altitude training 1 is main independent variable result shows that its beta value is -0.113 the t statistic value is -0.734 the significant rate is 0.466 shows that negative but its 46% significant relation in between the altitude training and endurance performance. the altitude training 2 is another independent variable result shows that its t statistic value is 0.618 the significant rate is 0.540 shows that positive and 54% significant relation between them. similarly, the altitude training 3 is another independent variable result demonstrate that its t statistic value is 0.182 the significant rate is 0.857 result shows that 18% positive and 85% significant relation in between altitude training and endurance performance. the beta value related to the unstandardized coefficients is 0.105, 0.031 and -0.113 respectively.

Table 3: Result of Test Statistics

TEST STATISTICS					
	ALTITUDE TRAINING 1	**ALTITUDE TRAINING 2**	**ALTITUDE TRAINING 3**	**ENDURANCE PERFORMANCE 1**	**ENDURANCE PERFORMANCE 2**
CHI-SQUARE	18.471[a]	29.059[a]	24.824[a]	10.706[a]	4.235[a]
DF	2	2	2	2	2
ASYMP. SIG.	.000	.000	.000	.005	.120
A. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 17.0.					

The above result of table 3 describes that chi square analysis related to altitude training and endurance performance. the overall chi square values are 18.471, 29.059, 24.824, also that it explains the 10.706 and 4.235 positive chi square values of each variables included dependent and independent. The overall significant rate is 0.000 result shows that 100% significant relation between them.

3. Applications of The Influence of Altitude Training on Endurance Performance: A Systematic Review

The applications of "The Influence of Altitude Training on Endurance Performance: A Systematic Review" extend across various fields, particularly in sports science, athletic training, and performance optimization. Some of the key applications include:

3.1 Athlete Performance Enhancement

Altitude training is a great way for endurance athletes including runners, cyclists, and triathletes to increase aerobic capacity, oxygen efficiency and competitive performance. The ability to produce better at lower altitudes or in oxygen deprived environments can be stimulated, if the efforts make the athlete produce and function better in red blood cells and with the density of the mitochondria. Athlete performance enhancement is the application of different training techniques, physiological adaptations and psychological strategies to maximize an athlete's physical ability, endurance, and overall performance. Altitude training is one of the best ways to train endurance athletes to improve performance, since you train at high altitudes, which simulate low oxygen conditions. Similar to this type of training, which triggers physiological adaptations, such as increased red blood cell production, improved oxygen-carrying capacity and increased aerobic efficiency, which all help up perform better at sea level or at high intensity. Altitude training also stimulates mitochondrial biogenesis, increasing the production of energy in the muscles, and therefore endurance and stamina.

At the same time, athlete performance enhancement goes beyond physiological adaptations to include mental toughness, focus and motivation enhancement. Visualization, goal setting, positive self-talk and relaxation exercises, as both sports psychology techniques, can greatly change an athlete's mental state and can help stress manage, be confident and perform under pressure. Adequate rest, nutrition and hydration, and recovery strategies, are also considered essential for enhancing performance, including ensuring athletes are in peak physical condition and are not overtraining or injured. In addition to altitude training adequate preparation for sports can also be achieved through use of advanced methods including strength conditioning, interval training and sport specific drills which both improve aerobic and anaerobic capabilities. At the same time, athletes also rely on technology, like wearables, to measure numbers like heart rate, pace and sleep patterns, to track their progress and adjust their training plans. Athlete performance enhancement is an overall multifaceted approach that includes physical training, mental conditioning or training, recovery and the use of modern technology to assist an athlete to reach his maximum potential and to achieve the result in the sport.

3.2 Training Protocol Development

This review offers useful understanding of the appropriate altitude levels, training duration and intensity for the design of efficient and individualized altitude training programs. This information can be used by coaches and trainers to tailor train plans to meet the needs and objectives of an athlete.

3.3 Sports Medicine and Rehabilitation

Similarly, while altitude training may be useful during the development of endurance, this training can also be applied in a rehabilitation setting, with athletes recovering from injury using a controlled hypoxic environment as a means of completing rapid recovery and building aerobic endurance without overtaxing the cardiovascular system.

3.4 Cross-Sport Adaptation

Traditionally, however, altitude training has mostly been geared towards endurance sports, but could prove advantageous to other athletes, such as those in sports which require stamina or endurance capacity. To think, team sports players like soccer or rugby athletes might well benefit from altitude training to boost their cardiovascular fitness and their ability to recover quickly from high intensity bursts.

3.5 Military and High-Altitude Activities

Altitude training proves beneficial to military personnel and hardy, enough mountaineers who work on high altitude conditions, for boosting their physical endurance, experiencing low-oxygen condition, and increasing their effectiveness on top of strict terrains. Military and high-altitude operations routinely use operations in adverse environments where oxygen levels are substantially reduced, for example mountainous regions, high altitude training areas, and combat zones. For soldiers and personnel, these are unique physical and psychological environments that can only be resolved through specialized training and equipment to ensure the performance and safety. Soldiers in high altitude military operations are subjected to hypoxic conditions that can have negative effect on physical performance, decision making and cognitive performance. This means that high altitude personnel require acclimatization to minimize the risk of altitude sickness and maximize their effectiveness to complete their mission. Commonly used in military preparation programs to enhance aerobatic capacity and overall physical fitness, altitude training consists of spending time at an elevated altitude. Soldiers gain the ability to function in the low oxygen environment by simulating high altitude conditions, much in the same way that enhancing stamina, strength and mental focus under stress. 'Live high, train low' techniques allow combining the benefits of acclimatization with high intensity training to ensure soldiers maintain peak performance levels. They also use specialized equipment like portable oxygen systems, hypoxic tents and masks to help soldiers get plenty of oxygen up at high altitudes, when it is necessary. In mountainous terrains, military operations which include high altitude activities like mountaineering and alpine operations involving personnel in traversing difficult landscapes and performing reconnaissance, or for combat are intrinsic. These testing settings, though,

push soldiers to their physical and mental limits, testing them to extremes on pushing their bodies through altitude, cold and extreme weather. Overall, altitude training and preparation for military and high-altitude activity are essential for personnel to perform their duties with maximum effectiveness, safety and with minimal risk, and are an essential element of modern military readiness and operational success.

3.6 Fitness and Health Optimization

Altitude training is not only beneficial for elite athletes; there is no reason that this could not be applied to more general forms of fitness programs looking to enhance cardiovascular health and endurance. For fitness athletes who wish to boost stamina, utilize oxygen better and boost aerobic capacity, altitude training may be incorporated into their routine. Fitness and health optimization is defined as the imposition of a series of exercise, nutrition, and lifestyle interventions aimed at improving physical health and fitness levels, as well as overall well-being. This one shows an approach to the key aspects that you need to be healthy, in a holistic way, by boosting cardiovascular fitness, strength, flexibility, and body composition. Fitness optimization is based on regular physical activity for exercise routines based on individual goals, to improve endurance, muscle building, weight loss or athletic performance. Optimizing nutrition is also important for supplying the body with fuel, facilitating recovery and delivering enough energy to support physical activity and promote good health. Also important in maintaining optimal health and fitness levels is proper sleep, stress management, and hydration. At the moment, wearable technology, including fitness trackers and smartwatches, that monitor how much physical activity a person does, the rate of their heart, sleep patterns, and how many calories they burn is one of many growing trends in fitness and health optimization. These devices offer very valuable real time data that can be used to adjust training plans, monitor progress and insure peoples reach their health goals. With more and more sports science being developed that supports more personalized fitness plans, a more tailored approach to fitting in fitness can be undertaken based on the individual. Also, fitness optimization is not just for athletes but for anyone at any level of fitness that wishes to improve health and general quality of life. If people are able to have embraced fitness and health optimization, they would attain good physical health, enough energy, don’t fall prey to chronic diseases and also have better mental health, which in turn, would lead to a balanced and more meaningful life.

3.7 Oxygen-Delivery Technologies

The review brings some light to the effect of hypoxia in improving endurance, and therefore also has input in the development of altitude simulation technologies. Indoor altitude training products, including hypoxic tents, masks and chambers, enable more people – athletes and non-athletes –

to train at altitude. Oxygen delivery technologies are developed to increase the oxygen delivery and improve presence during aerobic performance in low oxygen condition, for instance, training altitude or in medical setting. Usually, these technologies are used to simulate how high-altitude conditions will affect an athlete during their race, without the athlete needing to leave sea level. For this purpose, hypoxic tents, masks, and chambers are common devices. These systems work on the principle that by drastically decreasing the oxygen in the air, one mimics that at higher altitudes, which in turn makes the body evolve to carry out those physiological adaptations such as increased red blood cells production and increased oxygen utilization. Oxygen-delivery technologies not only help athletic performance but also have multiple functions in healthcare. Oxygen therapy is used for example to treat patients in the clinic c setting with respiratory problems such as chron ictal obstructive pulmonary diseases (COPD), pneumonia, as well as other pulmonary disorders by providing oxygen on top of breathing. For those suffering from respiratory ailments, oxygen-controlled delivery can reduce fatigue, enhance stamina and promote faster recovery. And these technologies could be used to shave precious time off of recovery after surgery, aid people with sleep apnea, or even help people recover after sickness or injury. Oxygen delivery technology innovations range from more portable, efficient and user-friendly versions to enhance performance and health outcomes in both athletic and medical applications.

3.8 Sports Psychology

It can also help us learn how altitude training helps physical and mental endurance in sports psychology. Altitude training improves an athlete's ability to cope with physical stress and oxygen deprivation and provides the grounds for psychological resilience and mental toughness in high pressure competitive environment. The scientific study of the psychological factors that can affect performance in sports and exercise, and how the sports and exercise experience affect mental and emotional well-being is known as sports psychology. It deals with what really influences performance at the mental level, which includes motivation, concentration, confidence, anxiety and stress management. Sports psychology focuses heavily on training athletes to become mentally resilient and adopt coping strategies to deal with incredibly high-pressure situations, recover, and stay in the present during competition. It is commonplace to use such methods as visualization, self-talk, relaxation exercises, and mindfulness to train athletes to become more mentally tough, and also better athletes overall. Sports psychologists also help athletes develop positive mindsets, team cohesion and a healthy balance in training, competition, and personal life besides. The use of sports psychology on elite athletes is just one area of use; it can also help amateur athletes and those in fitness routines achieve better goal setting, better self-esteeming as well as the consistency that is needed to pull it off. Sports psychology is basically about dealing with both the mental and emotional side of sports and helping the best utilize the

peak performance they can achieve and at the same time maintain long term psychological well-being. In summary, the findings of the systemic review provide helpful guidance to aid in several sectors enhancing endurance performance, general training procedures and recovery strategies.

Table 4: Result of Correlations

CORRELATIONS						
		ALTITUDE TRAINING 1	ALTITUDE TRAINING 2	ALTITUDE TRAINING 3	ENDURANCE PERFORMANCE 1	ENDURANCE PERFORMANCE 2
ALTITUDE TRAINING 1	Pearson Correlation	1	.041	-.113	-.106	.044
	Sig. (2-tailed)		.773	.430	.459	.757
	N	51	51	51	51	51
ALTITUDE TRAINING 2	Pearson Correlation	.041	1	-.252	.081	.196
	Sig. (2-tailed)	.773		.074	.572	.169
	N	51	51	51	51	51
ALTITUDE TRAINING 3	Pearson Correlation	-.113	-.252	1	.016	-.107
	Sig. (2-tailed)	.430	.074		.911	.454
	N	51	51	51	51	51
ENDURANCE PERFORMANCE 1	Pearson Correlation	-.106	.081	.016	1	.238
	Sig. (2-tailed)	.459	.572	.911		.093
	N	51	51	51	51	51
ENDURANCE PERFORMANCE 2	Pearson Correlation	.044	.196	-.107	.238	1
	Sig. (2-tailed)	.757	.169	.454	.093	
	N	51	51	51	51	51

The above result of table 4 describes that correlation coefficient analysis result represent the Pearson Correlation, significant value also that number of observations of each variables included independent and dependent. The endurance performance shows that positive and significant interrelation with

altitude training. The overall result shows some positive and some negative interrelation between them.

4. Conclusion

The main objective of this research is to understand the topic of The Influence of Altitude Training on Endurance Performance and A Systematic Review. This understanding will prove very helpful in the phenomenon of practical experience. We conclude that altitude training, which results in physiological adaptations such as improved oxygen transport and increased efficiency of mitochondria, may improve endurance performance. This systematic review has positive outcomes in parts of the cases, but that manifestation of the effectiveness of altitude training depends on a variety of factors like altitude level, intensity of training and the patient's acclimatization. The idea of 'live high, train low' is becoming more popular although hypoxia is beneficial along with high intensity training. But the review also points to variability in results across different sports and training contexts, and warrants more research to delineate optimal protocols for altitude training. In the end, despite the fact that altitude training can be a useful tool for endurance athletes, it has to be used with caution and within the framework of individualized training programs for maximum benefit. A widely practiced method for endurance athletes looking to improve their aerobic capacity and endurance performance is altitude training, in which the exercising subject tones up at high altitudes where the oxygen level is less. Considerable variations in results of altitude training studies taken together with a systematic review of such studies indicate both the benefits and possible limitations of altitude training. A body's adaptive response to hypoxic conditions is commonly believed to enhance performance itself, by means of increased levels of red blood cell production (via the hormone erythropoietin—EPO) resulting in increased oxygen transport to tissues. Altitude training also is said to promote mitochondrial density to raise the effectivity of production of energy during prolonged efforts. But the review also highlights several key factors that determine whether altitude training is successful how long of the training, how intense, which altitude levels, and how the individual acclimatizes.

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