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Analysis of Physiological Processes and Acclimatization Training Strategies in Hot and Cold Environmental Temperatures

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Abstract

Within the domain of sports science, this research seeks to explore and critically investigate various physiological responses of the human body and acclimatization training strategies in regards to thermal (hot/cold) environmental conditions. The employed method is a descriptive-analytical literature review based on relevant national and international scientific journals. These findings suggest that the human body reacts differently depending on extreme temperatures. Body responses to elevated ambient temperatures include vasodilation, increased sweating, and an increase in cardiovascular workload that can be exacerbated by dehydration [6]. In cold conditions the body responds with vasoconstriction, elevated metabolic rate, and shivering to defend core temperature. Effective acclimatization strategies in hot conditions include gradual training over 7–14 days, progressive intensity increase, proper hydration, and direct exposure to high temperatures. Meanwhile, cold environment strategies involve layered clothing, extended warm-up sessions, gradual adaptation, and high-energy nutritional intake. Optimal acclimatization has been shown to improve energy efficiency, maintain thermal stability, and enhance athletic endurance, while reducing the risk of injury and health complications. Therefore, integrating physiologically based acclimatization strategies is essential to support athletic performance in extreme environmental conditions.

Keywords: acclimatization, physiology of sport, athletic performance, cold temperature, exercise physiology, heat temperature

Introduction

The development of modern sports science demonstrates that environmental factors play a highly significant role in determining athletic performance (Schlawe et al., 2025). Among these factors, environmental temperature—both hot and cold—has a direct influence on the body's physiological responses during physical activity. Athletes who train or compete in extreme temperature conditions encounter substantial challenges in maintaining physiological balance; therefore, optimal adaptive capacity is essential to ensure stable athletic performance.

Physiologically, the human body possesses a thermoregulatory system that functions to maintain core temperature stability. However, under extreme environmental conditions, this system is required to work more intensively, triggering various adaptive responses such as vasodilation and increased sweating in hot environments, as well as vasoconstriction and elevated metabolic activity in cold environments (Osilla et al., 2026). These physiological responses illustrate the body's mechanisms for coping with environmental stress. If these mechanisms are not properly regulated, they may lead to physiological dysfunctions that ultimately reduce athletic performance.

In competitive sports, inadequate adaptation to extreme temperatures may result in serious consequences, including dehydration, exhaustion, and heat stroke in hot environments, as well as hypothermia and muscle rigidity in cold environments (Cramer et al., 2022). Such conditions not only impair athletic performance but also increase the risk of injury and other health-related complications. Therefore, understanding physiological responses to environmental temperature exposure is essential for the development of effective and safe training protocols.

One important approach to overcoming these challenges is acclimatization. Acclimatization refers to a gradual adaptive process that enables the body to adjust to specific environmental conditions through physiological modifications. Previous studies have shown that acclimatization can improve work efficiency, enhance thermoregulatory capacity, and increase tolerance to environmental stress (Rahimi et al., 2019). Consequently, acclimatization has become a crucial component in athlete preparation prior to competitions conducted in environmental conditions that differ from normal training environments.

Despite its importance, the implementation of acclimatization strategies in sports training programs remains suboptimal. Many training programs have not fully considered the characteristics of physiological responses to environmental temperature, resulting in less effective adaptation processes. Appropriate acclimatization strategies, including gradual exposure, exercise intensity regulation, adequate hydration, and the use of suitable equipment, have been shown to significantly contribute to improved athletic performance (Viscor et al., 2023). Previous studies have generally examined physiological adaptation to hot and cold environments separately, whereas limited research has comprehensively integrated both environmental conditions within the context of athletic performance enhancement. Furthermore, most existing studies primarily emphasize clinical or laboratory findings, with relatively limited discussion regarding their practical application in sports training programs.

Therefore, the novelty of this study lies in its integrated analysis of physiological responses to both hot and cold environmental conditions alongside evidence-based acclimatization strategies aimed at enhancing athletic performance. This study is expected to contribute theoretically to the development of environmental physiology within sports science and practically to provide guidance for coaches, athletes, and sports practitioners in designing adaptive, effective, and safe training programs under extreme environmental conditions.

Based on this background, this study aims to analyze the physiological mechanisms involved in the body's responses to hot and cold environmental temperatures and to examine effective acclimatization training strategies that support improvements in athletic performance. It is expected that the findings of this study will contribute to the development of more comprehensive and evidence-based training programs that consider environmental factors in sports performance.

Methods

Research Design

This study employed a qualitative research design using a systematic literature review (SLR) approach to examine physiological responses and acclimatization training strategies in hot and cold environmental conditions. The systematic review method was selected to ensure a transparent, comprehensive, and evidence-based synthesis of existing scientific literature.

Search Strategy

The literature search was conducted across three electronic databases: PubMed, ScienceDirect, and Google Scholar. Articles published up to August

2023 were considered for inclusion. The search strategy utilized combinations of the following keywords: *heat acclimatization*, *cold adaptation*, *exercise physiology*, *thermoregulation*, *environmental stress*, and *sport*. Boolean operators (AND, OR) were applied to refine the search and maximize the retrieval of relevant studies.

Eligibility Criteria

Studies were included if they met the following criteria:

1. Published in peer-reviewed scientific journals.
2. Available in full-text format.
3. Examined physiological responses or acclimatization strategies related to exercise or sport in hot and/or cold environments.
4. Published within the specified publication period.
5. Written in English or Indonesian.

Studies were excluded if they:

1. Were duplicate records.
2. Were not relevant to the study objectives.
3. Originated from non-accredited or non-peer-reviewed sources.
4. Presented substantial methodological limitations that could affect the validity of findings.

Study Selection

The study selection process followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. A total of 208 records were identified through database searching. Prior to screening, 18 duplicate records, 9 records flagged as ineligible by automation tools, and 5 records removed for other reasons were excluded. Consequently, 176 records were screened based on title and abstract.

During the screening stage, 118 records were excluded for failing to meet the inclusion criteria. Of the remaining studies, 58 reports were sought for retrieval, although 6 reports could not be obtained. Subsequently, 52 full-text articles were assessed for eligibility. Among these, 12 articles were excluded because they were not relevant to the review topic, 8 were excluded due to publication quality concerns, and 6 were excluded because of methodological limitations. Ultimately, 26 studies met all eligibility criteria and were included in the final synthesis.

Data Extraction and Synthesis

Data from the selected studies were extracted and organized according to study characteristics, participant profiles, environmental conditions, acclimatization protocols, physiological outcomes, and key findings. A descriptive-analytical approach was employed to compare and synthesize evidence across studies.

The synthesis focused on identifying patterns, similarities, differences, and emerging trends related to physiological adaptations and acclimatization strategies in hot and cold environments. Particular attention was given to thermoregulatory responses, cardiovascular adaptations, metabolic changes, and performance-related outcomes.

Quality Assurance

To enhance the validity and reliability of the review findings, only credible scientific sources meeting the eligibility criteria were included. Cross-study verification and comparison were conducted throughout the synthesis process to ensure consistency, objectivity, and scientific rigor in interpreting the evidence.

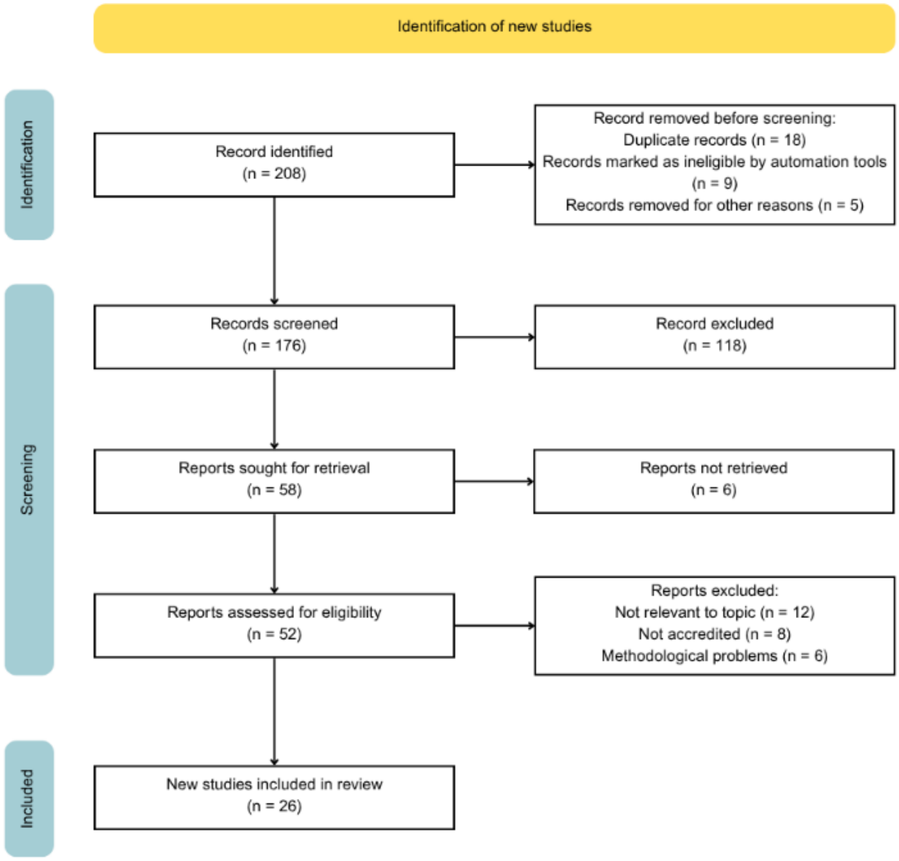
Results

On the basis of various scientific databases such as Google Scholar, PubMed, ScienceDirect, and national journal databases, one hundred and seventy-three primary research publications were identified. Thirty-two of these articles were found to be unauthorized before the screening process that was conducted: 18 duplicates, 9 articles did not satisfy preliminary prerequisites for eligibility and 5 others were expunged for technical reasons or incomplete information. As a result, 176 articles were selected for further preliminary identification through reviewing their titles and abstracts. At this stage, 118 papers were rejected because they did not conform to inclusion criteria not focusing on exercise physiology or acclimatization topics, were not obviously relevant to issues on extreme environmental temperatures, or There are research subjects not about athletes.

A total of 58 papers were then selected for full-text evaluation. Among them, six could not be secured for consideration because of space restrictions or technical glitches, so a 52 paper eligibility score was awarded. Amongst these, 26 were rejected books including: 12 which were just not in line with the main points of acclimatization strategy and physiological response, 8 anything from non-indexed or non-refereed journals omitted, and added 6 that did not reach minimal standards for methodology.

Finally, by the use of this methodical and strict quality-controlled screening process, 26 books have met conditions for inclusion into research analysis as shown in Figure 1. Daanen & Van Marken Lichtenbelt (2019) pointed out in their study that the physiological responses of human body to exposure extreme temperature, hot and cold, contain highly complex integrated mechanisms. The body's thermoregulating system plays the

Figure 1
Literature Selection Process



central role in keeping core temperature within an acceptable range, even when there is a great change in ambient temperature. In this context, people do indeed exhibit quite different abilities in handling the stresses imposed by different environments and this generates special responses from the body to bring them to rest. In hot weather conditions the body steps out its sweat and opens blood vessels around the skin expanding Sudbury to get rid of accumulated heat (Périard et al. 2021).

Blood volume increased by vasodilatation in peripheral vessels which have opened becomes cooler. Only augmented perspiration also functions as a cooling response by evaporation. However, sweating leads to the problem that fluid and essential minerals (electrolytes) are lost as well. In the absence of compensation from fluids ingested properly it could upset body's normal balance. When the weather gets cold, the body tends to switch over to conservation mode through peripheral blood-vessel closure measures for heat preservation. Such operation closes off the flow of blood at skin level so that no internal warmth escapes.

In addition, metabolism in the body generates heat through shivering thermogenesis to further raise temperatures internally through an increase in energy production from foodstuffs. This response suggests that the body places greater emphasis on keeping heat rather than casting it off in cold environments (Acevedo et al. 2015).

In order to give a more systematic overview of these physiological differences, we can compare hot versus cold temperature conditions in similarity format using the following Table 1.

Based on the table, it can be seen that each physiological system exhibits different responses as a form of adaptation to environmental stress (Debevec et al., 2024). In hot conditions, the dominance of cooling mechanisms encourages the heart to work harder and leads to greater likelihood of becoming dehydration.

The consequences of these physiological disparities are highly significant for sports performance. Athletes ignorant of or inadequately prepared for specific environmental conditions will undergo a marked drop in their level of activity (Segreti et al., 2024). Hence, these physiological responses serve as the primary basis for designing effective acclimatization training strategies, as will be discussed in the following section.

Table 1
Comparison of Physiological Responses in Hot and Cold Temperatures

Aspect	Hot Temperature	Cold Temperature
Blood circulation	Vasodilation (Périard et al., 2021; Ashadi et al., 2021)	Vasoconstriction (Daanen & Van Marken Lichtenbelt, 2019; Acevedo et al., 2025)
Sweat production	Increased (Périard et al., 2021)	Decreased (Acevedo et al., 2025)
Metabolism	Stable or slightly increased (Ashadi et al., 2021)	Increased (Viscor et al., 2023; Ramchandani et al., 2024)
Muscle response	Faster fatigue (Périard et al., 2021; Ashadi et al., 2021)	Muscle stiffness (Daanen & Van Marken Lichtenbelt, 2019; Acevedo et al., 2025)

Discussion

Acclimatization Training Strategies in Hot Environments

According to these characteristics of the physiological response to the heat it can be said that designing systems of acclimatization training for such climate conditions will require seriously thought-out compromise methods. The point of acclimatizing is not simply to sweat the heat out, but rather a matter of changing cardiovascular function, sweating more efficiently, and stablishing your core body temperature.

As a result, the staging of training must incorporate gradualism, quantifiability and sustainability. Over a period of 7 to 14 days of gradual training commonly, the body adapts to an environment in the heat acclimatization program (Sekiguchi et al., 2025). During this stage, the body gradually becomes accustomed to high temperatures. In the beginning, the body tends to experience high stress responses such as increased heartbeats, higher body temperature impulses etc. But through continued exposure, the body starts to develop its own changes which include increased plasma volume, more efficient blood distribution, as well as lower core temperatures in some circumstances of activity.

Based on the findings of one recent study (Im-shun KUO, 2004), in addition to the traditional way of doing heat acclimatization there is now also a faster approach. In this context, two main concepts are recognized, namely traditional heat acclimation (THA) and rapid heat acclimation (RHA). THA is generally carried out with one heat exposure per day for around 7–10 days or more (each of which is 60–90 minutes in length). By contrast, RHA compresses heat exposure into a shorter time frame with higher frequency such as multiple sessions per day over 2–5 days (Stevens et al., 2025).

These rate-alone studies show that though CHA is over a shorter duration, a thermal dose equivalent can produce relatively similar physiological adaptations such as decrease of core temperature, increase in plasma volume and improve cardiovascular efficiency. However, CHA tends to produce higher levels of physiological stress in the early stages, so it needs to be very carefully implemented. On the other hand, THA is more stable and widely used for athletic training because of how gradually it allows someone to become acclimatized.

This was once a major argument between two groups of medical researchers in the mid-20th century, and it still has practical consequences: by taking longer to complete the process one can reduce incarnate mortality right after exercise. Thus, the choice between CHA and THA should be adapted to the athlete's needs and conditions, with CHA possibly being an effective substitute for athletes with limited time for preparation while THA may be better suited in this stage to longer-term programs emphasizing stable physiological adaptation in athletes whose situations are stable or fixed without major changes during the near future.

To provide a more orderly presentation of the stages for heating or cooling body equilibration, we present the strategy of acclimation period with data studies in Table 2. As we can see from Table 2, the body gradually adjust in both hot and cold and adverse environments. Li et al. (20244) results showed that first stage of acclimate adaptation in the earliest year ' may be still subjected to physiological stress so the intensity of training has to be significantly reduced. Nevertheless, after some time the body starts to display more effective adaptive responses-for example improved thermo-regulatory capacity in hot conditions which leads to enhanced metabolic efficiency; or in cold conditions and while maintaining its own metabolic rejection station function still pretty well turning food calories into heat output (Kong and Yan, 2015).

In the final stage, the body reaches an optimal adaptive state that keeps athletes in their stably enhanced performance condition without physical disturbances any longer.

Table 2

Stages of Acclimatization Strategies in Hot and Cold Environments

Stage	Hot Environment	Cold Environment
Days 1–3 (Initial Adaptation Phase)	Low-intensity training, short duration, limited heat exposure, focus on initial hydration	Low-intensity training, adaptation to cold environment, use of layered clothing, longer warm-up
Days 4–7 (Intermediate Adaptation Phase)	Increased training duration, longer exposure to high temperatures, monitoring heart rate and body temperature	Increased training duration, gradual reduction of excessive layering, increased metabolic activity
Days 8–10 (Advanced Adaptation Phase)	Increased training intensity, improved sweating efficiency, more structured hydration strategy	Increased training intensity, improved tolerance to cold, reduced reliance on heavy clothing
Days 11–14 (Optimization Phase)	Training approaching competition conditions, improved body temperature stability, reduced dehydration risk	Training approaching competition conditions, improved metabolic efficiency, better body temperature control
Post-acclimatization	Maintenance through periodic training in hot conditions	Maintenance through regular exposure to cold conditions

A progressive approach allows the body to adapt without suffering too much fatigue or injury risk. Training at low-medium intensity in the early stages can increase heat tolerance gradually from there, in keeping with adaptation development. This is consistent with the sports training principle of overloading, which must be managed properly too.

Regulation of both the timing and recovery period for training is an important element in acclimatization. Practice has it that training for acclimatization is not continuous hard every day, but follows principles of progress and bring to rest when necessary. In hot conditions, even if there is heat exposure some adjustment should be made for about seven to 14 days. This comes with recovery periods in between to avoid getting too tired, dried out or in some cases + physical disturbances (Pryor and Smith, 2018; Perrier et al, 2021). Sessions generally last several hours per day with progressively increasing exposure, rather than one long day exposure.

Supporting Factors in Acclimatization, Recovery, Hydration, and Cold Environment Adaptation

Likewise, acclimatization in cold conditions is not continuous and without respite but performed by gradual exposure with recovery periods so each system can maintain optimal physiological function. These recovery periods are important to allow the body to reset metabolic and thermoregulatory responses without impairing performance or increasing susceptibility to injury or hypothermia (Daanen & Van Marken Lichtenbelt, 2019; Wang et al., 2025). Therefore, the balance between training exposure and recovery becomes a key factor in successful acclimatization under both extreme temperature conditions.

Hydration plays a crucial role in supporting successful acclimatization (Perrier et al., 2021). Fluid loss due to excessive sweating can disrupt physiological functions, including reduced plasma volume and electrolyte imbalance. Therefore, athletes must implement comprehensive hydration strategies, including fluid intake before, during, and after training (Judge et al., 2021). In addition, electrolyte replacement is essential to maintain optimal muscle and nervous system function.

Hydration in the acclimatization process is not only related to the amount of fluid consumed, but also to the frequency or timing of intake. In hot environments, athletes should drink fluids every 15 to 20 minutes (combining water and electrolytes to replace fluid and ion loss) caused by sweating. For activities lasting more than 1 hour or of particularly high intensity, the consumption of electrolytes is especially important in controlling neuromuscular function and maintaining fluid balance.

In contrast, in cold environments, a lower sense of thirst causes athletes to often be dehydrated without realizing it. Hydration strategies thus have to be planned: even when not feeling thirsty, drink fluids every 20 minutes or so. Although sweat loss will be less than in hot conditions, maintenance of metabolic activity and temperature requires fluid intake. In such circumstances water is generally more dominant, though a certain amount of electrolyte drinks are still needed, especially during extended physical activity (Daanen & Van Marken Lichtenbelt, 2019; Wang et al., 2025). Thus the timing of taking up fluids becomes a most important factor in being able to carry on performing without being disturbed next to nature in both extremes.

Another effective strategy to speed up adaptation is a strategy that Implis physical activity and training during periods of high temperature (Millard-Stafford et al., 2024). Direct exposure to heat alsomakes the thermoregulatory system of the body work harder These methods, however, must be carefully used to suit the individual conditions of athletes, their level of fitness and associated risks Close monitoring is required to eliminate the ill-effects of excessive heat exposure on health more generally.

Still, overall strategies for acclimatization to the hot environment must include duration and intensity of training, hydration, period of day (Millard-Stafford et al. 2024). A systematic approach based in physiology is sure to produce optimal acclimatization athletes who adapt the most and take with them least baggage still performing maintain high even in hot environments.

Acclimatization Training Strategies in Cold Environments

Unlike hot environments, acclimatization to cold places is about trying to keep heat in the body and maintain normal physiological activity (Leonard, 2018). In cold environments, damage primarily results from the increase in heat loss. Sportspeople run the danger of lowering their core body temperature and thus becoming unable to perform efficiently.

Hence, the connotation of training strategies in this direction should lie in heat conservation, increased metabolic activity, and musculoskeletal protection. One of the major ways to reduce heat from the body is to wear clothes in layers (Di Domenico et al., 2022). Our unique layering system serves as a superb thermal blanket to hold body heat in more effectively. The bottom layer is intended to draw off perspiration, the middle layer provides insulation, and the outermost layer shields against wind and moisture. This allows athletes to maintain a steady body temperature and train without discomfort.

When you are doing the physical project in a cold climate, longer warm-up time is more important then ever, because the special conditions of such an environment can reduce muscle resilience and make accidents such as tissue damage easier. An ideal warm-up can lift muscle temperature, improve blood circulation, and make soft tissue more elastic (Park et al., 2018).

This all keeps the organism prepared for future high-intensity work without musculoskeletal distress. The gradual adjustment thetone training strategy also has to be applied in cold adaptive process. However, what athletes do not dive directly into high intensity training immediately after, they should first be low intensity exercise, rise gradually (Wang et al., 2025). This allows the body to progressively acclimatise temperature and therefore lessens risk of physiological discord in addition to increasing adjustment productivity.

The duration required for acclimatization is also an important factor to consider in training planning. Several studies have shown that cold acclimatization in professional athletes generally occurs over a variable time period, with the intensity of exposure and body condition influencing variation. Early exposure to cold environments may begin to take effect relatively quickly, from around day 3-5. This time is marked by an increase in metabolic responses and a heightened tolerance to low temperatures. However, to reach a more stable and better adaptation stage can take around day 10-day 14. In some cases, especially among athletes not used to this kind of severe temperature exposure, it may require a longer period for them to reach optimal thermoregulatory balance. (Daanen & Van Marken Lichten 2019a, Wang et al. 2025a & c; Leonard 2018b)

In this process of adaptation, supplying our bodv with high- ergetie food becomes an important element. In eold environments, the hrg or activity levels far exceed normal. This eosts more energy, and so requires substances such as those in yellow foods we introduction Colby et al. (1990) for example. At the same time better nutrition and dietetic habits are needed The provision of plenty of this variety food containing both carbohydrates and healthy fat must be assured to meet these energy needs. Thermogenesis and muscular power not only can be richly promoted by proper nutrition, but are essential margin during athletic activity or other long-lasting physical exercises. Adequate nutrition irst sues not only thermoelectric power generation, but also durability and performance maintenance.

Overall, acclimatization training strategies in cold environments must be designed by considering aspects of body protection, enhancement of muscle readiness, and fulfillment of energy requirements. An integrated approach will enable athletes to adapt optimally to cold environments, thereby maintaining performance.

Implications for Athletic Performance

Based on the analysis of physiological responses and acclimatization strategies discussed, it can be concluded that acclimatization has highly significant implications for athletic performance (Périard et al., 2024). This adaptation process allows the body to reduce the physiological burden caused by environmental stress, thereby enabling energy to be used more efficiently to support physical activity. Athletes who have undergone acclimatization demonstrate better ability to maintain exercise intensity and duration compared to those who have not adapted (Bonato et al., 2023).

Energy efficiency is one of the key aspects influenced by acclimatization. Under adapted conditions, the body is able to optimize energy utilization through improved metabolic efficiency and enhanced oxygen distribution to muscle tissues. This is particularly important in endurance-based sports, where efficient energy use determines long-term performance success.

The stability of core body temperature is also a crucial factor contributing to athletic performance (Yu et al., 2024). In hot conditions, acclimatization enables the body to regulate temperature more effectively through sweating mechanisms and blood circulation. In cold conditions, on the other hand, the body can retain heat by ramping up metabolism and controlling blood flow. Have thermal stability is necessary for the physiological functions to be effective during movement.

Furthermore, acclimatization bias the delaying of bodily and psychical challenges in a good way. This physiological accommodation to extreme environments is matched by greater psychological readiness to endure adverse conditions (Ilardo & Nielsen, 2018). For example, familiarity with particular environmental conditions tends to be associated with higher confidence levels (Kitanovski et al.; Lowther, 2021) and more efficient regulation of fatigue (Berger); Hausswirth et al.

One of the most important implications is the reduction of injury and health risks. Acclimatisation prepares the body for environmental stress, reducing the likelihood of disturbances such as dehydration, heat stroke or hypothermia and injuries to muscle (Al-Mhanna et al. 2024). Improved physiological readiness allows an athlete to go through training and competition with a greater level of safety.

In general, acclimatization is a thorough way to enhance sports performance on many levels, physiologically and psychologically. Hence, ensuring the athlete's readiness to contend and face at different environmental conditions requires the implementation of acclimatization strategies in training programs.

Integration of Physiological Responses and Acclimatization Strategies

For the last part of our discussion it is worth emphasizing that physiological responses and acclimatization strategies are two interlocking indivisible components within sports science (Gibson et al., 2019). The way our body reacts to environmental stress in hot or cold environments has known physiological responses giving a scientific basis for understanding. In stark contrast, acclimatization strategies are the actual concepts in practice that improve the adaptive capacity of the human body. You are studying the physiological basis of performance up to October 2023 and this will most likely lead you astray without a good understanding of physiological mechanisms, what you transfer through training programs can be ineffective or worse still a threat to the health of athletes.

By combining the physiological responses and acclimatization strategies, training programs can be more systematic, more specifically targeted and evidence-based (Rios & Pyne 2025). Changing the way the body responds to heat via mechanisms like vasodilation and increased sweating leads a coach to place training programs that aid thermoregulatory efficiency. Conversely, in a cold environment the comprehension of vasoconstriction and increase metabolism can serve as foundations for formulating strategies like extended warm-up routines and suitable gear. Therefore, under these conditions of climate care, methods of training become far more pragmatic and change.

In addition, this integration enables personalized training approaches. Physiology-profile of each athlete is different in terms of, fitness level, adaptability and tolerance to extremes of temperature. Therefore, acclimatization strategies cannot be generalized, but must be tailored to individual conditions. This physiology-based approach helps optimize athlete potential while minimizing the risk of excessive fatigue and injury.

In addition, the application of this integration contributes to improving the long-term effectiveness of training programs. Training programs designed based on scientific principles tend to produce more stable and sustainable adaptations (Van Cutsem & Pattyn, 2022). This not only impacts current performance improvement, but also enhances athlete readiness in facing various environmental conditions in the future. In other words, acclimatization is not merely situational, but becomes an integral part of the overall athlete development process.

Thus, it can be concluded that a holistic and physiology-based approach is the key to integrating bodily responses with acclimatization training strategies (Páez et al., 2026). As a result, the combination of these disciplines will translate into more effective, safe, and performance-based training regimens for athletes. Thus coaches and sports practitioners should implement this integration as principal in understanding and executing training programs through various microniches environmental conditions.

Conclusions

In conclusion, the human body employs different physiological mechanisms to respond to hot and cold environments in order to maintain homeostasis. In hot conditions, the body increases heat dissipation through vasodilation and sweat production, whereas in cold conditions, the body retains heat through vasoconstriction and increased metabolism. Proper acclimatization strategies have been shown to play a crucial role in enhancing physiological adaptation, energy efficiency, endurance, and athlete safety during training and competition. Therefore, training programs must be scientifically designed and take environmental factors into account to ensure optimal athletic performance while safeguarding long-term health.

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