



**HAL**  
open science

# Natural altitude training: what are sportspeople looking for?

Florence Cassignol, Eric Fruchart

## ► To cite this version:

Florence Cassignol, Eric Fruchart. Natural altitude training: what are sportspeople looking for?. Journal of Sport & Tourism, inPress. hal-04272747

**HAL Id: hal-04272747**

**<https://hal.science/hal-04272747v1>**

Submitted on 6 Nov 2023

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

**Natural altitude training: what are sportspeople looking for?**

Florence Cassignol & Eric Fruchart

University of Perpignan Via Domitia, LIPSEM, France

**Abstract**

Performance enhancement is the main reason why sportspeople do natural altitude training. However, the sportspeople's perception of this type of altitude training and the literature in the field of mountain sports tourism suggest that other reasons for natural altitude training might be identified. The objective of the present work was to discover the structure underlying a sportsperson's reasons for natural altitude training. To this end, we conducted an exploratory study (with 290 participants) and a confirmatory study (with 116 participants). A three-factor structure of reasons for natural altitude training was found, with factors called "Mountain environment" (3 items), "Openness" (3 items), and "Performance focus" (3 items). The results of our exploratory study might have applications in sports coaching and mountain tourism and might open up research perspectives in sports psychology and mountain sports tourism.

**Keywords:** sportspeople; reasons; altitude training; mountains

Over the past six decades, altitude training (also known as hypoxia training) has increased in popularity. A growing number of sportspeople are seeking to improve their physical performance by altitude training. Indeed, research in sports physiology has demonstrated the beneficial effect of hypoxia or altitude on individual performance in endurance sports, team sports, and racket sports (Faiss et al., 2013). The positive physiological effect of altitude training sought by sportspeople can be triggered by artificial methods (e.g., hypobaric chambers and hypoxia rooms or tents) or natural methods, which are growing in popularity (Behrendt et al., 2022). Various natural altitude training models (such as the “live high-train high” or “live low-train high” approaches) are associated with improved sporting performance, due to the haematological benefit of prolonged exposure to altitude (Millet et al., 2021). Hence, when sportspeople go to the mountains to train, they are mainly looking to improve their sporting performance. But is that the only reason for natural altitude training? Indeed, one can hypothesize that natural altitude training may lead to other benefits for sportspeople, related to the environment in which they find themselves; for example, Turner et al.’s study of sportspeople’s perceptions of altitude training highlighted other benefits of physiological adaptations, such the “lifestyle”, the location, the psychological dimension, and the relaxing environment (Turner et al., 2018).

Given the variability of the benefits associated with natural altitude training (Turner et al., 2018), other factors (drawn from mountain tourism and sports tourism) can be considered. Natural altitude training takes places in a mountain environment; most sportspeople do not live in a mountain region and so have to travel to this destination. Consequently, academic studies of natural altitude training might overlap with the fields of mountain tourism and mountain sports tourism.

From the Millennial’s theoretical approach (Bonadonna et al., 2017), Giachino et al. (2020) identified six reasons for choosing a mountain environment as a tourism destination in

winter and summer among university students: sport; nature and wildlife; food and drink; relaxation and peacefulness; economic convenience; and a trendy location. In a study of mountain rural tourism from market segmentation approach (Almeida & Correia, 2014), Lwoga and Maturo (2020) found four main reasons for visiting Kilimanjaro: authenticity; visiting farms and nature; relaxation with friends and family; and casual experiences.

The reasons for natural altitude training in the mountains can be viewed from a mountain sports tourism perspective. Gammon and Robinson (2003) defined “hard sports tourists” as “individuals and/or groups of people who actively or passively participate in competitive or recreational sport, while travelling to and/or staying in places outside their usual environment”. Sport is the primary reason for travelling, with the idea of becoming more competitive or developing skills and abilities (Getz & McConnell, 2014). However, other reasons for participating in sports tourism (such as socializing, excitement, refreshment of the body and mind, and general wellbeing) have also been identified from three traditional approaches of sociology of tourism (Cohen, 1988).

Mountain sports tourism may be perceived as nature sports tourism, active sports tourism, outdoor tourism and/or adventure tourism. From a participant centred approach, nature sports tourism gives sportspeople opportunities to (i) connect with and feel part of nature, (ii) explore their potential, creativity and meaning, (iii) collaborate with other individuals, (iv) experience better health and well-being, and (v) examine mastery and development (Collins & Brymer, 2020). In active sports tourism and from the Millennial approach, IJspeert and Hernandez-Maskivker (2020) found that young sportspeople reportedly sought challenges, adrenaline (i.e. thrills and sensations), and an escape from the daily routine, whereas older adults mainly sought to improve their health.

From the approaches of eco-psychology and of nature human connections, Hanna et al. (2019) found that outdoor adventure tourism enabled sportspeople to reconnect with

nature, pro-environmental attitudes and behaviours and had a positive influence on wellbeing. From the adventure recreational market approach, Zeng et al. (2018) found five main reasons for adventure recreation: social motivation; enjoyment, adjustment of introspection; relationships with family members, friends, and other individuals), and self-identity (e.g., doing different things). From the push and pull factors approach, Giddy (2018) differentiated between “push” factors like thrills, socializing, enjoying nature, escapism, environmental education, novelty, overcoming nature, risk-taking, and challenges/skills, and “pull” factors like the environment (e.g., landscape), attraction (adventure activities, events, and heritage sites), and facilities (e.g., accessibility, accommodation, and food).

From the hypothetical framework of spectrum of adventure tourism experiences expectations, Ponte et al. (2021) reported that individuals idealized adventure tourism experiences from six dimensions: preparation, immersive fantasy, unpredictability, interaction with nature, self-reliance, and physical engagement. In a review of the adventure tourism literature and from the three pillars of adventure tourism framework, Janowski et al. (2021) identified twenty-two dimensions of adventure tourism and considered that the five most important were physical activity, natural environment, risk and danger, challenges, and thrill and excitement.

Some researchers have investigated the participants' reasons for doing particular mountain activities. From the approach of marketing segmentation, Rejón-Guardia et al. (2020) found four motivational factors for participating in mountain bike events: speed/excitement/risk; having fun; event attractiveness; and seeking out opportunities to engage in a physical challenge. Earlier, from the business model framework, Perić et al. (2018, 2019) had identified various reasons for doing mountain bike among sports tourists: safety, security, competition, stress, relief/health, enjoyment, nature, appearance, and socializing; the researchers found the same motivational factors for trail running (Perić et al.,

2018; Perić et al., 2019).

In referring to various theoretical approaches, Pomfret and Bramwell (2016) reviewed various differing reasons for doing various mountain sports: they listed six reasons for white-water rafting and kayaking (including a new experience, socialising, and a natural environment), 21 for doing several activities (such as novelty, a change of environment, exploration and discovery, cultures, and challenges), and 12 for mountaineering (such as a natural environment, the aesthetic and physical enjoyment of mountain environment, and ease of organisation). In for the latter activity, they specified that socializing (e.g., meeting new individuals), challenges (e.g. testing one's limits), achievement (e.g., hardship and physical achievement) and the natural environment (e.g., being in an inaccessible place and a lovely landscape) were the pull factors most frequently noted by mountaineers.

With regard to hiking, Pomfret and Bramwell (2016) suggested five reasons: feeling close to nature, relaxing mentally, getting away, being challenged, and having a sense of accomplishment. From the pull factors approach, Mohd Taher et al. (2015) found four main pull factors that induced people to hike in the mountains: the effectiveness of the organizing company, trail accessibility, perceived safety risks, and the mountain landscape.

In skiing, Pomfret and Bramwell (2016) referred to the social atmosphere, hills and trails, and achievement. Again for skiing and from the soft vs hard adventure tourism approach, Bichler and Peters (2021) identified six motivational factors: relaxation, recognition, challenges, socializing, creativity, and discovery.

According to the literature described above, the participants' reasons for participating differed from one type of activity – even though some common themes emerged (e.g. the impact of the natural environment, socializing, and challenges). A summary table of the potential motivational factors of natural altitude training from literature review is presented in Table 1. Another potential differentiating factor in reasons for participating in mountain sports

concerns the participants' sociodemographic characteristics, such as sex and the level of experience (Pomfret & Bramwell, 2016). For instance, Zeng et al. (2018) highlighted the influence of the participant's level of experience on their motivation for participating in outdoor activity; intermediate and advanced participants tended to be less motivated than beginners were. However, the level of motivation was barely influenced by the participant's sex. Burke et al. (2010) described several differences between recreational and elite climbers with regard to preparation, coping with obstacles, and the kind of feeling sought during the activity. Fraser et al. (2019) showed that recreational participants were more motivated by the natural exercise environment than competitive participants were.

Although many studies have attempted to understand the motivational factors in multiple sports tourism and mountain tourism activities, natural altitude training has not previously been studied in this respect. However, discovering what sportspeople look for in natural altitude training might be an important issue for both coaches and stakeholders in tourism. We reasoned that our present study might facilitate the implementation of altitude training camps and sports tourism.

The objective of the present work was to identify the factor structure of the sportspeople's reasons for natural altitude training. Two studies were conducted successively. Study 1 was designed to explore the putative structure of what sportspeople look for in natural altitude training. In view of the literature on mountain sports tourism and altitude training, we assumed (hypothesis #1) that the identified structure would be multifactorial. Notably, we expected that the structure would include a performance factor (Millet et al., 2021) and a mountain environment factor (e.g., Pomfret and Bramwell, 2016; Turner et al., 2018). Study 2 was designed to confirm the fit of the identified model (Hu & Bentler, 1998, 1999) and to test the influence of the sportspeople's characteristics on the structure of the reasons for natural altitude training. In line with hypothesis #1 and the putative presence of a "mountain



environment” factor, we expected (hypothesis #2) that the “mountain environment” score would be higher for recreational sportspeople than for competitive sportspeople (Fraser et al., 2019).

### Study 1

Study 1 was exploratory and was designed to identify factors structuring the sportspeople’s reasons for natural altitude training.

#### Method

**Participants.** A total of 290 competitive or recreational sportspeople from various sports ( $M_{\text{age}} = 20.70$ ;  $SD = 3.33$ ), including 173 men ( $M_{\text{age}} = 20.23$ ;  $SD = 1.82$ ) and 117 women ( $M_{\text{age}} = 21.38$ ;  $SD = 4.68$ ), were included in the study. The participants (all unpaid volunteers) were recruited through their respective clubs or sports centres or at the University.

**Material.** The material was composed of a 29-item questionnaire (see the 29 items in the Appendix) on what sportspeople look for in altitude training. As recommended by Boateng et al. (2018), the items were selected using a deductive-inductive method. First, a deductive method consisted of a literature review to describe the domain and identify potential items. Secondly, an inductive method, based on interviews with 10 sportspeople around the key theme “altitude training”, was led to confirm potential items from the deductive method and identify news questions to assess the domain. The 10 sportspeople differed with regard to their main sport and their type of activity (recreational vs. competitive). After the 29-item questionnaire had been developed, it was filled out by all the study participants. The question was: “What do sportspeople look for in altitude training?”. The 29 items were rated on a 4-point Likert-type scale ranging from 1 (“Not at all”) to 4 (“Very much”). There were additional questions on demographic variables (age, sex, type of activity (recreational vs. competitive), and frequency of activity).

**Procedure.** According to the French legislation covering this type of research, the

protocol did not require approval by an independent ethics committee. However, the study's design and execution followed the ethical tenets of the Declaration of Helsinki and those of the local independent ethics committee. After having obtained the approbation of the dean or the coach, we described the experiment to the sportspeople. If the sportspeople agreed to participate, we sent them an e-mail containing a link to the study questionnaire.

**Data analyses.** Each rating by each participant was converted into a numerical value expressing the distance (the number of points, from 1 to 4) between the point on the response scale and the left anchor, which served as the origin. These numerical values were then analyzed graphically and statistically. An exploratory factor analysis (EFA) was used to reveal the factor structure in the sportspeople's reasons for natural altitude training. The scree test, the eigenvalues, and a varimax rotation were used to extract the factors arising in the EFA. Data were analysed using Statistica software (version 8).

## Results

The 29 items showed variance and so were all included in the subsequent analysis. A first EFA yielded a 7-factor structure, which accounted for 59% of the variance. A varimax rotation with eigenvalues greater than one was conducted on the 7-factor structure. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was .85, and Bartlett's test of sphericity was significant ( $\chi^2 = 2868.60$ ,  $p < .001$ ). To improve the structure's psychometric quality, we removed the items present in at least two factors and factors composed of less than 3 items. Furthermore, only items with loadings higher than .50 in the EFA were included in the model (Fabrigar et al., 1999). Twenty of the original 29 items were thus eliminated.

The remaining 9 items were subjected to a second EFA with varimax rotation, giving a three-factor solution. The KMO measure of sampling adequacy was .71, and Bartlett's test of sphericity was significant ( $\chi^2 = 621.05$ ,  $p < .001$ ). The second EFA indicated a three-factor structure, which accounted for 63.95% of the variance.

The first factor accounted for 31.47% of the variance. This factor was called “Mountain environment” because it referred to the main characteristics of a mountain environment. Three items loaded positively on this factor: “In natural altitude training, sportspeople look for (i) silence; (ii) changing landscape; and (iii) peacefulness”.

The second factor accounted for 19.47% of the variance. It was called “Openness” because it referred to openness to high-quality, authentic, interpersonal relationships and the propensity of doing several sports activities. Three items loaded positively on this factor: “In natural altitude training, sportspeople look for (i) conviviality; (ii) authentic human relationships; (iii) varied activities”.

The third factor accounted for 13.01% of the variance. It was called “Performance focus” because it referred to sporting performance. Three items loaded positively on this factor: “In natural altitude training, sportspeople look to (i) enhance their performance; (ii) look for more difficult training conditions; (iii) look for greater physical difficulty”.

## Study 2

Study 2 had two objectives. The first was to test and confirm the three-factor structure (“Mountain environment”, “Openness”, and “Performance focus”) of the reasons for natural altitude training found in study 1. The second was to explore the relationships between these three factors and the sportspeople’s characteristics (sex, type of sports activity (recreational vs. competition), and frequency of sports activity (rarely, sometimes, very often)). We expected that the “mountain environment” score would be higher for recreational sportspeople than competitive sportspeople (Fraser et al., 2019).

## Method

**Participants.** A total of 116 sportspeople ( $M_{\text{age}} = 20.75$ ;  $SD = 2.35$ ) from various sports participated in the study. There were 58 men ( $M_{\text{age}} = 21.26$ ;  $SD = 2.72$ ) and 58 women ( $M_{\text{age}} = 20.24$ ;  $SD = 1.84$ ), and 51 competitive sportspeople and 65 recreational sportspeople

( $N=65$ ). The frequency of sports activity was reportedly low for 30 of the participants, frequent for 44, and very frequently for 42. The participants (all unpaid volunteers) were recruited through their respective clubs or sports centres or at the University.

**Material.** The material was the same as in study 1. It consisted of the same 29-item questionnaire, the same response format, and the same additional questions on demographic variables (age, sex, type of sports activity (competitive vs. recreational), and frequency of sports activity).

**Procedure.** The procedure was the same as in study 1 and followed the ethical tenets of the Declaration of Helsinki and those of the local independent ethics committee.

**Data Analyses.** To test the structure suggested by the second EFA in study 1, we conducted a confirmatory factor analysis. Multiple fit indices were used to test the identified structure (Hu & Bentler, 1998, 1999): the ratio between chi-squared and the degrees of freedom (good when  $1 < Chi^2/df < 2$ ); the Bentler Comparative Fit Index (acceptable for a value  $\geq .90$ ); the Tucker-Lewis Index (good when  $\geq .95$ ); the standardized root mean square residual (acceptable when  $\leq .08$ ); the root mean square error of approximation (good when  $\leq .60$ ). The internal consistency of the items' structure was measured using Cronbach's alpha value (acceptable when  $>.70$ ).

Several multivariate analysis of covariance and independent analyses of covariance were conducted to test the influence of the sportspeople's characteristics (sex, type of sports activity (competitive vs. recreational), and frequency of sports activity) on the model's factors. Data were analysed using STATISTICA 8.

## Results

We first tested the correlated three-factor model suggested by the second EFA from study 1 (Table 1). All the factor loadings were significant. The  $chi^2/df$  value was 31.8/24 (i.e. 1.32), the Bentler Comparative Fit Index was .97, the Tucker-Lewis index was .96, the

standardized root mean square residual was .06, and root mean square error of approximation was .05. Table 1 shows the coefficients estimated for the whole set of data.

Three multivariate analyses of covariance were conducted on the dataset as a whole, with (i) sex as the independent variable and the type of activity (recreational vs. competitive) and frequency of activity as covariables, (ii) the type of activity as the independent variable and the sex and the frequency of sports activity as covariables, and (iii) the frequency of sports activity as the independent variable and the sex and the type of sports activity as covariables. The effect of the type of sports activity (recreational vs. competitive) was significant,  $F(2, 109) = 13.03$ , Wilk's lambda = .535,  $p < .001$ ,  $\eta^2_p = .47$ . The Bonferroni test revealed significant differences between the "Mountain environment" factor and the "Openness" factor ( $p < .006$ ), the "Mountain environment" factor and the "Performance focus" factor ( $p < .001$ ), and the "Openness" factor and the "Performance focus" factor ( $p < .001$ ). The athlete's sex, the type of sports activity (recreational vs. competitive), and the frequency of activity were never statistically significant ( $p > .05$ ).

An independent analysis of covariance (with the type of activity as the independent variable and the sex and the frequency of sports activity as covariables) was conducted on the scores from each of the three series of factors. The resulting descriptive statistics are summarized in Table 2.

For the "mountain environment" factor, the effect of the type of activity (competitive vs. recreational) was significant,  $F(1,111) = 7.18$ ,  $p < .008$ ,  $\eta^2_p = .06$ . The "mountain environment" score was higher among the recreational sportspeople than among the competitive sportspeople. For the "openness" factor, the effect of the type of activity (competitive vs. recreational) was not significant ( $p = .90$ ). Lastly, for the "performance focus" factor, the type of activity (competitive vs. recreational) was not significant ( $p = .89$ ).

## Discussion

The objective of the present work was to identify the structure of sportspeople's reasons for doing natural altitude training. Our hypothesis #1 was that the structure would be multifactorial and would include a performance factor (Millet et al., 2021) and a mountain environment factor (e.g., Pomfret and Bramwell, 2016; Turner et al., 2018). Both our studies found that the 9 motivational items had a three-factor structure, with "performance focus" (3 items), "mountain environment" (3 items), and "openness" (3 items) factors. The presence of the first two factors confirmed hypothesis #1 and the presence of the third "openness" factor confirmed the structure's multifactorial nature.

Through the "Performance focus" factor, sportspeople sought to enhance their performance and were looking for more difficult training and greater physical difficulty. This performance-based approach is fully in line with the literature data in sports science (Behrendt et al., 2022; Faiss et al., 2013; Millet et al., 2021) and in sports mountain tourism, according to which sportspeople are motivated by achievement, competition, and opportunities to engage in physical challenges (Bichler & Peters, 2021; Giddy, 2018; Janowski et al., 2021; Perić et al., 2019; Pomfret & Bramwell, 2016; Ponte et al., 2021; Rejón-Guardia et al., 2020). For all participants, the score for the "Performance focus" factor was higher than the scores for the other two factors. This difference showed that the sportspeople's main reason for natural altitude training was the enhancement of their sporting performance and was consistent with the sportspeople's and coaches' perceptions of the utility of natural altitude training (Turner et al., 2018).

Through the "Mountain environment" factor, the sportspeople sought peacefulness, silence, and a changing landscape. They were attracted by the peacefulness of the mountain environment, the mountain landscape, and the nature. The emergence of this "mountain environment" factor as a motivational factor for natural altitude training is in line with the reasons for participating in mountain sports tourism, which were linked to the characteristics

of mountain environment (nature, the landscape, etc.) (Bichler & Peters, 2021; Giachino et al., 2020; Giddy, 2018; Janowski et al., 2021; Mohd Taher et al., 2015; Perić et al., 2018; Perić et al., 2019; Pomfret & Bramwell, 2016; Turner et al., 2018).

Through the third factor identified (“Openness”), the sportspeople were looking for conviviality, authentic human relationships, and varied activities. The sportspeople sought to open up to people and to mountain sports activities and wanted to develop rich, solid human relationships. This finding was in line with literature reports on socializing in a mountain tourism environment (Bichler & Peters, 2021; Cohen, 1988; Giddy, 2018; Perić et al., 2019; Pomfret & Bramwell, 2016; Zeng et al., 2018). This factor involves the concept of authenticity, which is a key notion for tourism development (Zhang & Yin, 2020). Furthermore, the sportspeople wanted to do various sports activities during their stay. Altitude training in an athlete’s main sport enables him/her to vary the sports activities and to take advantage of the unique opportunities available only in mountain areas (Bichler & Peters, 2021; Pomfret & Bramwell, 2016; Zeng et al., 2018).

Following on from our confirmation of hypothesis #1, hypothesis #2 held that the “mountain environment” score would be higher for recreational sportspeople than for competitive sportspeople (Fraser et al., 2019). This hypothesis was confirmed. Recreational sportspeople appear to be more sensitive to mountain environment than competitive sportspeople are. Fraser et al. (2019) previously found that competitive sportspeople were less attracted by outdoor activities in the mountains than recreational sportspeople were. However, we did not observe a difference between recreational sportspeople and competitive sportspeople in the “Openness” and “Performance” factor scores. Both competitive and recreational sportspeople are ready to discover other mountain sports and to develop their social life between specific training sessions, such as at training camp (Turner et al., 2018). Furthermore, performance enhancement through altitude training was of interest to purely recreational sportspeople as

well as sportspeople training for or participating in competitive events.

Our present work was innovative and exploratory because it was the first to have probed the structure of sportspeople's reasons for altitude training. It demonstrated that the reasons for natural altitude training are complex and multifactorial. In view of our results, our study might refer to the theoretical framework of push and pull factors (e.g., Giddy, 2018).

To understand people's tourism motivation, internal factors, i.e. push factors, were opposed to external factors, i.e. pull factors (e.g., Giddy, 2018). The push/pull approach has been applied in various studies of mountain sports tourism (Giddy, 2018; Giddy & Webb, 2018) and has been widely tried and tested in tourism more generally (e.g., Lwoga & Maturo, 2020). In line with this approach, the "Mountain environment" factor and the "Openness" factor may be considered as two pull factors. But the identification of the "Performance focus" is not so clear. The first item ("more difficult training conditions") refers to pull (external) dimension and the two other items ("greater physical difficulty" and "performance enhancement") refer to push (internal) dimension.

Thus, another theoretical approach, the Mullet et al. (2000)'s push-pull-antipush-antipull model, can be used to position our structure of reason for doing natural altitude training. In this approach the push and pull factors are not defined in the same way than the Giddy (2018)'s push/pull factors. Adapted to decision to natural altitude training, the push factor is conceptualized as negative considerations in present situation that induce to natural altitude training. Pull factors are typically positive considerations in future situation of natural altitude training. In considering the present and future barriers to the altitude natural training decision, the anti-push factor have been defined as attachment to the present situation, and the anti-pull factor as the perceived costs and risks of the future situation.

In considering the push-pull-antipush-antipull approach (Mullet et al. 2000), our structure of reasons to natural altitude training is clearly a model of three pull factors. This



may be explained by the fact that the 29 items identified from the inductive-deductive method were exclusively pull items according to the Mullet's (2000) definition. In the same way that the push/pull/antipush/antipull model has been used in the sports domain to identify the reasons for stopping a sports career (Fernandez et al., 2006) and in work psychology to understand workers' attitudes to the decision to retire (Fouquereau et al., 2018), we could implement this model to investigate the issue of natural altitude training decision.

### **Limitations**

There are several possible ways of circumventing this limitation. Firstly, our exploratory study of the structure of sportspeople's reasons for natural altitude training was not solidly grounded in psychology theory. Accordingly, this issue warrants further investigation with robust theoretical approaches and the push-pull-antipush-antipull model (Mullet et al. 2000) could be tested. Also, the reversal theory framework could also be implemented (Apter, 2001); this motivational theory is commonly used to reveal the structure of reasons for doing something, such as attacking an opposing player in team sports (Fruchart et al., 2020).

Secondly, our investigation compared the study populations' data with regard to their sex, the frequency of sports activity, and the type of activity (recreational vs. competitive). However, one could also investigate other variables, such as cultural variables (Zeng et al., 2018), age (Pomfret & Bramwell, 2016), and the athlete's origin (Ponte et al., 2021). Our study was focused on natural altitude training but it might also be useful to investigate the reasons for doing simulated altitude training (e.g. in hypobaric chambers, and hypoxia rooms and tents) (Behrendt et al., 2022).

### **Practical applications**

Our study's findings clearly showed that performance enhancement is not the only aspect that adds value to altitude training, even though it remains the priority. The

sportspeople's other interests must be taken into consideration by sports coaches and stakeholders in tourism.

For coaches, it might be valuable to slot moments designed to satisfy sportspeople's needs for a "mountain environment" and "openness" into the training program. Socializing periods could be envisaged for promoting conviviality between sportspeople themselves but also between sportspeople and local residents near the training camp. Other sports activities or natural experiences could be added to the work on physiological abilities. For example, some of the training camp's time could be reserved for connecting to the peacefulness and silence of a natural mountain environment. All these various factors might have positive impact on an athlete's well-being (Lawton et al., 2017).

The complexity sought by sportspeople might also be beneficial for stakeholders in sports tourism. For example, the latter could offer tourism packages comprising various services: altitude training sessions (to enhance performance), hiking or other mountain activities (to enable sportspeople to interact with the natural environment), and team-building sessions (to underpin interindividual relationships) (Beauchamp et al., 2017). In this sense, the diversification of services provided in sports tourism programmes and the collaboration between various sports training organizations, tourism specialists, and other stakeholders in mountain sports might foster the development of mountain sports tourism (Mollah et al., 2021).

The Appendix: the 29 items

- Contact with nature
- Optimisation of their abilities
- Better self-knowledge
- Silence
- Better oxygenation
- The change of landscape
- Better recovery
- Strengthening of group cohesion

Calmness  
The practice of diversified activities  
Conviviality  
A break from routine  
An Increase in red blood cells  
A greater concentration  
The opportunity to recharge their batteries  
A challenge to their bodies  
Fresh air  
The opportunity to challenge themselves  
Increased performance  
More difficult training conditions  
Relaxation  
Open spaces  
Cooler temperatures  
Increased physical stamina  
A healthy lifestyle  
Remobilisation on their projects  
Authentic human relationships  
A renewed energy  
A refocusing on oneself

### References

- Apter, M. J. (2001). *Motivational styles in everyday life: A guide to reversal theory*. Washington, DC.
- Almeida, A. M. M., & Correia, A. (s. d.). *Segmentation by benefits sought: The case of rural tourism in Madeira*.
- Beauchamp, M. R., McEwan, D., & Waldhauser, K. J. (2017). Team building: Conceptual, methodological, and applied considerations. *Current Opinion in Psychology*, 16, 114-117. <https://doi.org/10.1016/j.copsyc.2017.02.031>
- Behrendt, T., Bielitzki, R., Behrens, M., Herold, F., & Schega, L. (2022). Effects of intermittent hypoxia–hyperoxia on performance- and health-related outcomes in humans: A systematic review. *Sports Medicine - Open*, 8(1), 70. <https://doi.org/10.1186/s40798-022-00450-x>

- Bichler, B. F., & Peters, M. (2021). Soft adventure motivation: An exploratory study of hiking tourism. *Tourism Review*, 76(2), 473-488. <https://doi.org/10.1108/TR-10-2019-0403>
- Boateng, G. O., Neilands, T. B., Frongillo, E. A., Melgar-Quiñonez, H. R., & Young, S. L. (2018). Best practices for developing and validating scales for health, social, and behavioral research: A primer. *Frontiers in Public Health*, 6, 149. <https://doi.org/10.3389/fpubh.2018.00149>
- Bonadonna, A., Giachino, C., & Truant, E. (2017). Sustainability and mountain tourism: The Millennial's perspective. *Sustainability*, 9(7), 1219. <https://doi.org/10.3390/su9071219>
- Burke, S. M., Durand-Bush, N., & Doell, K. (2010). Exploring feel and motivation with recreational and elite Mount Everest climbers: An ethnographic study. *International Journal of Sport and Exercise Psychology*, 8(4), 373-393. <https://doi.org/10.1080/1612197X.2010.9671959>
- Cohen, E. (1988). Traditions in the qualitative sociology of tourism. *Annals of Tourism Research*, 15(1), 29-46. [https://doi.org/10.1016/0160-7383\(88\)90069-2](https://doi.org/10.1016/0160-7383(88)90069-2)
- Collins, L., & Brymer, E. (2020). Understanding nature sports: A participant centred perspective and its implications for the design and facilitating of learning and performance. *Annals of Leisure Research*, 23(1), 110-125. <https://doi.org/10.1080/11745398.2018.1525302>
- Fabrigar, L. R., Wegener, D. T., MacCallum, R. C., & Strahan, E. J. (1999). Evaluating the use of exploratory factor analysis in psychological research. *Psychological Methods*, 4(3), 272-299. <https://doi.org/10.1037/1082-989X.4.3.272>
- Faiss, R., Girard, O., & Millet, G. P. (2013). Advancing hypoxic training in team sports: From intermittent hypoxic training to repeated sprint training in hypoxia: Table 1. *British*

*Journal of Sports Medicine*, 47(Suppl 1), i45-i50. <https://doi.org/10.1136/bjsports-2013-092741>

Fernandez, A., Stephan, Y., & Fouquereau, E. (2006). Assessing reasons for sports career termination: Development of the Athletes' Retirement Decision Inventory (ARDI). *Psychology of Sport and Exercise*, 7(4), 407-421. <https://doi.org/10.1016/j.psychsport.2005.11.001>

Fouquereau, E., Bosselut, G., Chevalier, S., Coillot, H., Demulier, V., Becker, C., & Gillet, N. (2018). Better understanding the workers' retirement decision attitudes: Development and validation of a new measure. *Frontiers in Psychology*, 9, 2429. <https://doi.org/10.3389/fpsyg.2018.02429>

Fraser, M., Munoz, S.-A., & MacRury, S. (2019). What motivates participants to adhere to green exercise? *International Journal of Environmental Research and Public Health*, 16(10), 1832. <https://doi.org/10.3390/ijerph16101832>

Fruchart, E., Rulence-Pâques, P., & Mullet, E. (2020). Aggression in team sports A quantitative investigation of reversal theory motives. *International Journal of Sport Psychology*, 51, 383-399. <https://doi.org/10.7352/IJSP.2020.51.383>

Gammon, S., & Robinson, T. (2003). Sport and tourism: A conceptual framework. *Journal of Sport & Tourism*, 8(1), 21-26. <https://doi.org/10.1080/14775080306236>

Getz, D., & McConnell, A. (2014). Comparing Trail Runners and Mountain Bikers: Motivation, involvement, portfolios, and event-tourist careers. *Journal of Convention & Event Tourism*, 15(1), 69-100. <https://doi.org/10.1080/15470148.2013.834807>

Giachino, C., Truant, E., & Bonadonna, A. (2020). Mountain tourism and motivation: Millennial students' seasonal preferences. *Current Issues in Tourism*, 23(19), 2461-2475. <https://doi.org/10.1080/13683500.2019.1653831>

- Giddy, J. K. (2018). Adventure tourism motivations: A push and pull factor approach. *Bulletin of Geography. Socio-Economic Series*, 42(42), 47-58.  
<https://doi.org/10.2478/bog-2018-0030>
- Giddy, J. K., & Webb, N. L. (2018). The influence of the environment on adventure tourism: From motivations to experiences. *Current Issues in Tourism*, 21(18), 2132-2146.  
<https://doi.org/10.1080/13683500.2016.1245715>
- Hanna, P., Wijesinghe, S., Paliatsos, I., Walker, C., Adams, M., & Kimbu, A. (2019). Active engagement with nature: Outdoor adventure tourism, sustainability and wellbeing. *Journal of Sustainable Tourism*, 27(9), 1355-1373.  
<https://doi.org/10.1080/09669582.2019.1621883>
- Hu, L., & Bentler, P. M. (1998). Fit indices in covariance structure modeling: Sensitivity to underparameterized model misspecification. *Psychological Methods*, 3(4), 424-453.
- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1), 1-55. <https://doi.org/10.1080/10705519909540118>
- IJspeert, R., & Hernandez-Maskivker, G. (2020). Active sport tourists: Millennials vs Baby boomers. *Journal of Tourism, Heritage & Services Marketing*, 6(2), 12-20.  
<https://doi.org/10.5281/ZENODO.3835813>
- Janowski, I., Gardiner, S., & Kwek, A. (2021). Dimensions of adventure tourism. *Tourism Management Perspectives*, 37, 100776. <https://doi.org/10.1016/j.tmp.2020.100776>
- Lawton, E., Brymer, E., Clough, P., & Denovan, A. (2017). The relationship between the physical activity environment, nature relatedness, anxiety, and the psychological well-being benefits of regular exercisers. *Frontiers in Psychology*, 8, 1058.  
<https://doi.org/10.3389/fpsyg.2017.01058>

- Lwoga, N. B., & Maturo, E. (2020). Motivation-based segmentation of rural tourism market in African villages. *Development Southern Africa*, 37(5), 773-790.  
<https://doi.org/10.1080/0376835X.2020.1760791>
- Millet, G. P., Burtscher, M., & Burtscher, J. (2021). Is hypoxic/altitude training an important topic in the field of hypoxia? *Journal of Science in Sport and Exercise*.  
<https://doi.org/10.1007/s42978-021-00144-y>
- Mohd Taher, S. H., Jamal, S. A., Sumarjan, N., & Aminudin, N. (2015). Examining the structural relations among hikers' assessment of pull-factors, satisfaction and revisit intentions: The case of mountain tourism in Malaysia. *Journal of Outdoor Recreation and Tourism*, 12, 82-88. <https://doi.org/10.1016/j.jort.2015.11.012>
- Mollah, M. R. A., Cuskelly, G., & Hill, B. (2021). Sport tourism collaboration: A systematic quantitative literature review. *Journal of Sport & Tourism*, 25(1), 3-25.  
<https://doi.org/10.1080/14775085.2021.1877563>
- Mullet, E., Dej, V., Lemaire, I., Raïff, P., & Barthorpe, J. (2000). Studying, working, and living in another EU country: French youth's point of view. *European Psychologist*, 5(3), 216-227. <https://doi.org/10.1027//1016-9040.5.3.216>
- Perić, M., Dragičević, D., & Škorić, S. (2019). Determinants of active sport event tourists' expenditure – the case of mountain bikers and trail runners. *Journal of Sport & Tourism*, 23(1), 19-39. <https://doi.org/10.1080/14775085.2019.1623064>
- Perić, M., Đurkin, J., & Vitezić, V. (2018). Active event sport tourism experience: The role of the natural environment, safety and security in event business models. *International Journal of Sustainable Development and Planning*, 13(05), 758-772.  
<https://doi.org/10.2495/SDP-V13-N5-758-772>

- Pomfret, G., & Bramwell, B. (2016). The characteristics and motivational decisions of outdoor adventure tourists: A review and analysis. *Current Issues in Tourism*, 19(14), 1447-1478. <https://doi.org/10.1080/13683500.2014.925430>
- Ponte, J., Couto, G., Sousa, Á., Pimentel, P., & Oliveira, A. (2021). Idealizing adventure tourism experiences: Tourists' self-assessment and expectations. *Journal of Outdoor Recreation and Tourism*, 35, 100379. <https://doi.org/10.1016/j.jort.2021.100379>
- Rejón-Guardia, F., Alemany-Hormaeche, M., & García-Sastre, M. A. (2020). Ibiza dances to the rhythm of pedals: The motivations of mountain biking tourists competing in sporting events. *Tourism Management Perspectives*, 36, 100750. <https://doi.org/10.1016/j.tmp.2020.100750>
- Turner, G., Fudge, W. B., Pringle, J. S. M., Maxwell, N. S., & Ridcharson, A. J. (2018). Altitude training in endurance running: Perceptions of elite athletes and support staff. *Journal of Sports Sciences*. <https://doi.org/10.1080/02640414.2018.1488383>
- Zeng, X., Liu, R., & Gong, H. (2018). Motivations of adventure recreation in an emerging market: Scale development and an empirical study on mainland Chinese enthusiasts. *Asia Pacific Journal of Tourism Research*, 23(6), 600-612. <https://doi.org/10.1080/10941665.2018.1469522>
- Zhang, T., & Yin, P. (2020). Testing the structural relationships of tourism authenticities. *Journal of Destination Marketing & Management*, 18, 100485. <https://doi.org/10.1016/j.jdmm.2020.100485>



## REASONS OF NATURAL ALTITUDE TRAINING

Table 1

*Potential reasons of altitude natural training*

<b>DOMAIN</b>	<b>POTENTIAL REASONS OF NATURAL ALTITUDE TRAINING</b>	<b>AUTHORS</b>
<b>Sports sciences</b>	performance enhancement explained by physiological adaptations	Millet et al. (2021)
	lifestyle; location; psychological dimension; relaxing environment	Turner et al. (2018)
<b>Mountain tourism</b>	sport; nature and wildlife; food and drink; relaxation and peacefulness; economic convenience; trendy location	Giachino et al. (2020)
	authenticity; visiting farms and nature; relaxation with friends and family; casual experiences	Lwoga and Maturo (2020)
<b>Mountain sports tourism (nature sports tourism, active sport tourism, and outdoor/adventure sport tourism)</b>	connect with and feel part of nature; explore their potential; creativity and meaning; collaborate with other individuals; experience better health and well-being; mastery and development	Collins and Brymer (2020)
	challenges; adrenaline (i.e. thrills and sensations); escape from the daily routine; improvement of health	IJspeert and Hernandez-Maskivker (2020)
	reconnection with nature; pro-environmental attitudes and behaviours; positive influence on wellbeing	Hanna et al. (2019)
	social motivation; enjoyment; adjustment of introspection; relationships with family members, friends, and other individuals; self-identity (e.g., doing different things)	Zeng et al. (2018)
	“push” factors: thrills; socializing; enjoying nature; escapism; environmental education; novelty; overcoming nature; risk-taking; challenges/skills. “pull” factors: environment (e.g., landscape), attraction (adventure activities, events, and heritage sites); facilities (e.g., accessibility, accommodation, and food).	Giddy (2018)
	preparation; immersive fantasy; unpredictability; interaction with nature; self-reliance; physical engagement	Ponte et al. (2021)
	physical activity; natural environment; risk and danger; challenges; thrill and excitement	Janowski et al. (2021)
	speed/excitement/risk; having fun; event attractiveness; seeking out opportunities to engage in a physical challenge	Rejón-Guardia et al. (2020)
	safety; security; competition; stress; relief/health; enjoyment; nature; appearance; socializing	Perić et al. (2018, 2019)
	a new experience; socialising; natural environment; novelty; change of environment; exploration; discovery; cultures; challenges; natural environment; the aesthetic and physical enjoyment of mountain environment; ease of organisation socializing (e.g., meeting new individuals); achievement (e.g., hardship and physical achievement); feeling close to nature; relaxing mentally; getting away; being challenged; having a sense of accomplishment; social atmosphere; hills and trails	Pomfret and Bramwell (2016)
	effectiveness of the organizing company; trail accessibility; perceived safety risks; the mountain landscape	Mohd Taher et al. (2015)
relaxation; recognition; challenges; socializing; creativity; discovery	Bichler and Peters (2021)	

## REASONS OF NATURAL ALTITUDE TRAINING

Table 2

*Results of the confirmatory factor analysis conducted in Study 2.*

Items: In natural altitude training, athletes are looking for	Mountain environment	Openness	Performance focus
silence.	.886		
peacefulness.	.867		
a changing landscape.	.643		
conviviality.		.829	
authentic human relationships.		.750	
varied activities.		.749	
more difficult training conditions.			.767
greater physical difficulty.			.757
performance enhancement.			.741
Alpha	0.76	0.71	0.75
Mean	2.77	2.57	3.41
SD	0.61	0.63	0.53

## REASONS OF NATURAL ALTITUDE TRAINING

Table 3

*Mean (M) and standard deviation (SD) factor scores for competitive sportspeople and recreational sportspeople*

	Mountain environment		Openness		Performance focus	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Competitive	2.60	0.84	2.59	0.83	3.42	0.66
Recreational	2.90	0.80	2.56	0.87	3.40	0.72