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Psychological Effects on Trainees of High-Altitude Mountaineering Courses in the Indian Himalayas

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High-altitude mountaineering (HAM) involves the ascent and descent of mountains exceeding 2,500 m, necessitating specialized equipment and technical skills. In the Indian Himalayas, formal training is provided through government-recognized Basic and Advance Mountaineering Courses (BMC/AMC). Within this context, a pre-post design was conceptualized to examine the effects of participation in the BMC/AMC on key psychological constructs related to mental toughness, including subjective goal difficulty, self-efficacy, experience of stressors, state self-control capacity, self-reflection, and insight. A total of 43 trainee mountaineers were recruited from two national mountaineering institutes; 31 completed both pre- and post-assessments. Subjective goal difficulty exhibited a significant decrease, even as the experience of stressors increased significantly, suggesting that goal attainment can retrospectively alter perceived challenge. No increase in mental toughness or other psychological variables was observed, indicating that physical training alone is insufficient. It is recommended that mountaineering curricula incorporate psychological insights to further enhance the performance and safety of mountaineers.

Keywords: High-altitude, Mountaineering, Mental toughness, Psychological Training, Himalayas

The Himalayas constitute one of the most prominent mountain ranges globally, extending across five South Asian nations: India, Nepal, Bhutan, China (Tibet), and Pakistan. India is home to several notable ranges, including the Great Himalayas, Zanskar, Laddakh, Dhauladhar, and Karakoram, as well as mountain peaks exceeding 7,000 m, such as Kangchenjunga, Nanda Devi, Kamet, Kun, and Nun. High-altitude mountaineering (HAM) is defined as a multi-day ascent and descent to and from a designated point on a mountain, typically the summit, at an altitude above 2,500 m. This activity necessitates specialized equipment, a substantial team, technical expertise, and proficiency in climbing. Henceforth, the terms high-altitude mountaineering (HAM) and 'mountaineering' will be used interchangeably. Several factors influence the duration of an expedition, including mountain elevation, chosen route, acclimatization, logistics, weather conditions, and distance of the base camp from the roadhead. The towering mountains have facilitated the steady development and growth of the sport in India (Kumar & Reddy, 2024).

Mountaineering Training in India

The inaugural successful expedition of the Indian Army to Mount Everest was led by Captain M. S. Kohli in 1965. Since then, the Indian Army has consistently played a significant role in organizing expeditions to peaks exceeding 6,000 m, with other defense services following this precedent. There are five government-recognized mountaineering institutes that provide training to amateur mountaineers. These institutes offer a 28-day Basic Mountaineering Course (BMC), and individuals who achieve an 'A' grade in

the BMC are eligible to enroll in the 28-day Advance Mountaineering Course (AMC). These certifications serve multiple purposes, including obtaining approval for expeditions above 6,000 m in India, qualifying as a mountaineering guide, and establishing a trekking or mountaineering agency. All these activities are conducted under the auspices of the Indian Mountaineering Foundation (IMF), which functions as the national regulatory authority for mountaineering and related sports in India. The curricula for the BMC and AMC typically encompass training in various modules, including rock climbing, ice climbing, and snow craft. A detailed, weekly breakdown is provided in *Table 1*. Notably, the psychological competencies essential for success in such training modules receive limited emphasis, warranting a closer examination of the psychological impact of participating in these courses on prospective mountaineers.

Table 1: Components of Basic and Advance Mountaineering Course

	Basic Mountaineering Course	Advance Mountaineering Course
Week 1:*Rock Climbing*	Physical training, hill walk with loaded rucksack, introduction to mountaineering equipment, rope care, coiling and maintenance, rope knots and roping up, preparing rucksack, pitching of tent, first aids, mountain manners and customs, fundamentals of rock climbing, descending, grips, bouldering, securing and belaying, crafting a makeshift seat harness, the history of mountaineering, terminology related to rock climbing, hygiene and sanitation in camps, weather conditions, and the process of acclimatization.	Physical conditioning/yoga, health check-ups, belaying and descending, navigating with maps, utilizing GPS, practicing sports climbing, planning of expeditions, checking and adjusting rope knots, using fixed ropes and artificial climbing aids, dynamic belay, jumar climbing with load, building of anchors, long pitch, friction hitches, avalanche, first aid, weather, and clouds, training films, supplementary oxygen system in high altitude
Week 2:*Trek to Base Camp*	Artificial wall climbing, roping up, lecture on Himalayas, establishment of camp, acclimatization walks, choosing of camp site.	Acclimatization, lecture on surrounding peaks, bouldering, handing out supplies, load ferry to the forward base camp, ascending with a jumar.
Week 3:*Snow Craft and Ice Craft*	Introduction to ice craft equipment,ice axes and crampons,setting anchors and belaying, descending with ropes,using ice pitons, ascending with jumars, navigating crevasses, performing rescues, understanding mountain hazards, traversing glaciers, and reading maps, load ferry to advance base camp, snow craft training, negotiating snow slopes, glissading, self-arrest or team arrest, camping in snow.	Move to forward base camp, expedition planning, map reading/GPS, managing waste, pick toe climbing on rock faces, direct aid climbing, using two pitons for climbing, reviewing avalanche safety, cooking at high altitudes, using fixed ropes, techniques for rescuing from crevasses, deploying ladders, constructing stretchers, negotiating snow slopes, glissading, self-arrest or team arrest, camping in snow.
Week 4:*Height gain and Return*	Height gain, clearing camp site, descend to base, feedback, quiz, navigation exercise, maintenance of equipment, medical inspection, De-briefing, graduation ceremony.	Peak summit, Tyrolean traverse and suspension traverse, rescue evacuation, clearing camp site, sports climbing competition, presentation of expedition climbing, graduation ceremony.

Psychological Aspects of Mountaineering

The psychological literature on mountaineering can be broadly divided into two primary analytical themes: the personality traits of mountaineers and their psychological experiences during expeditions (Jackman et al., 2023). Studies on personality traits, using cross-sectional methods, reveal that mountaineers generally possess high extraversion and conscientiousness, low neuroticism, self-transcendence, mental resilience, and a pronounced tendency for thrill-seeking and experiential activities through social interactions (Crust, 2020; Monasterio & Brymer, 2015). High-altitude mountaineering is acknowledged as one of the most perilous outdoor activities, with an estimated risk of approximately 12,000 micromorts per climb in the Himalayas, setting it apart from other mountaineering-related sports, with climbers often unaware of the severity of this risk (Duits, 2020). Individuals who undertake the ascent of towering peaks encounter some of the most hazardous conditions, including crevasses, avalanches, falling rocks and ice, hypoxia, extreme cold, and severe weather. These environmental challenges require endurance, and an adequate level of physical fitness. The immediate psychological impact of participating in mountaineering activities remains underexplored and has not been a primary focus of existing research despite the risk involved. However, risk-taking is neither the predominant aspect of mountaineering nor a significant motivator for mountaineers (Monasterio and Brymer, 2015). This observation raises the question of which psychological elements are associated with mountaineering, given that mental toughness is a crucial attribute that mountaineers should possess (Crust et al., 2016).

Mental toughness encompasses the values, beliefs, emotions, and cognitions that facilitate the pursuit, maintenance, and achievement of performance goals despite adversity or obstacles (Gucciardi et al., 2015). It is conceptualized as a unidimensional construct; wherein various psychological dimensions accumulate and integrate over time to form a resource. Mentally tough mountaineers are characterized by their calmness and rationality in crisis situations: '*People that are mentally tough can take all the ups and downs with more calm because I think we act in a more rational way*' (Crust et al., 2016, p. 163). MT is also associated with advantageous behavior and enhanced sports performance outcomes (Stamatis et al., 2023). The GES Model (Goal, Expectancy, Self-Control) introduced by Bédard-Thom, Gruay, and Trottier (2021) characterizes MT as a psychological asset that allows individuals to adjust their efforts to reach demanding and precise objectives when faced with stressors that jeopardize their goal achievement. The GES Model also suggests that for MT to be used most effectively, three key resources are necessary: the establishment of specific and demanding goals, a strong sense of self-efficacy, and a high level of self-control, especially when faced with stressful situations.

There remains a dearth of psychological literature around personality profiling, psychological correlates and especially around training in the Indian context, Hence, the present study adopted an exploratory approach to examine the impact of a month-long Basic Mountaineering Course (BMC) or Advance Mountaineering Course (AMC) at mountaineering institutes in the Indian Himalayas on the mental toughness of trainees in relation to other psychological variables and their subsequent subjective endurance performance (SEP). Data were collected in situ to ensure that subjective responses were unaffected by temporal changes. There is a notable paucity of psychological research and insights available

to mountaineers in a formal training context. Consequently, the ensued study utilized self-report scales to measure subjective goal difficulty (SGD), self-efficacy (SE), experience of stressors (ES), and self-control (SC) in accordance with this model. Additionally, qualitative research has highlighted the importance of examining self-awareness in relation to MT; therefore, self-reflection (SR) and insight were considered. This study provides valuable insights for prospective mountaineers and training institutes globally.

Objectives

The study consisted of the following objectives:

1. To examine the perception of mental toughness in the context of high-altitude mountaineering and investigate its associations with established psychological constructs, including self-efficacy, state self-control capacity, self-reflection, insight, experience of stressors, subjective goal difficulty, and subjective endurance performance.
2. To explore the psychological effects of participation in Basic and Advance Mountaineering Courses (BMC/AMC) by employing pre-course and post-course psychological measures.
3. To conduct a comparative analysis between BMC and AMC trainees with respect to psychological responses and outcomes.

Method

Sample:

A total of 43 participants were initially recruited from two government-recognized mountaineering institutes in the Indian Himalayas. Five trainees left the course after going to higher camps because of symptoms of altitude-related illness, such as breathlessness, extreme fatigue, headache, nausea, vomiting, dizziness, and poor sleep. These symptoms were indicative of acute mountain sickness. As shown in *Table 2*, the sample consisted predominantly of males (94.5%) with a mean age of 29.32 years (SD = 7.01). Most participants had graduate-level education, were employed, and engaged in preparatory training for the course. Non-probability purposive and convenience sampling was employed, with data collected using Google Forms during the first three days of training. All participants provided informed consent and were subject to voluntary participation, with the option to withdraw at any stage without consequences. The final sample size (N=31) was considered appropriate for identifying patterns and generating insights, as the focus was on the depth of psychological assessment, aligning with the goals of early-stage research and feasibility-oriented field studies.

Tools:

Participants gave their informed consent after being briefed on the study's objectives, guaranteed confidentiality, and notified of their ability to withdraw at any point. No incentives were offered beyond contributing to the scientific community.

Subjective Goal Difficulty was assessed using a 5-item subscale from Lee and Bobko (1992), which evaluated the perceived challenge of the course on a 5-point Likert scale ($\Omega = 0.85$).

State Self-Control Capacity was measured using the SMS-5 (Lindner et al., 2019), which assessed self-control as fatigue on a 5-point Likert scale ($\alpha = .73$).

Self-Reflection and Insight Scale – Short Form, a 12-item instrument (Silvia, 2022) includes two subscales: *Self-Reflection* ($\alpha = .87$) and *Insight* ($\alpha = .83$), measured on a 7-point Likert scale. This scale has demonstrated acceptable reliability and convergent validity in prior studies.

Mental Toughness Index (Gucciardi et al., 2015) is an 8-item, unidimensional scale that assesses overall mental toughness on a 7-point Likert scale (α =.83).

Experience of Stressors, based on the GES model (Bédard-Thom et al., 2024), was measured using a single Likert-type item to assess exposure to unexpected challenges during the training period.

Self-Efficacy, adapted from Bandura (2006), was a single-item measure that assessed participants' confidence in course completion, using a 5-point scale.

Subjective Endurance Performance, a 4-item post-course measure (Ω = 0.87) evaluated perceived goal achievement, improvement, and satisfaction.

Procedure:

The researcher (NP), who underwent training at both BMC and AMC, invited fellow course participants to engage in the study. The preliminary phase of data collection was executed within the first three days, during which the participants were stationed at low altitudes and were provided with accommodation and equipment by the institute. Subsequently, over 20 days, the trainees ascended to higher camps, reaching altitudes of approximately 15,250 ft (BMC) and 17,200 ft (AMC). Upon their return, the trainees were afforded two days of rest prior to the graduation ceremony. The subsequent phase of data collection was conducted over the ensuing three days, during which the same participants were re-contacted and requested to complete the post-test. In addition to quantitative data, the researcher, maintained field notes and mobile diary entries documenting personal reflections, interactions with instructors and peers, and experiential insights. Data analysis was performed using the latest version 26 of the IBM SPSS software, employing a range of statistical procedures.

Results

To examine the psychological effects of participation in high-altitude mountaineering training, descriptive and inferential analyses were conducted on data collected from trainees who completed both pre- and post-course measures. Demographic characteristics and training backgrounds were first summarized to contextualize the sample. Subsequently, paired-samples t-tests were employed to evaluate changes across key psychological constructs following the course. Correlational analyses further explored associations between mental toughness and related variables.

Table 2: Demographic and Training Information (N=31)

Variable	Category	n (%)
Course	*BMC*	16 (51.6%)
	AMC	15 (48.4%)
Sex	*Male*	29 (93.5%)
	Female	2 (6.5%)
Age		
(Mean ± SD)	-	29.32 ± 7.01
Course Waiting Time[a]		
(Mean ± SD)	-	13.71 ± 13.83
Education	*Secondary or below*	1 (3.2%)
	Senior Secondary	2 (6.5%)
	Graduate/Postgraduate	28 (90.3%)
Employment	*Student*	3 (9.7%)
	Unemployed	4 (12.9)
	Part-time/Full-time	24 (77.4%)

Living	*Alone*	11 (35.5%)
Arrangement	*With Family*	20 (64.5%)
Training Start	*≥ 1 Year Ago*	7 (22.6%)
Time	*6-9 Months Ago*	3 (9.7%)
	3-6 Months Ago	8 (25.8%)
	<2 Months Ago	6 (19.4%)
	Did Not Train	7 (22.6%)
Training	*5-6 Days/Week*	11 (35.5%)
Frequency	*3-4 Days/Week*	13 (41.9%)
	1-2 Days/Week	4 (12.9%)
	<1-2 Days/Week	3 (9.7%)
Training	*Self-guided*	16 (51.6%)
Method	*Gym/Program*	9 (29%)
	No Formal Training	6 (19.4)

Note. [a]=in months (average time between payment of fee and course commencement)

Normality testing using the Shapiro–Wilk test demonstrated that over 75% of the variables and their difference scores yielded non-significant p-values, indicating approximate normality. Consequently, parametric analyses were employed because the total sample size exceeded 30. Paired-samples t-tests (see *Table 3*) identified a significant reduction in Subjective Goal Difficulty, $t(30) = 2.48$, $p = .019$, and a significant increase in Experience of Stressors, $t(30) = -2.15$, $p = .039$. Changes in other variables were non-significant; however, Mental Toughness approached significance ($p = .052$). As illustrated in *Table 4*, Mental Toughness exhibited a positive correlation with self-reflection ($r = .43$, $p = .017$). Experience of Stressors was positively correlated with Subjective Goal Difficulty ($r = .41$, $p = .021$) and negatively correlated with State Self-Control Capacity ($r = -.40$, $p = .026$). No significant differences in Mental Toughness were observed based on course type, training duration, frequency, or method (all $p > .05$, Mann–Whitney *U* tests). Notably, all three participants who anticipated receiving a B grade prior to the course withdrew early because of illness.

Table 3: Pre-Post Comparison of Psychological Variables Among Mountaineering Trainees

Variable Pair	Pre (M ± SD)	Post (M ± SD)	t(30)	p	Mean Difference	95% CI of Difference
Subjective Goal Difficulty	17.45 ± 2.96	16.13 ± 4.03	2.48	.019*	1.32	[0.23, 2.41]
Self-Efficacy	4.16 ± 0.64	3.94 ± 0.93	1.13	.269	0.23	[–0.18, 0.64]
Experience of Stressors	2.61 ± 0.95	3.19 ± 1.33	–2.15	.039*	–0.58	[–1.13, –0.03]
State Self-Control Capacity	18.87 ± 4.03	18.74 ± 2.86	0.16	.874	0.13	[–1.52, 1.78]
Self-Reflection	29.19 ± 7.28	30.71 ± 5.73	–1.42	.165	–1.52	[–3.69, 0.66]
Insight	30.42 ± 5.99	31.19 ± 6.55	–0.94	.357	–0.77	[–2.46, 0.92]
Mental Toughness	43.39 ± 7.26	46.35 ± 6.74	–2.02	.052	–2.97	[–5.97, 0.03]

Note. *p <0.05, N=31

Table 4: Correlations Between Post-Training Psychological Variables, Mental Toughness, and Subjective Endurance Performance (SEP)

	SGD	SE	ES	SSCC	SR	IN	MT	SEP
1. SGD	—							
2. SE	–.26	—						
3. ES	.41*	–.18	—					
4. SSCC	–.19	.33	–.40*	—				
5. SR	.35	–.17	.20	–.02	—			
6. IN	–.09	.12	.09	–.04	–.10	—		
7. MT	–.20	.24	–.03	.23	.43*	.18	—	
8. SEP	.29	.12	.00	.17	.21	–.06	.19	—

Note. *p <0.05; SGD=Subjective Goal Difficulty, SE=Self-Efficacy, ES=Experience of Stressors, SSCC=State Self-Control Capacity, SR=Self-Reflection, IN=Insight, MT=Mental Toughness, SEP=Subjective Endurance Performance

Discussion

This exploratory research aimed to generate psychological insights into high-altitude mountaineering and serve as a catalyst for further empirical investigations in the Indian Himalayas. The socio-demographic analysis of the sample revealed that the majority of the trainees were male (94.5%), highlighting the gender disparity in participation in competitive adventure sports. However, this disparity diminishes when considering the percentage of individuals who successfully reach the summit (Apollo et al. 2023) relative to their gender who do not. Men and women were accommodated in separate living quarters, which initially limited the researcher's (a male) ability to engage and recruit female participants for the study. These institutes also offer an annual women-only mountaineering course, and the data collected for this study were derived from both 'mixed' courses. The BMC and AMC are prestigious training courses offered at a highly subsidized rate, aimed at imparting knowledge and promoting mountaineering-related activities. Nevertheless, high-altitude mountaineering (HAM) is an expensive endeavor (Apollo, 2017), with the institutes opening limited slots each year which results in an average waiting time of 13.71 ± 13.83 months. Trainees, most of whom are employed (77.4%) and live with their families (64.5%), must plan in advance to apply for a month-long leave and achieve physical readiness before the course commences. The waiting period ensures that only serious trainees with prior trekking or hiking experience participate. Consequently, a baseline level of physical fitness is essential to maintain performance, as HAM is primarily an endurance sport (Rokowski et al., 2017) with specific goals.

Goal-setting is recognized as a precursor to performance, particularly in the sports domain (Healy et al., 2018). In mountaineering, the primary objective is to reach the summit and safely return to the base camp. Subjective goal difficulty (SGD) in the pre-form refers to the trainee's anticipation of the course's challenge, whereas the post-form reflects their actual perception of the course's difficulty. A significant decrease in perceived difficulty was observed, even as the experience of

stressors (ES), conceptualized as unforeseen events or risky situations, increased. Despite encountering obstacles such as cold, adverse weather, crevasses, fatigue, and exhaustion, the perception of difficulty diminished in retrospect, as the satisfaction of achieving a challenging goal remained prominent in their minds (Hardie-Bick & Bonner, 2016). ES was negatively associated with state self-control capacity (SSCC) and positively associated with SGD. Stress linked to unforeseen events or risky situations necessitates attentional focus and behavioral perseverance, which may contribute to a subsequent decline in self-control (Bhanji et al., 2016; DiMenichi & Richmond, 2015).

In the preliminary assessment, trainees were required to indicate the grade they anticipated receiving at the conclusion of the course, choosing between A or B. This grading system is essential for certification and is determined by a team of instructors who meticulously evaluate the trainees' performance based on their technical skills, theoretical knowledge, discipline, and participation in teamwork. Of the 43 participants initially recruited, only three anticipated receiving a B grade, while the remainder expected an A grade. All participants who expected a B grade fell ill at higher camps and were compelled to descend and withdraw from the course, underscoring the significance of psychological preparedness and self-efficacy prior to commencing the course (McDonald et al., 2023). All these three individuals were BMC trainees, suggesting that mountaineering experience is also a predictor of goal achievement (Savage et al., 2020), which, in this context, was course completion. No differences were observed between the pre- and post-MT levels of BMC or AMC.

Mental toughness (MT) can be conceptualized as a finite psychological resource (Bédard Thom et al., 2021) developed by overcoming challenging circumstances in personal contexts that can translate to the mountaineering domain. It facilitates the maintenance of goal-directed behavior when faced with difficult obstacles. Although an increase in MT levels was observed over the course duration, this increase was not statistically significant, suggesting that physical training alone may be insufficient. Therefore, it is necessary to integrate mental or psychological skills training with physical training (Lange-Smith et al., 2024). MT was also found to have a positive correlation with self-reflection, an aspect of self-awareness. A mountaineer with heightened self-awareness can better comprehend their motivations, bodily sensations, and performance potential, enabling them to make critical decisions in adverse situations, such as abandoning a summit attempt and returning. Overcoming pain, fatigue, and illness fostered perseverance and reinforced their belief in their capabilities, and enduring discomfort was regarded as an indicator of MT. This is aptly illustrated by the researcher's own diary entry after struggling to carry a 22 kg load and walk uphill for 12 km at 13,000 ft: "Opting to continue the journey necessitates the acceptance of pain and the development of mental toughness."

Conclusion

Training that focuses on pain coping strategies may contribute to the enhancement of mental toughness, particularly when integrated with other techniques such as positive self-talk, visualization, and mindfulness. Psychological measures that did not see an increase during the course, i.e., self-efficacy, self-control and self-awareness should also be incorporated in training modules. Further qualitative interviews with experienced mountaineers are necessary to identify additional psychological factors that should be considered beyond mental toughness (Crust et al., 2016). Future training programs at

mountaineering institutes should elaborate on essential psychological skills by incorporating theoretical lectures, group discussions, experiential exercises, or presenting case studies of specific survival stories in mountainous environments. The current research was constrained by the self-reported nature of the measures employed, with some variables (SE and ES) assessed using single items. Future performance measures should aim to include objective evaluations by instructors and peers or incorporate physiological metrics, which may provide greater validity when compared to self-reports.

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