

BRIEF REPORT

Acute Mountain Sickness (AMS) Knowledge Among High Altitude Marathon Runners Competing in the Everest Marathon

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Objective.—Although there are a number of studies on trekkers' knowledge of acute mountain sickness (AMS), there is little current literature on other groups at altitude, for example, marathon runners. Increased knowledge of AMS is associated with a lower incidence of AMS. The purpose of this study was to determine AMS knowledge of marathon runners with an aim to improve AMS information distribution. Incidence of AMS was also determined.

Methods.—Participants completed a self-assessment AMS knowledge questionnaire in Kathmandu before starting the acclimatization trek for the Tenzing Hillary Everest Marathon in Nepal. Lake Louise Scoring questionnaires were completed every day of the 12-day acclimatization trek.

Results.—The majority (86%; 43 of 50) of participants obtained information about AMS before the marathon, with the Internet providing the most common source (50%; 25 of 50). Ninety-two percent (46 of 50) of participants rated their knowledge as average or above, and self-assessment correlated with knowledge questionnaire scores ($r = .479, P < .001$). However, 48% (24 of 50) did not know it was unsafe to ascend with mild AMS symptoms, and 66% (33 of 50) thought it was safe to go higher with symptoms relieved by medication. Only 50% (25 of 50) knew AMS could occur from 2500 m. Thirty-eight percent (19 of 50) of participants had AMS during the acclimatization trek, and 6% (3 of 50) experienced it during the race.

Conclusions.—This study adds to previous literature regarding knowledge and incidence of AMS. It further highlights that more needs to be done to improve knowledge through better information dissemination, with inclusion of scenario-based information to aid application of this knowledge to practical situations.

Key words: altitude sickness, knowledge, marathon runners, Nepal

Introduction

Ascent to high altitude is becoming increasingly popular and accessible. Those traveling to altitudes above 2500 m are at risk of developing acute mountain sickness (AMS), high altitude cerebral edema, or high altitude pulmonary edema.¹ The Lake Louise Consensus Group defined AMS as the presence of a cardinal headache after a recent gain in altitude, with one or more of the following symptoms: gastrointestinal symptoms, fatigue, dizziness, or insomnia.²

Slow ascent reduces the risk of AMS. Above 3000 m, sleeping elevation should not be increased by more than 500 m a day, and a rest day should be included every 3 to 4 days. The use of acetazolamide is recommended prophylactically (125 mg twice daily) if a gradual ascent cannot be followed or there is a prior history of AMS.¹

In the Himalayas, observational studies suggest AMS incidence ranges from 14% to 53% in foreign visitors.³ A study comparing incidence in porters and trekkers concluded that accessible knowledge needs to be improved to help increase understanding and reduce incidence.³ However, even with knowledge of AMS, trekkers in the Himalayas did not always act on it.⁴ Lack

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of knowledge is also seen among trekkers in other areas, with observations in Cuzco, Peru, illustrating a general lack of AMS awareness in foreign travelers.⁵ Previous studies have proven that a better understanding of altitude illness reduces incidence.⁶

Although there have been several observational studies on trekkers' knowledge, there is little current literature on AMS knowledge in those undertaking other activities at altitude, such as marathons. These participants all have different goals, levels of fitness, prior exposure to altitude, and access to knowledge about AMS.

The marathon industry is growing fast, with people wanting to compete in more challenging marathons, and races at altitude provide this opportunity. There are several high altitude marathons, the highest of which is the Tenzing Hillary Everest Marathon (THEM).⁷ Given the severity of some cases of AMS, it is important to gather information on different groups visiting altitude for recreation to gain a better understanding of their knowledge before going to altitude. These data can then be used to optimize information dissemination and help minimize AMS incidence.

The purpose of this study was to determine AMS knowledge of marathon runners, with an aim to improve AMS information distribution, especially for high altitude endurance events. Incidence of AMS was also determined.

Methods

The THEM, based in the Khumbu region of Nepal, is an annual 42-km run from Everest Base Camp (5365 m) to Namche Bazaar (3440 m), open to both Nepali and international competitors.⁷ In 2014, however, because of poor weather conditions, competitors started at Gorak Shep (5100 m), with an extra loop added to maintain the course length. Most of the international competitors participate in a 12-day acclimatization trek beginning at Lukla (2860 m) and ending at Everest Base Camp (5365 m). This has a standardized ascent profile to reach the start line and complies with the Wilderness Medical Society Consensus guidelines for a safe ascent.¹

All runners participating in the acclimatization trek were approached to be participants at the race briefings in Kathmandu (1200 m). Informed written consent was obtained, and a questionnaire was completed to ascertain their prior knowledge of AMS. Daily Lake Louise self-assessment Score (LLS) questionnaires were completed on the ascent from Lukla. A diagnosis of AMS was made if participants had a headache with an LLS greater than 3.² Participants with AMS were offered a consultation with an expedition doctor. Any medication

taken by participants for prophylaxis or treatment of AMS was recorded. A postmarathon questionnaire was completed, incorporating an LLS applicable to symptoms during the marathon.

A knowledge questionnaire (Appendix 1) was written, incorporating questions from previous papers that looked at knowledge of visitors to high altitude.^{5,6,8,9} It was reviewed by members of the Birmingham Medical Research Expeditionary Society to assess whether it was suitable. An overall knowledge score was created using the information from the questionnaire (Table 1).

All data were entered into Microsoft Excel (Microsoft Corp, Redmond, WA) and transferred to SPSS version 22 (IBM Corp, Armonk, NY). Data were summarized using percentages and means. A Student's *t* test was used to see whether obtaining prior knowledge increased participants' knowledge. Spearman's correlation was used to analyze questionnaire scores. Significance was assumed at a probability value > .05 when appropriate.

Ethical approval was granted by the University of Birmingham and the Nepal Health Research Council (2071-2-1).

Results

There were 36 Nepali and 95 international competitors. None of the Nepali competitors undertook the

Table 1. Scoring system for overall knowledge score

| <i>Answer</i> | <i>Maximum points available</i> |
|---|---------------------------------|
| AMS can be prevented by medication | 1 |
| - Acetazolamide | 1 |
| AMS can be prevented by other methods | 1 |
| - Slow ascent, hydration | 2 |
| Headache is the main symptom of AMS | 1 |
| Number of correct other main symptoms | 4 |
| Symptoms can occur from 2500 m | 1 |
| AMS symptoms can be relieved by medication | 1 |
| AMS can be treated | 1 |
| - Descent, oxygen, acetazolamide, dexamethasone, ibuprofen | 3 |
| AMS has more serious complications | 1 |
| - HACE, death | 2 |
| Signs AMS is getting more serious | |
| - Altered mental state, drowsy, ataxia, coma, decreased exercise tolerance, dry cough, worsening headache | 4 |
| Scenario questions (Table 4) | 4 |
| Total | 27 |

AMS, acute mountain sickness; HACE, high altitude cerebral edema.

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