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ORIGINAL RESEARCH

Physical and Medical Characteristics of Successful and Unsuccessful Summiteers of Mount Everest in 2003

Colette Wiseman, BS; Luanne Freer, MD, FACEP; Erick Hung, MD

From the University of Chicago Pritzker School of Medicine, Chicago, IL (Wiseman); the Himalayan Rescue Association, Everest Base Camp Medical Clinic, Nepal, Bozeman, MT (Dr Freer); and the University of California, San Francisco, CA (Dr Hung).

Objectives.—To describe physiological attributes (height, weight, sex, resting heart rate, etc) of climbers attempting to summit Mt Everest and to investigate differences between successful and unsuccessful summiteers.

Methods.—One-hundred thirteen Everest climbers were surveyed by questionnaire before and after the spring 2003 climbing season. Climbers' previous high-altitude climbing experience and physical characteristics were recorded, as well as health before and during expedition, medication used, body weight before expedition and after summit attempt, and ultimate summit success or failure.

Results.—The most common afflictions among climbers were cough, diarrhea, nausea, and vomiting, and the most common medications used were acetazolamide, aspirin, and antibiotics. Average postacclimatization, presummit ''rest'' altitude was 4571 m, and average weight carried 10.7 kg. Average body mass loss during expedition, regardless of success, was 7%.

Conclusions.—Oxygen use and existence of gastrointestinal disorders are strongly correlated with success in summiting Mt Everest. On the other hand, a history of acute mountain sickness before the attempt is correlated with failure in summiting Mt Everest. Several other factors were found to be marginally correlated with chance of success, but the power of the study was limited by a low postsummit attempt questionnaire return rate (34%).

Key words: altitude, altitude sickness, mountaineering, physical fitness, snow sports, sports medicine, oxygen

Introduction

Many factors affect performance of mountaineers at altitude, including underlying medical conditions, genetics, diet, acclimatization schedule, psychological factors, weather, training, oxygen use, mountaineering experience, and expedition support. In 2003, 264 climbers summited Mt Everest (8848 m), setting a new record for most summits from all routes combined in 1 year, a record that was broken yet again in 2004 with 330 successful summits. Multiple factors doubtlessly interact to influence success, and these may include (but are not necessarily limited to) factors such as weight (muscle mass) lost, medication used, previous high-altitude climbing experience, or weight carried on the summit attempt. This study queried 113 climbers attempting to summit Mt Everest to identify variables predicting likelihood of success vs failure. The study also documents and quantifies health problems encountered by climbers, data that are likely to prove useful to future expedition planning.

Corresponding authors: Colette Wiseman, BS, 5050 South Lake Shore Drive #2417, Chicago, IL 60615 (e-mail: col@uchicago.edu); and Luanne Freer, MD, 220 Deer Path, Bozeman, MT 59718 (e-mail: LuanneFreer@gmail.com).

Methods

The study was conducted at Everest Base Camp, Nepal (5350 m). All English speaking climbers present at Everest Base Camp during the spring 2003 season were asked to participate in a 2-step questionnaire comprised of 1 pre-summit-attempt survey conducted by staff and 1 post-summit-attempt questionnaire completed by the climber and returned by email. The presummit survey contained background information such as past climbing experience and past medical history. The postsummit survey contained questions about expedition and medical history (including postexpedition weight) during summit attempts.

Table 1. Summary statistics comparing subjects who returned follow-up questionnaires and those who did not*

	Mean		*SD*	
	Non–follow-ups	*Follow-ups*	*All subjects*	*Follow-ups*
Number of subjects	75	38		
Original weight (kg)	74	76	10.84	12.36
Height (cm)	176	179	8.80	8.81
Original BMI†	23.8	23.7	2.42	2.48
Oxygen saturation (%)	83%	82%	3.95	4.18
Heart rate	85	83	15.19	16.02
Male (% of total)	93	87		
Age (years)	41.0	38.2	9.04	7.51
Continent of residence (% of total)				
North America	28	55		
South America	0	5		
Europe	60	24		
Asia	7	3		
Africa	5	11		
Australia	0	3		
No. of previous Everest attempts	0.83	0.58	1.31	1.15
No. of previous Everest summits	0.21	0.13	0.56	0.48
No. of previous 8000-m mountain attempts	1.57	1.26	2.03	1.83
No. of previous 8000-m mountain summits	0.65	0.40	1.04	1.00

*The mean values in the overall populations as well as the mean values among the follow-ups are known; from this, the mean values among non–follow-ups were deduced.

†BMI indicates body mass index, (weight [kg]/[height (m)]^2).

Climbers who did not speak English were excluded from the study, as were climbers who were attempting anything other than Mt Everest's South Col route.

Each climber completed a presummit questionnaire as well as measurement of weight on a portable scale, heart rate via pulse measurement, and pulse oximetry via a portable pulse oximeter. In June 2003, all 113 climbers received the secondary questionnaire via e-mail. If there was no response, the secondary questionnaire was sent twice more in a 3-month period. A total of 38 climbers returned the secondary questionnaire.

Although the total number of climbers attempting Mt Everest via the South Col in 2003 was not available, in past years approximately 34% of climbers attempting this route successfully summited. If 264 climbers successfully summited Everest in 2003, and they represented 34% of all climbers attempting to summit, we assume that approximately 776 climbers made attempts. Therefore, the 113 climbers replying to the initial survey probably represent approximately 15% of total climbers, and the 38 climbers replying to the postexpedition survey represented approximately 5% of all South Col Everest climbers in 2003.

In evaluating the collected data, statistical significance was established at $p < 0.05$.

Results

One-hundred thirteen climbers completed the initial interview, and 38 returned the secondary survey.

CHARACTERISTICS OF CLIMBERS BEFORE SUMMIT ATTEMPT

Ninety-three percent of the climbers surveyed were male. The average height, weight, and age of English-speaking Everest climbers were 164 cm, 57 kg, and 36 years (female) and 178 cm, 76 kg, and 40 years (male). At Everest Base Camp (5350 m) before the summit attempt, the average heart rate among climbers was 82 and the average oxygen saturation was 84% (see Table 1).

Eighty-seven percent of climbers took prescription or over-the-counter medications at some time before the summit attempt. The most common medications used were aspirin (25%), acetazolamide (24%), ciprofloxacin (13%), and azithromycin (5%). The most common medical conditions reported during the trek to Everest Base Camp were diarrhea (30%), chronic cough (24%), upper respiratory infection/common cold (20%), and fever (18%) (see Table 2).