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Age is no barrier to success at very high altitudes

SIR—As medical care improves and life expectancy continues to rise in most developed countries, older people are able to enjoy high-altitude adventures later in life [1]. All visitors to high altitude (>2,500 m) are at risk of illness, notably Acute Mountain Sickness (AMS), which is usually a self-limiting illness presenting between 6 and 12 h of arrival at altitude. Common features include headache, fatigue and weakness, nausea and vomiting and poor sleep [2]. Despite the increased prevalence of pre-existing medical conditions with age, the risk of AMS has been found to be lower in older people [3, 4]. More serious sequelae include high-altitude cerebral oedema and high-altitude pulmonary oedema that can be fatal if not recognised and treated promptly. There is an abundance of literature on AMS and altitude-related pathology [5–7]. However, there is little work specifically on Mt Kilimanjaro with its unique ascent profile [8].

Older people are no more susceptible to AMS than their younger counterparts [9], and increasing age is associated with less severe symptoms of AMS [1]. However, rapid ascent and extreme exertion will have a more marked physical effect due to age-related declines in maximum oxygen uptake [10], in VO_2 max [11] and in skeletal muscle mass [12]. The reduction in exercise capacity at altitude is predictable based on sea-level performance. Moderate altitude exposure is unsurprisingly associated with hypoxemia and sympathetic activation, although the overall physiological response to hypobaric hypoxia is comparable between younger and older people [13]. Surprisingly, however, there remains a paucity of information about this significant group of high-altitude adventurers. Our data about older people contributes to a necessary and important evidence base, particularly at altitudes over 5,000 m.

We studied the physiological characteristics and the incidence of AMS in tourist trekkers attempting the summit (Uhuru Peak) of Mount Kilimanjaro (5,895 m). The trekkers were recruited at Mandara hut (2,720 m), the first hut on the popular Marangu route. Physiological measurements and Lake Louise Scores (LLS) for AMS were taken at the end of the day's trekking over the 4- or 5-day ascent. Arterial

haemoglobin oxygen saturations (SaO_2) were determined using a pulse oximeter (Nellcor® N-20PA, Tyco Healthcare, UK). Blood pressure was measured using a portable monitor (M10-IT model, Omron-Healthcare®, UK). The mean arterial pressure (MAP) was calculated as diastolic pressure + 1/3 × (systolic − diastolic pressures). The body mass index (BMI) was determined as weight (kg) / height^2 (m). The heart rate (HR, beats per minute) and respiratory rate (RR, breaths per minute) were also measured. The average of three readings was taken for all physiological variables, after a minimum of 30 min rest and before the consumption of caffeinated drinks. All the measurements were taken with the subject in a sitting position. Ethical approval was obtained from the Tanzanian Commission for Science and Technology (2005-261-NA-2005-62) in addition to written informed consent from participants.

Results were analysed using SPSS version 14. Mann–Whitney *U* with the Bonferroni correction was used to determine differences in physiological variables and mean AMS scores. Chi-squared was used to determine differences in summiting success and AMS incidence. Correlation of AMS scores and SaO_2 was investigated using Pearson's rank. Univariate analysis of summit success was performed with age as the dependent variable.

Two hundred and fifty trekkers <50 years old (age range 11–49 years, mean 30.9, 112 female) and 45 trekkers aged 50 years or older (range 50–70, mean 55.8, 13 female) participated in our study. Ageing and endurance studies in extreme sports have shown that performance declines with age [11, 15], although there is no universally accepted definition of old age. We decided to use ≥50 as a cut-off, as this age coincides with the transition between moderate and marked deterioration in performance. After 60 years, it declines exponentially [16]. On Everest, it has been shown that summiting success reduced significantly when >40 years, and death rates (particularly during descent following summiting) increased noticeably >60 years [17].

The proportion of trekkers with medical conditions was similar between the two groups. In trekkers ≥50, six declared hypertension as a co-morbidity, one had asthma, one had diarrhoea for 24 h and one had symptoms of an upper respiratory tract infection (URTI; total = 9/45, 20%). In the group aged <50, six had hypertension, 18 had asthma, 11 had diabetes, 15 had diarrhoea 24 h before ascent and 14 described symptoms of an URTI (total = 64/250, 26%).

Acetazolamide (AZ), a carbonic anhydrase inhibitor, ameliorates some of the effects of altitude by improving minute ventilation, increasing diuresis and reducing sleep-associated periodic breathing [18]. The recommended dose is 125 mg BD for prophylaxis and 250–500 mg for treatment [19]. Of the 250 trekkers <50 years old, 69 were taking AZ prophylaxis 100–750 mg per day (28%), compared with 10/45 (22%) ≥50 ($P > 0.05$). No climbers reported using dexamethasone [20] or the herbal remedy *Ginkgo biloba*, and no observations were made of individuals using supplemental oxygen or oxygen hyperbaric chambers.

Table 1. Presence of AMS, summit success and drop-out rate in study participants

Height	Age	No. of trekkers followed-up (no. of trekkers who dropped out)	Arterial oxygen saturation (SaO_2)					Acute mountain sickness (AMS)				
			Mean	Test of mean SaO_2 ≥50 vs <50	Dropped out	Followed-up	Test of mean SaO_2 drop-out vs followed-up	Mean LLS in trekkers that were followed-up	Median LLS	Range	Test of mean LLS ≥50 vs <50	Mean LLS in trekkers that dropped out
2,700 m	<50	250 (6)	**94.5 (SD 5.0)**	*0.05*	94.5	94.5	*0.91*	0.56 (SD 0.9)	0	0–4	*0.08*	0.59 (SD 0.95)
	≥50	45 (2)	**92.1 (SD 10.0)**		92	92.2	*0.78*	0.63 (SD 1.6)	0	0–7		0.62 (SD 1.82)
3,700 m	<50	244 (39)	**90.3 (SD 6.7)**	*0.37*	90.4	90.3	*0.93*	1.65 (SD 1.5)	1	0–6	*0.08*	1.71 (SD 1.6)
	≥50	43 (6)	**89.4 (SD 4.4)**		89.6	89.4	*0.78*	1.16 (SD 1.2)	1	0–4		1.31 (SD 2.1)
3,700 m[a]	<50	146	**93.2 (SD 1.5)**	*0.74*	–	93.2	*0.89*	1.91 (SD 2.2)	1	0–14	*0.75*	–
	≥50	25	**91 (SD 1.4)**		–	90.1	*0.57*	1.68 (SD 1.4)	2	0–5		–
4,700 m	<50	205 (42)	**82.1 (SD 6.7)**	*0.01*	82.1	82.2	*0.8*	2.99 (SD 2.3)	3	0–11	*0.15*	3.03 (2.1)
	≥50	37 (7)	**78.1 (SD 9.7)**		78	78.1	*0.74*	2.0 (SD 1.8)	1	0–6		2.4 (2.3)
Summit day	<50	163	**89.4 (SD 9.8)**	*0.82*	–	–	–	6.38 (SD 4.2)	6	0–17	*0.54*	–
	≥50	30	**88.6 (SD 4.9)**		–	–	–	6.27 (SD 4)	5	0–13		–

LLS, Lake Louise Score.
[a]Some trekkers spent a second night acclimatising at this height.

Table 2. Use of acetazolamide (AZ) and summit success in trekkers attempting Mt Kilimanjaro

		Acetazolamide (AZ) use	Summit success	No summit success	Subtotal	Total
Age (years)	<50	AZ	37[a]	9	46	163
		No AZ	65	52	117	
	≥50	AZ	4	4	8	30
		No AZ	10	12	22	
	Total		116	77	193	

[a]Signifies significant difference in summit success in trekkers <50 years old that were taking AZ (37/46 v. 65/117, $P < 0.05$).

Physical characteristics (height 173 ± 10 cm, weight 70.1 ± 30.1 kg) were not different between those ≥50 years old, between those who dropped out of the study, between those on the two ascent routes or between those on/off AZ (data not shown).

There was no significant difference between the two groups in HR (99 SD 45.8 < 50 vs 93 SD 10.9 ≥ 50), RR (18 SD 3.4 < 50 vs 19 SD 3.8 ≥ 50) or MAP (100 SD 9.1 < 50 vs 102 SD 11.4 ≥ 50) at 4,700 m. Saturations decreased with altitude in both groups with a trend towards older participants having lower saturations. This difference reached statistical significance at 4,700 m (82 vs 78%, $P = 0.01$).

Unlike previous studies where incidence of AMS was found to be inversely related to age [3, 4], neither the presence of AMS (LLS ≥3) nor AMS severity differed between those <50 and those ≥50 at any altitude. AMS presence was 125/163 (76.7%) vs 23/30 (76.7%) ($P = 0.58$) on the summit attempt, and severity ranged from 0 to 17 in <50 and 0 to 13 in ≥50 (Table 1). After adjusting for multiple comparisons, there was no significant association between high AMS scores and low SaO_2. At no altitude were AMS scores or oxygen saturations different between those followed-up and those who dropped out of the study (Table 1).

Summit success was not different between <50 and ≥50: 102/163 (62.6%) vs 14/30 (46.7%), $P = 0.11$. Of the three climbers over the age of 65, one reached the summit. Separate analysis of those trekkers aged 40–49 showed a similar summit success rate to those <40 (21/35 (60.0%) vs 81/128 (63.3%), $P > 0.05$). Univariate analysis with age as the dependent variable did indicate a trend towards decreased summit success, although this was not significant ($P = 0.07$). Summit success was greater in those <50 taking AZ (37/46 (80.4%) vs 65/117, 55.6%, $P < 0.05$), but no difference was seen in those ≥50 (4/8 vs 10/22, $P > 0.05$, Table 2).

Of those followed-up at 3,700 m, 25/43 (58.1%) trekkers ≥50 and 146/244 (59.8%) trekkers <50 spent an extra acclimatisation night ($P > 0.05$). An extra day of acclimatisation made no difference to summit success in trekkers <50 (41/61 on 4-day route (67.2%) versus 61/102 (59.8%) on the 5-day route, $P = 0.20$). However, there was a non-significant trend towards increased summit success in trekkers ≥50 on the 5-day route (11/19 (57.9%) vs 3/11 (27.3%), $P = 0.14$).

At the age of 76, Bahadur Sherchan became the oldest man to summit Everest and proved that age alone is not a barrier to mountain success. For most people, however, Kilimanjaro provides a more realistic goal. Our results show a lower summit success rate in trekkers ≥50 years old compared with those <50 (46.7 vs 62.6%). Although the observed difference was not significant, this might be due to the lack of study powering. The 40–49 sub-analysis group did very well, with an almost identical summit success rate to those <40 years old (60.0 vs 63.3%).

To increase chances of success, we recommend an additional nights' acclimatisation; there was a non-significant trend towards better success rates in trekkers ≥50 years old spending an extra night at 3,700 m on ascent. Furthermore, although our data did not show improved summit success in those ≥50 taking AZ, younger subjects did have improved summit success, and it might be sensible for older trekkers to use AZ prophylaxis, provided there are no contraindications.

This study does have weaknesses, mainly relating to inevitable logistic problems of such field work. One hundred and two trekkers dropped out during the study (see Table 1). Although no difference in AMS symptoms or SaO_2 was found comparing those who dropped out and those subsequently followed-up, we cannot determine whether some of those lost chose to descend or withdraw from the study due to AMS. Symptoms of AMS can develop overnight, and data could not be collected from those who decided to descend early in the day or between huts. This might cause an underestimate of the presence of AMS and an over-estimate of summit success. In addition, the demanding nature of the climb may have deterred people from delaying sleep or food to participate in the study.

At best, age may offer a small protecting effect against AMS, and recent studies suggest these benefits are easily nullified by extremely rapid ascent profiles commonly used by commercial trekking companies on Kilimanjaro [8,21]. This may mean that Kilimanjaro is not an ideal altitude environment for identifying possible subtle benefits that age may provide, particularly when most participants will be part of large groups whose speed of ascent may be determined by younger and faster climbers.

As with all travellers, management of pre-existing conditions should be optimised before embarking on an arduous trek. An adequate supply of other regular medications should be carried, and medical insurance needs to cover high-altitude adventures. These data suggest that ordinary people who maintain reasonable levels of physical fitness should not be discouraged from going to altitudes above 5,000 m simply based on age.

Key points

- Age alone is not a barrier to trekking at high altitudes.
- All individuals are susceptible to AMS.

- On Kilimanjaro specifically, there was a trend towards increased summit success in those spending an extra night acclimatising.

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Experience of a rapid access blackout service for older people

SIR—Syncope is experienced by almost half the population during a lifetime [1, 2] and accounts for significant morbidity [3–5]. The overall incidence in community-dwelling older people is reported as 6.2 per 1,000 person years, rising to 16.9 and 19.5 per 1,000 person years in men and women aged >80 years, respectively [6].

Recent studies on syncope in older patients have focussed on evidence-based approaches to syncope management within existing geriatric medicine departments [7], with only 10.4% of cases remaining unexplained. Others have described the needs for, and benefits of, rapid access syncope clinics [8, 9]. However, few have focussed upon the applicability of these units in older age groups, where studies have suggested that the importance of making a correct diagnosis may be higher and management particularly challenging with the concomitant high prevalence of comorbidity and polypharmacy [10, 11]. Furthermore, older patients have a higher incidence of cardiac causes of syncope requiring a high index of suspicion and additional expertise [3]. Some authors [8, 9] suggest that rapid access syncope services should ideally be led by either cardiologists or neurologists without mention of the potential role of geriatricians in delivering these important services [11]. Despite the holistic view inherent in geriatric medical practice, there are relatively few data to support the role of geriatri-