Calories and steps! How many days of walking/hiking in the Himalayas does ONE Christmas lunch translate to?

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Background. The festive season is a time when people are at risk of overeating and weight gain. An active break during this time can help maintain energy balance.
Objectives. To determine steps taken during a walk/hike to Everest Base Camp and back and compare estimated activity-related energy expenditure to a typical Christmas lunch.
Methods. Five adults (39-70 years) completed an 11-day walk/hike. Pedometer-measured steps were recorded at two cadences: 'aerobic' (>100 steps/minute for 10 consecutive minutes) or 'slower' steps. Activity-related energy expenditure was estimated using generic values for walking uphill/downhill at each cadence. Energy intake of a typical Christmas lunch was estimated.
Results. Participants accumulated a total of 143 770 steps, or 13 070 (SD 8 272) steps/day, 20% of which were 'aerobic'. Total walk-related energy expenditure was estimated at 22 816 kcals, or 1 901 (SD 580) kcals/day.
Conclusion. Estimated energy intake in one Christmas lunch equates to 1.7 days of walking/hiking.
Keywords. Energy intake, physical activity, energy expenditure, pedometer

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Christmas is a time when most people eat far too much food than usual, certainly more than is required to balance energy expenditure. An article in the Daily Mail[1] advised readers to 'Think before you reach for that extra mince pie' and claimed that the food and drink consumed during Christmas lunch/dinner festivities could provide an energy intake equating with 7 000 kilocalories.

One of the authors (JDP) joined four friends over Christmas in a walk/hike to Everest Base Camp (EBC) and back (starting from, and ending at, the most frequently used access to the Himalayas, Lukla International Airport). In this paper the estimated energy expenditure is compared during the 11-day hike, based on pedometer steps, and compared to energy intake based on a diet record kept by the second author who stayed at home to eat Christmas lunch.

Methods

Study design

An observational and descriptive case study.

Participants and setting

Five adults (three men, two women, aged 39-70 years) walked to EBC and back over 11 days in December 2014.

Data collection

All trek participants wore a pedometer (Omron HJ720ITC) on their hip from the start to the end of each daily walk, and daily step counts at two cadences were recorded: 'aerobic' steps were those accumulated at a cadence of >100 steps/minute in bouts of at least 10 minutes; 'slower' steps were accumulated at a lower cadence and/or in shorter bouts. The validity and reliability of this brand and model of pedometers have been shown to be acceptable under prescribed and self-paced walking conditions in both healthy and overweight adults.[2] Total distances and hours of walking time were estimated from diaries and from information provided by the Himalayan National Parks Authority.[3] Christmas lunch energy intake was estimated from the second author's food records and the tables available in the "MyFitnessPal" iPhone and Android application.[4]

Data management and statistical analyses

General characteristics of the study group and number of total steps, 'aerobic' steps and 'slower' steps each day, and estimated walk-related energy expenditure were summarised using descriptive statistics (SPSS, version 23.0). Walk-related energy expenditure was calculated by multiplying time (hours) spent in 'slower' steps by 5 METs (ascending) or 4 METs (descending), and time spent in 'aerobic' steps by 7 METs (ascending) and 6 METs (descending), hence allowing for the greater amount of energy needed to walk uphill. Resulting MET.hours values for 'aerobic' and 'slower' steps were summed, and multiplied by average body weight to derive kcals/day of energy expenditure. Summary data are reported as means and standard deviations.

Results

Participant characteristics

Participants were three men and two women, average age 54.8 (SD 11.1) years, average weight 66.1 (SD 8.4) kg and average body mass index 24.0 (SD 1.8) kg/m^2.

Average daily and total steps

Step data and estimated walk-related energy expenditure values are shown in Table 1. The average total steps recorded during the hike to EBC and back was 143 770 or an average of 13 070 (SD 8 272) steps/day. The inter-individual variability, expressed as the co-efficient of variance in mean steps/day was 63% (SD/mean steps * 100). Approximately one-fifth of these steps were at the 'aerobic' cadence. Step counts on 'ascent days' (Days 1, 2, 4, 5, 7 and 8) ranged from 6 265 to 12 748 steps/day, with fewer steps on Days 3 and 6, which were 'acclimatisation' days, involving shorter hikes. Step counts on 'descent days' (Days 9, 10 and 11) were much higher, in keeping with the easier downhill walking.

Estimates of energy expenditure and energy intake

Energy expenditure in 'aerobic' steps (61.53 MET.hours in total) accounted for about one fifth of total energy expenditure. Overall, total walk-related energy expenditure was 21 093 kcals, or 1 918 kcals/day.

Table 1. Daily steps, walking time and estimated energy expenditure (N=5; 3 men, 2 women, aged 39-70 years)

Day of hike	Total steps/day	'normal' steps/day	'aerobic' steps/day	Total walk time (hours/day)	'normal' walk time (hours/day)	MET.hours for 'normal' walking[a]	'aerobic' walking time (hours/day)	MET.hours for 'aerobic' walking[b]	Energy Expenditure (kcal/day)[c]
Day 1	10 713	9 257	1 456	3.75	3.38	16.88	0.38	2.63	1 287
Day 2	10 902	10 902	0	7.00	7.00	35.00	0.00	0.00	2 310
Day 3	4 276	4 087	189	3.00	3.00	15.00	0.00	0.00	990
Day 4	11 023	10 855	168	6.00	6.00	30.00	0.00	0.00	1 980
Day 5	12 748	10 400	2 348	6.00	4.80	24.00	1.20	8.40	2 138
Day 6	1 917	1 453	464	2.50	2.00	10.00	0.50	3.50	891
Day 7	6 265	6 265	0	6.00	6.00	30.00	0.00	0.00	1 980
Day 8	9 230	8 430	800	8.00	7.20	36.00	0.80	5.60	2 746
Day 9	25 746	15 477	10 270	7.00	4.80	19.20	3.20	19.20	2 534
Day 10	23 609	15 393	8 215	7.00	4.90	19.60	2.10	12.60	2 125
Day 11	27 341	19 173	8 167	8.00	5.60	22.40	1.60	9.60	2 112
Total	143 770	111 692	32 077	65.25	54.68	258.08	9.78	61.53	21 093
Average	13 070	10 154	2 916	5.9	5.0	23.10	0.90	5.70	1 901
Standard deviation	8 272	4 951	3 750	1.91	1.57	8.12	1.00	6.02	580

a METs for slow walking = 5 on ascent and 4 on descent b METs for aerobic walking = 7 on ascent and 6 on descent c Estimated as total walk-related MET.hours * average body weight (66 kg)

Estimated MET.hours/day for 'aerobic' and 'normal' walking are also shown in Table 1.

The energy value of food and drink consumed in a typical Christmas lunch is shown in Table 2. The overall energy intake in this single meal was 3 295 kcals, which equates with about 1.7 days of walking/hiking in the Himalayas (see Table 1 and Table 2).

Discussion

During an 11-day hike to EBC, five people each accumulated about 13 000 steps/day, which equates to an estimated walk-related energy expenditure of about 1 900 kcals/day. During this time one person sat at home and consumed 3 295 kcals in one Christmas lunch. Over-consumption of food and drink during the festive season is common and is not restricted to a single day, as it is not uncommon to have several Christmas meals with different friends/family groups during this period. The data presented here illustrate how one group addressed the energy imbalance of Christmas, while participating in an exciting expedition to the Himalayas. In doing this, it was estimated that one Christmas lunch was the equivalent of 1.7 days of walking/hiking at an average 13 070 steps/day. Current public health messages support the accumulation of at least 10 000 steps/day, and using these caloric and step/day estimates, 2.2 days of accumulating 10 000 steps might be adequate to work off that Christmas lunch. These estimates were, however, based on at least one-fifth of these steps being accumulated at a moderate-fast pace.

To the authors' knowledge this is the first study to record pedometer steps during an 11-day hike with the data being translated to estimates of energy expenditure. A pedometer was used to allow the estimation of steps that accords with the notion of 'aerobic' activity in bouts of at least ten minutes, which is the level of activity recommended in many national physical activity guidelines.[5] A limitation of the method in this study was that generic MET values were used to account for intensity. Under conditions of extreme (sub-zero) temperatures and altitude, even very slow movement involves significant exertion, so these MET values (ranging from 4 to 7) were

Table 2. Estimated energy of a Christmas lunch using MyFitnessPal App

Item	Approximate serving size	Approximate kcals
Sparkling champagne	2 x 150 ml	215
Red wine (Shiraz)	2 x 175 ml	240
Vegetable soup	200 ml	160
Roast turkey	120 g	150
Roast pork	100 g	260
Crackling	20 g	130
Sausages	2	130
Roast potato	100 g	160
Roast parsnip	65 g	125
Brussels sprouts	100 g	60
Broccoli	100 g	35
Green beans	100 g	31
Gravy	3 tablespoon	40
Bread sauce	50 g	50
Stuffing	¼ cup	75
Cranberry sauce	2 tablespoon	55
Christmas pudding	1 slice	300
Brandy butter	25 g	120
Custard	½ cup	160
Mince pie	1	109
Cheese – Stilton	30 g	125
Cheese – camembert	30 g	95
Biscuits	6 small	120
Baileys	50 ml	165
Chocolate balls	2	150
Cherries	½ cup	35
TOTAL		**3 295**

chosen to reflect the authors' perceptions of the effort involved in walking up and downhill in these conditions. In comparison, three METs is indicative of walking at a moderate intensity on flat ground.[6]

Conclusion

This case study provides information on steps/day during an 11-day hike along a popular mountain range. It also highlights the potential imbalance of energy intake and expenditure over the festive season. The authors are not proposing that everyone should go to the Himalayas to walk off their Christmas lunch, but a daily walk with an energy expenditure equivalent to around 1 900 kcals, as shown here for this 11-day walk, will offset 60% of the energy consumed in a typical Christmas meal.

Authorship. All authors consent to publication.

Competing interests. The authors declare that they have no competing interests. The manuscript has not been previously published and is not presently under consideration by another journal, and will not be submitted to another journal before the final editorial decision is rendered.

Contributorship. JDP was responsible for the acquisition of pedometer data and WB estimated the energy content of Christmas lunch. Both authors contributed to analysis and interpretation of the data and to the writing of the manuscript.

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