

Changes in body-weight of men in the Antarctic

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Regular physiological observations were made on the members of the Norwegian–British–Swedish Expedition 1949–52 (NBSX) to the Antarctic (Giaever, 1954) during their 2-year stay in the Antarctic as well as before they left for the south and after they returned home. The NBSX landed in the Antarctic in February 1950 and departed in January 1952. Accounts of the climate and working conditions on the expedition have been given in previous reports on blood tests and basal metabolic rates (Wilson, 1953, 1956). This report deals with changes in body-weight.

EXPERIMENTAL

During the 1st year, there were fifteen members of the expedition. Three new men then arrived, one replacing another member returning home. Soon afterwards three men were killed in an accident, reducing the number to fourteen during the 2nd year. The mean age of the seventeen subjects observed was 33 years (median 31 years) and the mean height was 179 cm (see Table 1).

The men were weighed naked at home as part of their medical examination before departure. Measurements during the voyage to the Antarctic could not be made because the equipment was in the hold of the heavily loaded ship and unavailable, and weighing probably would not have been possible because of the pitching of the vessel. However, fairly accurate readings were obtained on the trip home on calm days in the tropical zone. Owing to the landing operations (February 1950) and to the building of the base, observations did not begin until April 1950. The subjects were weighed monthly under standard conditions whenever they were at the base, Maudheim. The weighing took place in the evening when the men undressed to go to bed. They were asked to empty their bladders and were weighed naked. This procedure gave rise to some protests, mainly because of the relatively low temperatures that prevailed in the living huts, but also because some subjects felt conscious of a dirty body and unwashed clothes, which are unavoidable on a polar expedition. Thus some men preferred to weigh themselves in the privacy of their cubicles. The same balance was used for all measurements in the Antarctic and for most of the measurements after the return. The balance, which was calibrated regularly, was of Swedish make (Radix personal scale, Nynäshamns Vågfabrik) and of standard lever type with sliding weights; the smallest scale division was at 100 g intervals. The weighings at home before the departure, and also sometimes after the return, were made on different balances (see Table 1, where these measurements are in italics).

Table 1. *Changes in body-weight (kg) of men before departure* (1949), *during 2 years at Maudheim, Antarctica* (1950–2), *and after return* (1952). *Values are related to weight in April* 1950. *Unless otherwise stated, measurements were made at the beginning of each month*

Subject no.*	Age, 1950 (years)	Height (cm)	At home 1949	1950									1951									1952			At home	At home
				Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Apr.	Mid-Apr.	May	June	July	Aug.	Sept.	Oct.	Mid-Oct.	Jan.	Feb.	Mid-Feb.	1952–3	1956
1	36	187	*+3·5*	79·0	+2·0	+3·2	+2·0	+3·8	+3·8	+3·0	+2·8	+1·0	—	—	—	+4·0	+6·5	+7·0	+8·0	+7·1	—	+1·5	+1·0	+0·5	+4·3	*+8·0*
2	28	178	*−2·5*	79·5	+0·5	−1·8	−3·0	−4·0	−7·3	−4·5	−4·3	−1·5	—	—	—	+2·5	+3·1	+0·5	+1·4	+0·3	—	+0·7	−3·7	−4·5	*−3·0*	*−2·5*
12	29	175	*−0·5*	62·0	0	+1·2	+2·6	+2·0	+0·2	0	+1·0	+5·5	—	—	—	+7·5	+7·5	+5·4	+5·5	+4·0	—	+6·2	+5·1	+4·0	*+4·0*	+1·4
3	33	176	*+4·0*	68·0	+1·5	+1·5	+2·1	+1·8	+1·6	−0·7	0	+0·5	+2·3	+3·5	+3·2	+2·3	+3·2	+3·9	+2·7	+1·3	+1·3	+0·5	+0·8	0	+5·6	—
4	29	169	*−2·5*	74·5	−1·5	+1·6	+3·0	+0·9	0	−0·4	+0·4	+0·5	+1·2	+1·5	+2·3	+2·8	+2·2	+3·3	+1·6	+1·0	−0·1	+1·5	+1·5	+0·1	+0·5	*+8·0*
5	27	187	*−2·5*	81·0	0	+0·6	+1·6	0	−0·8	−1·7	−2·3	−2·3	+1·0	+0·8	+1·5	+0·1	+0·4	−0·6	−0·1	−1·3	−2·8	−0·9	−0·5	−1·6	−5·3	−5·5
6	31	195	*+1·0*	96·0	+1·0	+1·0	+2·4	+3·2	+4·3	+2·5	−2·8	−2·0	−4·0	−3·5	+0·2	+0·8	+5·8	+8·3	+9·2	+8·0	—	+2·5	+2·3	+1·5	+4·4	+3·3
7	29	176	*−5·0*	68·0	−1·0	−0·7	−0·7	−1·3	+0·5	−0·8	−1·4	−1·5	0	+2·0	+2·5	+1·0	+1·3	+0·5	−0·2	+0·1	0	−0·9	−1·9	−3·0	−2·8	−3·0
8	42	182	*0*	74·5	−0·5	−0·5	+1·5	+1·1	+2·7	+0·7	+0·7	+0·2	+1·5	+1·6	+1·9	+1·7	+2·2	+1·1	+1·5	0	−0·7	−1·0	−2·6	−2·8	+2·0	*+0·5*
9	36	176	*−0·5*	71·0	0	+0·1	+1·2	+2·3	+4·2	+4·0	+3·0	+3·2	+5·2	+5·0	+5·7	+7·5	+7·8	+8·2	+8·2	+6·5	+6·3	+8·2	+5·3	+4·7	+6·3	+3·3
16	49	194	*−5·0*	90·0	+3·0	+3·6	+2·9	+2·5	+1·3	−1·5	−1·0	−0·4	+2·8	+3·0	+4·3	+3·8	+4·0	+3·9	+3·4	+3·1	+2·2	+1·7	+0·1	−0·4	*+5·0*	*+4·0*
17	31	181	*−2·0*	68·0	0	−0·4	−0·4	+0·1	+0·7	+1·6	+1·4	+0·7	+4·3	+3·9	+4·3	+5·3	+4·3	+4·2	+5·3	+4·7	+5·1	+2·5	+2·0	+1·6	*+2·5*	—
Mean (12 subjects)			−1·0	76·0	+0·4	+0·8	+1·3	+1·0	+0·9	+0·2	−0·2	+0·3†	+1·6‡	+2·0‡	+2·9‡	+3·3	+4·0	+3·8	+3·9	+2·9	+1·4‡	+1·9	+0·8	0	+2·0	+1·8
Standard deviation			2·9	9·7	1·3	1·6	1·8	2·1	3·1	2·6	2·2	2·2	2·7	2·5	1·7	2·5	2·4	3·0	3·3	3·1	3·0	2·8	2·8	2·7	3·8	4·5
10	28	182	*−2·0*	78·0	+1·0	+1·2	+1·3	+1·9	+2·0	+1·2	+0·5	−1·0	(Measured only during 1950)					(On board expedition ship during 1951–2)				+1·5§	+1·3§	+1·3§	*+1·5§*	
11	27	175	*−4·0*	74·0	−1·0	−1·5	−1·8	−1·9	−0·8	−2·5	−3·2	−2·9	(Measured only during 1950)													
13	31	163	*−8·0*	64·0	0	+0·4	−0·1	+1·1	+1·4	+0·5	+1·2	−1·1	(Measured only during 1950)													
Mean (15 subjects)			−1·7	75·2	+0·3	+0·6	+1·0	+0·9	+0·9	+0·1	−0·3	−0·1														
Standard deviation			3·2	9·3	1·2	1·5	1·8	2·1	2·8	2·2	2·2	2·2														
	1951		1950	1951																						
14	50	161	*−5·5*	63·5	(Measured only during 1951)								0	0	0	+1·0	+0·5	+0·5	+1·5	+1·5	+0·5	+1·5	+1·7	+1·5	−5·5	—
15	25	191	*−4·0*	97·8	(Measured only during 1951)								0	+0·2	+0·4	+2·6	+3·7	+4·5	+2·6	+1·5	—	+1·2	+0·7	−0·8	−0·4	−0·2
Mean (14 subjects)	33‖	179‖	−1·5	76·6	—	—	—	—	—	—	—	—	+1·3‡	+1·6‡	+2·4‡	+3·1	+3·8	+3·6	+3·6	+2·7	+1·3‡	+1·8	+0·8	+0·1	+1·3	+1·6
Standard deviation			3·0	11·4	—	—	—	—	—	—	—	—	2·5	2·3	1·9	2·3	2·4	2·9	3·1	2·9	2·9	2·6	2·6	2·6	4·1	4·3

Values in italics are those determined on balances other than that regularly used (see p. 391).

* Subjects nos. 8, 9, 16, 17 and 10, 11, 13, 14 were continuously at the base. The other subjects participated in the summer sledging journeys.

† The four members of the spring sledging party (nos. 2, 12, 3, 6) were responsible for the increase in December 1950, having returned 3 weeks earlier from a 40-day field trip, after which they increased steadily in weight.

‡ Mean for nine, eight or eleven subjects, some being away sledging.

§ Not included in the mean.

‖ Mean for seventeen subjects.

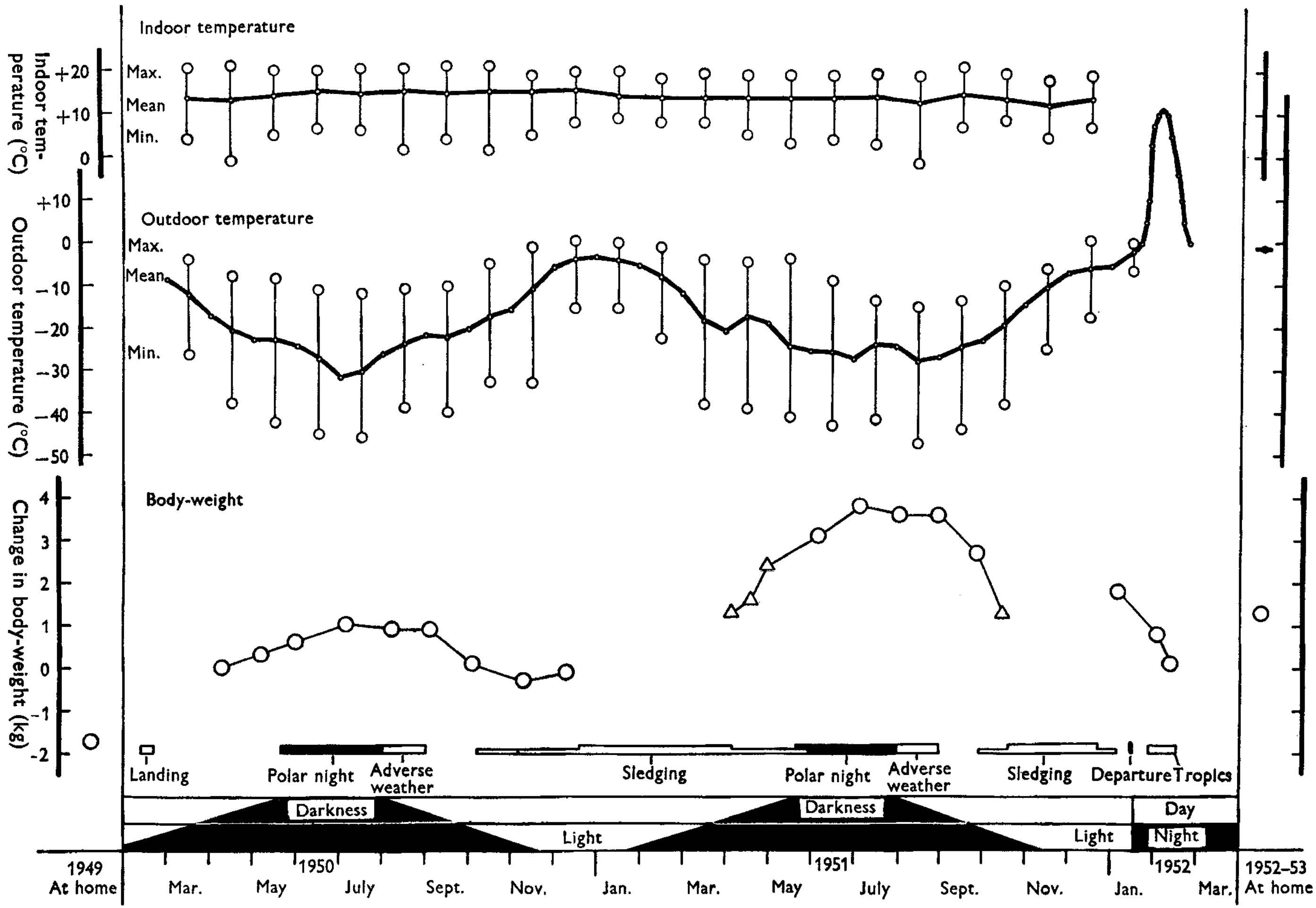

Fig. 1. Changes in body-weight of the men during 2 years in the Antarctic. Environmental temperatures at the base, Maudheim, are shown in the upper part of the figure. The diagram at the bottom of the figure shows the light and darkness pattern of the polar seasons at Maudheim (latitude 71° S) and other important factors influencing body-weight. ○—○, mean monthly change in body-weight of fifteen men in 1950 and of fourteen men in 1951; △—△, mean of less than fourteen men, some being away sledging (see Table 1).

RESULTS

The results of the body-weight measurements are shown in Table 1 and the mean values for the whole group are plotted in Fig. 1. The values for the first weight measurements in the Antarctic (April 1950) have been used as base values, as they were the first to be made with the same balance, and at that time all members were subject to the same environment, which was not so at home. Two facts are clearly evident. There was a general increase in weight, most noticeable in the 2nd year, and there was a marked seasonal fluctuation over and above the general increase.

During the first polar winter (July 1950) the mean body-weight for the whole group (fifteen subjects) had increased by 1·0 kg above the April value and was 2·7 kg above the home weight in 1949; by July 1951 the mean weight (fourteen subjects) had increased by 3·8 kg, which was 5·3 kg above that at home. This general increase was still evident after the return to a temperate climate. Although the mean body-weight

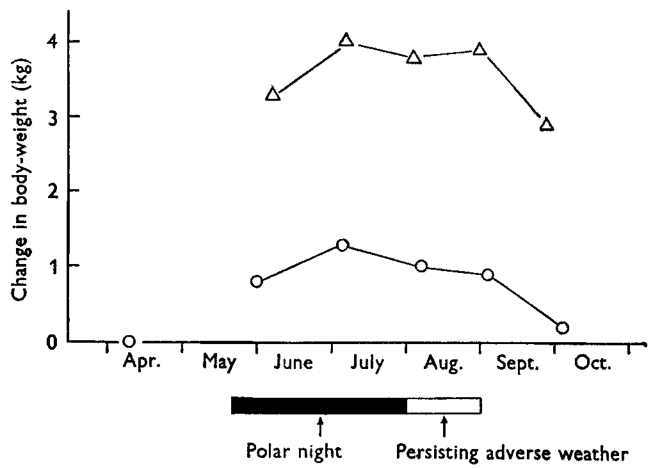

Fig. 2. Seasonal changes from their mean body-weight in April 1950 during corresponding periods in 1950 and 1951 of the twelve men who wintered both years in the Antarctic. ○—○, monthly mean in 1950; △—△, monthly mean in 1951.

fell markedly after the men left the Antarctic, the mean weight at home in 1952 was still about 3 kg above the home value in 1949. Control measurements on eleven subjects in 1956 have shown that the mean body-weight at home had not changed markedly since the return in 1952, although there was a large individual scatter.

There was also a marked seasonal variation in weight, with a rise in the autumn to a high level during winter, with a peak in July, and a loss in the spring to a lower level in the summer. In the 2nd year this pattern was repeated. If the weight curves during 1950 and 1951 (June–October) for the twelve members who spent both years in the Antarctic are compared (Fig. 2), they will be found to be almost identical, though body-weight was considerably higher in the 2nd year.

During the summer months most expedition members (including the author) were out sledging inland, and therefore measurements had to be discontinued during this

Table 2. *Body-weight changes of men in Antarctica after long periods of sledging inland*

Sledging group	Subject no.	Time out sledging (days)	Body-weight (kg): Before departure	On the day of return (after meal)	Change	1 day after return	Change	10–12 days after return	Change	3 weeks after return	Change	4 weeks after return	Change
A*	6	40	98·5	90·5	−8·0	93·2	+2·7	—	—	94·0	+0·8	—	—
	12	40	62·0	62·0	0	63·0	+1·0	—	—	67·5	+4·5	—	—
	2	40	75·0	72·3	−2·7	75·2	+2·9	—	—	78·0	+2·8	—	—
	3	40	67·3	66·5	−0·8	68·0†	+1·5	—	—	68·5	+0·5	—	—
Mean (4 subjects)	—	—	75·7	72·8	−2·9	74·8	+2·0	—	—	77·0	+2·2	—	—
B‡	3	98	68·5	—	—	70·3†	+1·8	71·2	+0·9	—	—	71·5	+0·3
	5	108	78·7	—	—	82·0	+3·3	81·8	−0·2	—	—	82·5	+0·7
	6	108	94·0	—	—	92·0	−2·0	92·5	+0·5	—	—	96·2	+3·7
	7	108	66·5	—	—	68·0	+1·5	70·0	+2·0	—	—	70·3	+0·3
C‡	1	162	80·0	—	—	80·0	0	83·0	+3·0	—	—	85·5	+2·5
	2	162	78·0	—	—	78·3	+0·3	82·0	+3·7	—	—	82·6	+0·6
	12	162	67·5	—	—	67·0	−0·5	69·5	+2·5	—	—	69·5	0
Mean (7 subjects)	—	—	76·2	—	—	76·8	+0·6	78·6	+1·8	—	—	79·7	+1·1

* Departure, October 1950. † Third day after return. ‡ Departure, December 1950.

period, as no scales were available in the field. During sledging there was always a general loss in body-weight, well noticed by the participants, and a marked increase after the return to the base. The body-weight was measured at intervals after the return from some of the major sledging trips inland. The results in Table 2 show the trend of the weight changes after sledging. The sledging group A lost on an average 3 kg during a 40-day sledging trip. During the 1st day after the return there was a marked weight gain of about 2 kg. The weight then increased about 2 kg more during the 3 weeks that followed the 1st day. The members of the sledging groups B and C showed a corresponding increase of about 3 kg during the 4 weeks that followed the 1st day after their return. Most of this weight gain occurred during the first 2 weeks. When the assembled data for all sledging groups shown in Table 2 are considered, it can be concluded that a member of a sledging group lost on an average about 3 kg during sledging; about 2 kg was then gained during the 1st day after the return to the

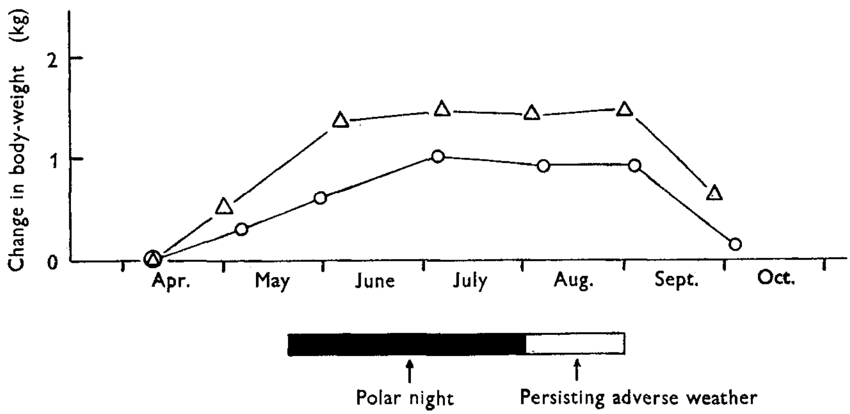

Fig. 3. Seasonal changes from their mean body-weight in April 1950 or 1951 of men at base who had not taken part in sledging journeys inland. ○—○, monthly mean for fifteen men (1950); △—△, monthly mean for six men (1951).

base. During the following 2 weeks the weight increased by about 2 kg more. Thereafter less weight was gained and only about 1 kg was added during the 3rd and 4th weeks, but this was slightly more than the mean monthly gain during the winter period for other members.

The seasonal increase in mean body-weight during autumn was not mainly due to the marked weight gain of the sledging members after they had returned from their sledging journeys, nor did the decrease during spring depend on weight loss due to sledging trips. The seasonal increase and decrease were equally evident in the expedition members who had not taken part in major sledging journeys, as shown in Fig. 3.

DISCUSSION

Body-weight in a cold climate. Johnson & Kark (1947) showed that American servicemen in the Arctic were, on average, heavier than those serving in the tropics. The daily calorie intake in the Arctic was about 4000–5000 kcal compared to 3000–

3500 in the tropics. Reports from many expeditions also give evidence that the body-weight is increased in a polar climate. McLean (1919) on the Australasian Antarctic Expedition 1911–14 reported a mean increase in body-weight of 4·5 kg for eighteen men during the first winter with a maximum in June–July. Kalnenas (1951) on the Macquarie Island Antarctic Research Expedition 1950–1 found a mean increase of 3·6 kg for sixteen men during the winter period. The maximum value on the NBSX was observed during the second polar winter (July 1951), being 5·3 kg above that at home before the men left for the Antarctic. Similar figures were found on the British North Greenland Expedition 1952–4 (Lewis, Masterton & Rosenbaum, 1956; Lewis, 1958; Lewis & Masterton, 1959). Thus it can be said that a general weight gain of about 5 kg during 2 years is a normal occurrence on a polar expedition. There is also a weight decrease in men leaving a cold climate for a warmer environment. When the NBSX left the Antarctic the body-weight decreased promptly on the journey home and in a subtropical climate was about 4 kg below the maximum polar winter values. Mason (1934, 1940) also observed similar weight changes in her subjects when they moved from one climate to another.

Seasonal changes. Over and above the general weight gain in a polar climate there is also a marked seasonal fluctuation. The highest weight values on polar expeditions have been recorded during the sedentary period of the polar winter (Jackson, 1899; Cavalli, 1903; Ekelöf, 1904; Lindhard, 1913; McLean, 1919; Kalnenas, 1951; Sapin-Jaloustre, 1957), followed by a decrease during the spring. This seasonal fluctuation was clearly evident on the British North Greenland Expedition (Lewis *et al.* 1956) and on the NBSX (Figs. 1, 2).

Activity as well as food intake are important factors that influence the seasonal body-weight changes. When spring came the body-weight of the NBSX members markedly declined with rising outdoor temperature and the resulting increase in spring activity. The falling off of weight during the spring was not caused by sledging, as the major weight loss occurred before the summer's sledging trips started and it was equally evident in the base personnel, who did not take part in the sledge journeys (Fig. 3). The weight loss was more correlated with the periods of outdoor activity, which are distinctly seasonal owing to the extreme climatic conditions of the Antarctic. The sedentary period of the polar night is extended into early spring by a period of persisting cold and adverse weather, which restricts outdoor activity in spite of the increasing daylight. The marked decline in body-weight began in both years in September, which coincides with the period of increased spring activity involving considerably more muscular work. This seasonal activity also affected the basal metabolic rate on the NBSX (Wilson, 1956). On the Advance Party of the Commonwealth Trans-Antarctic Expedition (Goldsmith, 1959) the men's body-weights, in contrast to those observed on other expeditions, fell or remained steady and showed no rise in the winter months. This behaviour was attributed to the fact that on this expedition, owing to adverse circumstances, the men were forced to live in inadequate shelter with too little fuel and had to work outdoors throughout the polar night. The food, however, was adequate. When the second polar winter came, the body-weight on the NBSX again increased markedly. A similar seasonal rise in weight after the summer's lower level was also observed on other expeditions (Ekelöf, 1904; Lindhard, 1913; Lewis *et al.* 1956; Lewis & Masterton, 1959) in the second winter. Ekelöf (1904), however, reported that the increase was considerably less during the second winter. This lower level can be attributed at least partly to a certain restriction in the diet, as the relief ship did not arrive during the intervening summer having been trapped in the pack ice and wrecked. Lewis *et al.* (1956, 1959) also found that there was a smaller gain in weight in the 2nd year, but it was partly due to there being smaller men in the 2nd-year party.

Weight changes on sledging journeys. It is a common observation on polar expeditions that body-weight decreases during sledging. Mean weight losses ranging from 1 to 7 kg have been reported (Ekelöf, 1904; Lindhard, 1917; Kalnenas, 1951). This loss has mostly been attributed to hardship and a limited food supply. But even on field trips with adequate rations the weight decreases, which is evident from a series of investigations made by Wilson (Wilson & Forsberg, 1957; Wilson, 1958) while testing pemmican field rations in Sweden.

As the results of these studies are available only in Swedish, they will be briefly summarized here. Tests were made during military operations in the subarctic mountain region of northern Lapland. During the field operations the men marched or skied through a roadless mountain area, covering about 200 km in 2 weeks or less. The men taking part were well-trained mountain soldiers carrying rucksack loads of more than 30 kg with additional man-hauling in the winter. Nights were spent in tent bivouacs in the summer and in snow pits dug each night in the winter. The men were weighed naked under standard conditions before beginning the operation and immediately before the return to barracks after completing the trip. In each investigation a decrease in weight was observed. In study 1 in March 1955 the mean weight loss of twenty-five men was 2·4 kg (range 0 to −5 kg) during 7 days' ski travel with 4300 kcal supplied daily. In study 2 in August 1955 the mean weight loss of sixty-five men was 2·5 kg (range +0·6 to −5·1 kg) during 14 days' march with 3900 kcal supplied daily. In study 3 in August 1956 the mean weight loss of 354 men was 2·8 kg (range +0·4 to −6·9 kg) during 12 days' march on rations with 3900–4600 kcal supplied daily. The same mean weight loss was found for the group with the largest calorie intake (4400 kcal/day) as for the group with the lowest calorie intake (3700 kcal/day). Later, in study 4 (Oehrnell, Sandberg & de Verdier, 1958), in August 1958 the mean weight loss of 189 men was 3·3 kg (range 0 to −6·0 kg) during 12 days' march on rations with 3400–3900 kcal supplied daily. The weight loss was slightly less for the group with the highest calorie consumption (3800 kcal/day) than for that with the lowest (3400 kcal/day). The pemmican rations used in these investigations in Lapland were similar in composition to our trail rations on the NBSX in the Antarctic.

The weight loss found after a major sledging journey on the NBSX agrees well with the above figures: on average 3 kg for four men during 40 days' sledging with 4200 kcal supplied daily. Sledging in the Antarctic calls for hard muscular work. Travelling is done on ski beside the heavily loaded sledges, and when going uphill or on a bad surface continuous pushing and pulling are necessary to keep the sledge going. A weight loss of 3 kg seems to be normal for a period of physical activity of this sort, independent of the length of the period and of the amount of calories supplied, if the food ration is adequate. The major portion of the weight loss is probably body water; this was the finding of Buskirk, Dee, Welch, Levy & Consolazio (1957) in an investigation in the Canadian subarctic.

Large sweat losses occur during exertion even in the polar regions. Much clothing is frequently required when work is begun in cold or bad weather. Very often the situation prevents removal of some clothing during exertion, so that overheating results. Respiratory water losses alone may exceed 1–1·5 l. daily during work in the cold, especially if the relative humidity of the respired air is low (Brebbia, Goldman & Buskirk, 1957). When men live on trail, and have to melt snow for drinking water, they tend not to replace water lost, and dehydration may reach 5% of body-weight. Large water deficits are not repaid promptly when conditions permit; it usually requires a meal or two and a night's sleep (Rothstein, Adolph & Wills, 1947).

During the 1st day at base the fluid losses were largely replaced, which probably explains the marked increase in weight observed during the 1st day after the return from a long sledging trip (Table 2, group A). Furthermore, the members of sledging parties had been longing for different food while on trail, especially for luxury items, so that on return they were apt to eat voraciously. It is, therefore, not surprising that there was an additional marked gain in weight during the next fortnight (Table 2, groups B and C). There was also a further increase during the following winter month.

General increase in body-weight. On the NBSX the body-weight level was considerably higher during the second polar winter; on average 2·6 kg above that of the previous winter. This was especially noticeable for the twelve members who spent both years in the Antarctic. Their mean body-weight showed a greater increase in the 2nd year (Fig. 2). This general increase in weight was still evident after the return to a temperate climate, being about 3 kg above the mean home value in 1949. The same general increase in weight was observed after the return from the British North Greenland Expedition, amounting to 3 kg in 2 years. It was six times the annual increase in weight in a 'standard' population in England (Lewis *et al.* 1956). Evidently activity and climate had imposed a marked change, which may be interpreted as a sign of adaptation.

Body-weight and thickness of subcutaneous fat. The increase in weight in polar regions is clearly associated with a thicker layer of subcutaneous fat. Lewis *et al.* (1956) made estimations of thickness of subcutaneous fat in relation to weight on the British North Greenland Expedition and found that variations in skinfold thickess closely followed the seasonal changes in body-weight. Added weight is not all pure fat, and allowance must be made for changes in body fluid and non-fat tissue. Body fluids, however, are little affected by prolonged exposure to cold, and neither total blood volume nor extracellular fluid volume seems to be altered in man staying in a cold environment (Bass & Henschel, 1956). But the amount of muscle tissue is no doubt increased, especially in men on expeditions who are engaged in strenuous field work. Because of the high insulating properties of fat, it has been presumed that in a cold environment the heat loss is smaller in fat than in thin individuals, especially as the insulating effect of fat increases as ambient temperature falls below 21°. This difference was evident in a study by LeBlanc (1954), who found lower skin temperatures to occur with greater fat thickness in man. Baker & Daniels (1956) also found that fat acts as an insulator. Not only do fat individuals have an increased thermal insulation, but also they have a greater reservoir of heat and call less on metabolism when exposed to cold, as has been demonstrated in both men and women (Mark, 1928; Hardy, Milhorat & DuBois, 1941; Bernstein, Johnston, Ryan, Inouye & Hick, 1956).

Nevertheless, life in a polar climate does not necessarily mean exposure to cold, as man primarily adapts to a cold climate by increasing his artificial insulation and retaining his own subtropical microclimate by means of proper clothing and housing. The work on a polar expedition, however, forces members to expose themselves repeatedly to very cold weather. With experience of cold climates there is a noticeable tendency for the men to wear less clothing. It was observed on the NBSX as well as on earlier expeditions (Frazier, 1945). Goldsmith (1959) kept weekly records, which showed that in similar climatic conditions less clothing was worn at the end of a year in the Antarctic than at the beginning, which indicates an adaptation with a possible increase in body insulation.

SUMMARY

1. The body-weight of seventeen members of a polar expedition was recorded during 2 years in the Antarctic, as well as at home before their departure, and after their return.

2. A general increase in weight was found in the Antarctic, amounting to 2·7 kg during the first polar winter and rising to 5·3 kg during the second winter.

3. There was also a marked seasonal fluctuation in the weight, with a rise in the autumn to a peak in the winter (July) and a loss in the spring to lower summer values. This fluctuation was repeated during the 2nd year.

4. This seasonal rise is attributed to the sedentary indoor life during the polar night and is not regarded as a function of cold acclimatization. The decrease during spring was correlated with the increase in outdoor activity due to rising temperatures and better weather. The weight loss occurred before the summer sledging started and was evident also in the base personnel, who did not take part in the sledging trips.

5. The mean weight loss during sledging was not large, amounting to about 3 kg. Weight losses of the same order were recorded by the author during military operations in northern Lapland. The loss during sledging was probably mainly loss of body water and most of it was regained during the 1st day of the return to the base. During the following 2 weeks all lost weight had been regained and more added.

6. The higher weight level observed during the 2nd year may be a sign of adaptation to activity and climate. The gain was still evident after the return to a temperate climate, and amounted to about 3 kg.

7. The significance of the results is discussed, and related to observations made on other polar expeditions.

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