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The Evolution of Polar Rations

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Much thought, effort and ingenuity have gone into the development of polar rations in the course of the last 50 years, and indeed for a century earlier. Insufficient knowledge of nutritional principles, lack of perspective and, more especially, lack of controlled experiment, have all had their successive influence on the evolution of polar rations. The lack of sufficient experiment, still largely applies to-day, though, it may be said at once, that some of the need for specially superior rations has disappeared with the advent of vehicles that can travel over the snow.

Throughout the course of the deliberate development of polar rations certain assumptions and criteria have had special weight. The availability of ample water has always been assumed. Lightness of weight has been of extreme importance. High calorie content has been urgently sought as, in recent times, has nutritional completeness in terms of several months, and a suitable ratio of protein, carbohydrate and fat. Further features are simplicity in preparation, sufficient palatability, and permanence of quality in store. Subsidiary have been such aspects as retention of quality during passage through the tropics, packaging against the teeth of dogs and the effects of extraneous water, and the limitation of expense. In fulfilment of these requirements, it is worthy of note that some of the very earliest canned foods to be made were used in polar travel. Particular mention may be made of the preserved meats, soups and vegetables which formed part of the stores taken by Sir Edward Parry on his Arctic expeditions between 1819 and 1825.

It seems a fair assertion that, in the evolution of polar rations, the factor of palatability has played no great part. The healthy and willing organism, working at low altitudes, when hungry and having no choice of diet, is well content with what is available. Lack of palatability has rarely obtruded itself except when there has been a choice. Indeed it may even be suggested that maintenance of a polar expedition on a humble but adequate diet will lead to greater contentment than its provisioning with a large assortment so that choice must be exercised. With the more educated type of man I believe that raising the standard of living in polar conditions more often than not leads to less satisfaction.

It must be stressed again that here the concern is solely with rations for the use of expeditions, that is to say food for willing and intelligent volunteers ready to accept a severe personal discipline. It is not a question of military rations for use in

Arctic conditions. For military rations, quite other considerations obtain, of which coping with innate conservatism of food habits is but one.

A polar ration is normally looked upon as being a standardized diet for use when travelling by sledge in regions of low temperature, where the environment can be relied upon to provide nothing more than an inexhaustible supply of frozen water, where great bodily exertion is normally to be expected, and where heat loss will be extremely high, and also extremely varied. It is usually reasonable to assume a good initial bodily reserve of fat, built up, or to be replenished, at a base camp where ample food is available. The problem, in its simplest terms, is the provision for the traveller of a diet that is nutritively complete in the normal sense, yet possesses the maximum amount of calories in proportion to its total weight. The exclusion of water and indigestible matter, and an increase in the amount of fat, are obvious, important features. Indeed the fat content of the ration may be so high as to be distasteful or even nauseous during the first few days of a journey.

In the last 50 years the provision of rations that are nutritively complete has, in general, been carried to the limit of nutritional knowledge at the given date but, though true in general, there are examples of far too hasty preparation and insufficient use of available knowledge. Requirements in terms of calories have been judged by trial and error, by expediency in limiting total sledge loads, by subjective inference and so on, rather than by experiment or any sure knowledge. Hunger is by no means a safe measure of inadequacy. The maximum, even the average, energy requirement of the polar traveller in differing conditions is still not satisfactorily agreed. It must obviously be extremely varied; some have put the figure as high as 6000 Cal. or even more. Much lower figures were recently mentioned at the Physiological Conference at Montreal in 1953. For example, it is asserted that trappers in Greenland managed with 3000 Cal. daily, miners in Spitsbergen with 4500, and that members of the U.S. armed forces, and Eskimos in tests in Alaska, consumed from 3000 to 3500. The effectiveness of bodily insulation is a most important factor, as is the extent of space heating for a part of the 24 hours. The usual rations of British polar expeditions in the last 20 years have provided rather over 4000 Cal. a day in a net weight for the ration of about 30 oz.

The matter that obtrudes itself into these considerations, though as yet insufficiently recognized, is the innate variability in the physiological efficiency of individuals who may, in addition, differ considerably in size. There is no doubt that the dairy and pig farmers know much more of good and bad doers and individual variations in that field than is known to the human physiologist who all too often clings to an erroneous belief in the equality of man. There are, however, strong reasons connected with psychology and morale against differentiating between individuals in the rations they may consume on an arduous sledge journey. What has in fact happened is that in polar travel a very real hunger has been normal but the extent of the true deficit from man to man has gone unmeasured.

The literature of polar travel provides interesting examples of men suffering from food dreams. All those that I have come upon, in their insistence on carbohydrates and fats, are presumably a clear sign of calorie shortage. The extent to

which man's body can usefully force to the conscious attention of his brain precisely what is lacking in his diet is a topic of great interest. Detailed experiment seems lacking, though perhaps much more is known about it than I am aware of.

The story of polar rations, of which some detailed examples will be given later, demonstrates in general a long series of inadequacies, both practical and theoretical, despite the best endeavour, up to the first world war and even later. Scurvy was the most spectacular feature. With inadequacy went suffering, which was often severe, sometimes extreme, and was greatest on long journeys with men hauling their own sledges and with quite exceptional demands made upon them. In man-hauling the attempt to minimize weight in the rations, and in all else besides, is at its strongest. The real state of affairs is more clearly visible to the nutritional historian if he surveys what happened in the Antarctic rather than the Arctic. Arctic rations have been supplemented more frequently and to an unknown degree, by the local fauna.

Since the late nineteen-twenties polar rations for long journeys by dog sledge have been moderately standardized in British practice. Much encouragement and advice have been given by physiologists, and nutritional knowledge has been nearly adequate. Human exertion has been superseded largely by canine exertion, and human insulation from the elements has been improved with consequent decrease in heat loss. An important degree of human suffering has disappeared, but the need for minimum weight remains. Dog rations (say 1 lb. of dog pemmican a day), on the other hand, still leave a good deal to be desired, and an investigation of them is shortly to begin in the Falkland Islands Dependencies Survey. Indeed, from the point of view of lightness, the effort towards perfection in human rations has, in a sense, been partly wasted when one realizes that in a normal sledge-load the weight of dog food exceeds the weight of human food in the proportion of 4 to 1. Progress in packaging, too, has somewhat lagged.

In the period of standardized adequacy, and even earlier, the rations have normally been made up in boxes containing sufficient for so many man-days at a predetermined full rate. Then, when necessity has so demanded, the rations have been eked out or scaled down in a precise ratio, so that the individual has daily taken anything between a full and a half ration. Despite the present quality of the human rations, body fat has continued to be used up on long journeys in cold conditions, but, after all, that is what it is intended for, to act as a reserve for tiding over bad periods. Sensation of hunger continues all the time and thus great talk of what will be eaten on return.

Next in the story comes the time of transition to mechanical transport over the snow, to say nothing of aircraft, and hot meals served by stewardesses far above the ice. The amount of human exertion has become still smaller, though perhaps in its character more trying to the temper and hands of the mechanic, and personal insulation has been made even better; calorie requirements have dropped markedly. With large quantities of fuel in the loads of tractors and trailing sledges the proportion of the whole that is human food has fallen to a low figure, so that the spur to minimize weight in the ration has largely disappeared. Individual preferences

again obtrude themselves, and equality in total consumption between man and man may disappear, unless the journey in contemplation is of extreme length or duration. Then the ration should, presumably, be reduced and divided to give a standard daily total for protein and other requirements, with a supplement of carbohydrate and fat to be eked out as expedient. Indeed one might imagine the tractor-train equipped with a spring balance and the leader administering supplementary calories to his men in accordance with their changes in body-weight and the distance still to be traversed.

In Table 1 are shown some of the rations taken by polar travellers, whose experience has led up to the culmination of knowledge as expressed in the travelling ration used now in the Falkland Islands Dependencies Survey (Table 2). One can but wish that the giants of polar exploration in the past could have had the quality of rations available to their grandsons, who to-day are moving into an epoch of mechanical transport in which the very perfection of the ration ceases to be of such supreme importance.

Table 1. *Scale of rations per man, daily carried by some polar expeditions in the past, compiled from expedition narratives and other sources*

Food item	Sherard Osborn 1853 (oz.)	*Alert* and *Discovery* 1875 (oz.)	Scott 1903 (oz.)	Scott 1911 (oz.)	Typical about 1933 (oz.)	Falkland Islands Dependencies Survey 1950 (oz.)
Pemmican	12	16	7½	12	7	5·6
Boiled pork	6	—	—	—	—	—
Bacon	—	4	½	—	—	—
Cheese	—	—	2	—	—	—
Margarine	—	—	—	2	6	4·8
Pea-flour	—	—	2	—	2	0·8
Biscuit	12½	14	12	16	3	3·75
Potato, dried	—	2	—	—	—	0·8
Oatmeal	—	—	1½	—	3	2·5
Sugar	¾	2	3¾	3	3·5	3·2
Chocolate and/or cocoa	1½	1	1¾	0·57	4	3·2
Milk derivatives, including Plasmon	—	—	2	—	2·5	1·6
Tea	¼	½	—	0·86	—	0·4
Rum	3	2½	—	—	—	—
Total	36	42	33	34·43	31	26·65

In addition assorted vitamins, pepper, curry powder and other condiments, according to supplies available at the given date.

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Table 2. *Full daily ration per man used in the Falkland Islands Dependencies Survey*, 1950*

Food item	Consumption/ man/day (oz.)	Nutrient intake/man/day			
		Calories (Cal.)	Protein (g)	Fat (g)	Carbohydrate (g)
Pemmican	5·60	913	70·9	68·4	—
Butter	4·80	1104	—	116·2	—
Biscuits	3·75	505	7·3	22·0	64·0
Porridge oats	2·50	288	10·4	4·4	49·5
Milk powder	1·60	230	11·3	12·0	17·4
Sugar	3·20	371	—	—	90·7
Cocoa	0·80	110	4·1	6·0	8·2
Pea flour	0·80	83	6·3	0·5	12·9
Potato powder	0·80	80	—	—	14·0
Chocolate	2·40	382	2·9	22·1	40·8
Onion, dehydrated	0·40	—	—	—	—
Coffee, Nescafe	0·20	—	—	—	—
Tea	0·40	—	—	—	—
Marmite	0·20	—	—	—	—
Total	27·45	4066	113·2	251·6	297·5

In addition vitamin tablets containing vitamin C, nicotinic acid, thiamine, riboflavin.

* Fuchs (1952).

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