

und M. J. KARVONEN, *Ann. Med. Exp. et Biol. Fenniae* **34**, 246 (1956). — 15. SCHLÜSSEL, H., M. SCHULTE, W. HEINRICH und J. HAMACHER, *Z. Kreislaufforschg* **48**, 734 (1959). — 16. WARNOCK, N. H., T. B. CLARKSON und R. STEVENSON, *Circulation Res.* **5**, 478 (1957). — 17. WONG, H. Y. C., F. B. JOHNSON und A. K. WONG, *Circulation* **18**, 482 (1958). — 18. WIGAND, G., Entry for the „Ciba Foundation Awards for Basic Research Relevant to the Problem of Ageing“ (London 1957). — 19. WIGAND, G., *Acta med. Scand.* **166**, Suppl. 1959. — 20. LAMBERT, G. F., J. P. MILLER, R. T. OLSEN und D. V. FROST, *Proc. Soc. Exp. Biol. Med.* **97**, 544 (1958). — 21. ANDERSON, J. T. und A. KEYS, *Clin. Chem.* **2**, 145 (1956). — 22. KESTEN, H. D., *Arch. Pathol.* **20**, 1 (1935). — 23. MALMROS, H. und G. WIGAND, *Lancet* **1959** *II*, 749. — 24. ALFIN-SLATIER, R. B. und S. BERNICK, *Am. J. Clin. Nutr.* **6**, 613 (1958). — 25. FISHER, H., A. S. FEIGENBAUM und H. S. WEISS, *Nature* **192**, 1310 (1961). — 26. STORMBY, N. und G. WIGAND, (Persönliche Mitteilung). — 27. MILLER, C. PH., *J. Exp. Med.* **40**, 543 (1924). — 28. PRIOR, J. T., D. M. KURTZ und D. D. ZIEGLER, *Arch. Pathol.* **71**, 672 (1961). — 29. CONSTANTINIDES, P., J. BOOTH und G. CARLSON, *Arch. Pathol.* **70**, 712 (1960).

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The Diet of Finnish Lapps

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With 1 figure and 5 tables

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The Lapps inhabit the northern parts of Finland as well as those of Sweden, Norway, and the Kola peninsula in the Soviet Union. They form a separate tribe, which is allied to both the Mongolian race and to some European races (1). The Lapps are of short stature, slender build, and have mostly normal or lean bodies. Their muscles are usually well developed owing to their walking long distances, rowing, and carrying heavy loads (2).

On the basis of their anthropological properties, the Finnish Lapps are divided into two groups: Utsjoki-Inari Lapps and Skolt Lapps. The former resemble anthropologically so closely the Lapps of Sweden and Norway that they may be considered Scandinavian Lapps. The Skolts are related to the Lapps of the Kola peninsula (2).

The Lapps earn their livelihood by reindeer breeding or fishing or by both. Besides this, agriculture is practised in some areas. It is, however, mostly limited to growing forage crops for cattle feed and potatoes.

Reindeer breeding is the principal means of livelihood for the majority of the Lappish population, and it determines their way of living. Constant tending of the animals is necessary for successful reindeer breeding, and consequently

the men – and in one group even the whole family – migrate together with the herds. This kind of occupation naturally leaves its mark on the food habits of the people. A characteristic feature of their diet is the high consumption of reindeer meat during the long periods spent in the wilds.

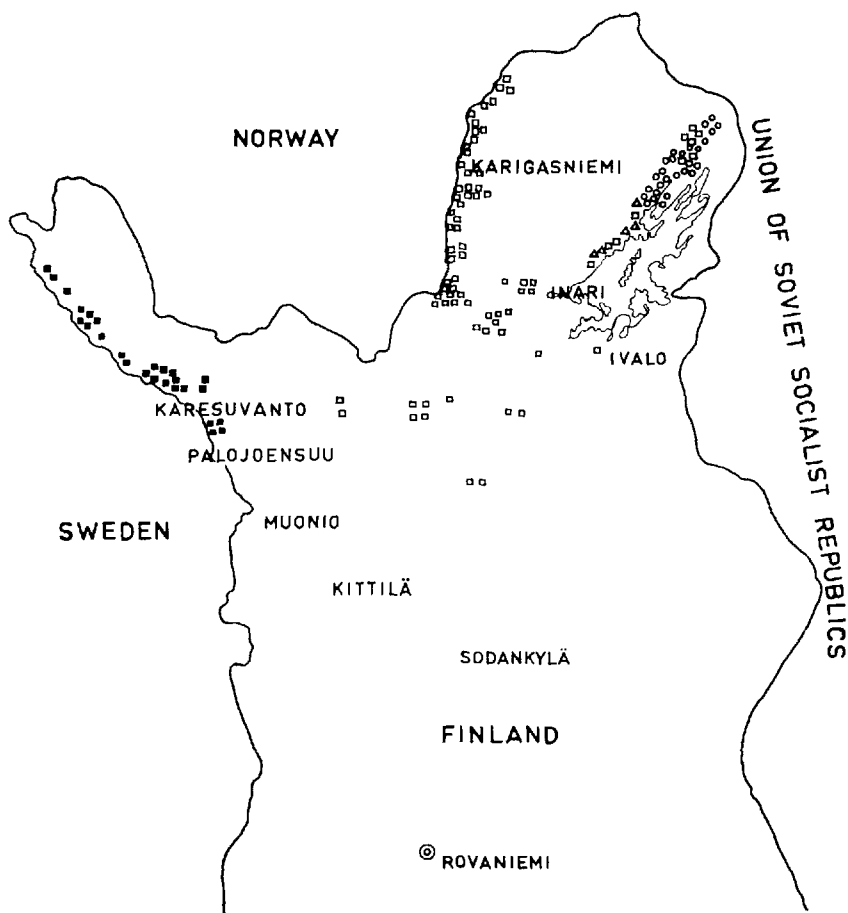


Fig. 1. Geographic distribution of the Lapps studied
 ■ Nomadic Mountain Lapps □ Settled Mountain Lapps △ Fisher Lapps ○ Skolt Lapps
 One dot represents one family

The present investigation was called for by the observation that long-lived radio-nuclides, ^{90}Sr and ^{137}Cs in particular, of the global fallout caused by the nuclear bomb tests, accumulate in the flora and fauna of Lapland. The high figures for ^{90}Sr in reindeer meat and bone, obtained in preliminary determinations (3, 4; cf. 5) and the large amount of ^{137}Cs in cow's milk observed in Lapland in 1959 (6) were evidently due to wild plants and especially the slow-growing bryophytes, these being the chief feed of animals north of the arctic

circle. Since reindeer meat is one of the most important foodstuffs of the Lapps, the question of the accumulation of the mentioned radio-nuclides in plants and their transmittance through reindeer and cattle into humans evidently needs thorough investigation; i. e. determination of the ^{90}Sr and ^{137}Cs content of the food of both humans and domestic animals.

The composition of the diet of the Lapps has not, as far as we know, been scientifically studied previously. In order to obtain a general idea of the quality and quantity of the foods consumed by Finnish Lapps, a dietary survey by the interview method was carried out in the winter and summer of 1960. This study was considered necessary also for planning the more accurate later studies as well as for collecting appropriate food samples for radioactivity determinations.

This paper presents the results of the dietary survey, which included approximately one third of the total Lapp population in Finland. It gives a picture of the mean food consumption of the Lapps throughout the year. Great seasonal variations are known to occur in the diet; the use of particularly reindeer meat is mainly restricted to wintertime (from November to May). To study these variations, investigations were also carried out by other methods, e. g. the weighing method. The results of these as well as of studies on radio-nuclide contents of the diet of Lapps will be published later.

Material

About 2500 Lapps live in the Finnish Lapp area. By occupation and language they are divided into three groups: Mountain Lapps, also called Reindeer Lapps, Fisher Lapps, and Skolt Lapps. Mountain Lapps, who form the largest group, about 62% of the total Lappish population, are further divided into settled Lapps and nomads. The number of Fisher Lapps is 22% and that of Skolt Lapps 16% of the total (7).

The dietary survey was conducted in all the main living areas of the Lapps. In all 135 families, comprising 812 persons, were included in the sample. About one third of the Lapps thus came into the scope of the investigation. The distribution of the material between the different Lapp groups is presented in Table 1, and the geographic localization of the studied families appears in Figure 1.

The survey was carried out during two periods in 1960, in February-March and July-August, respectively.

Table 1. Number of surveyed families and individuals, and their distribution between different Lapp groups

	Nomadic Mountain Lapps	Settled Mountain Lapps	Fisher Lapps	Skolt Lapps	Total
Families	26	77	5	27	135
Individuals:	119	468	38	187	812
Men	43	141	10	45	239
Women	29	109	10	42	190
Children (0-16 years)	47	218	18	100	383

Method

The interview method based on the use of food lists was employed. The interviewing was done by two specially trained Lapps, both university students, who were familiar with the local conditions and ways of living. Information on the structure of the families and their food consumption in detail was collected on record forms. The foods consumed could be reported as quantities either per year, per month, per week, or per day. These alternatives proved necessary, because the Lapps usually buy foodstuffs that can be stored for long periods, such as grain, potatoes, sugar, coffee, tea, and dried fruits, only once or twice a year. During the cold season even foods that do not normally keep very long, e.g. margarine, meat, and fish, are stored for several months. Fresh milk is obtained daily. It may be pointed out that the employed interview method evidently gives exceptionally good results when applied to a population group like Lapps, since foodstuffs purchased at long intervals and in great amounts at a time are usually well remembered.

The average amounts of food consumed daily per person were computed from the obtained data. The calory and nutrient contents of the diets were calculated with the aid of food composition tables (8, 9).

Results

The amounts of different foodstuffs consumed daily per person are given in Table 2. The main foodstuffs are grain products, margarine, milk, sugar, potatoes, meat, and fish. The percentage contribution of the main foodstuffs to the total energy is given in Table 3. For comparison, this table also includes corresponding figures obtained in food consumption surveys of the rural population in southern Finland (10). It can be seen that the consumption of grain products is quite high, clearly higher than in southern Finland. The consumption of potatoes is somewhat lower, that of sugar about equal, and that of margarine

Table 2. Amounts of different foodstuffs (g) consumed per person per day

	Nomadic Mountain Lapps	Settled Mountain Lapps	Fisher Lapps	Skolt Lapps
Grain products	290	387	366	394
Sugar	78	80	81	82
Potatoes	156	212	238	164
Other vegetables	1.3	6.6	4.7	3.8
Peas (dried)	1.5	4.2	1.8	6.9
Berries and fruits	42	33	29	31
Reindeer				
carcass meat	405	236	71	160
offal: liver, heart, kidney, blood	55	18	8	24
Other meat				
and meat products	4	21	16	6
Fish	144	128	308	90
Milk and skim milk				
(buttermilk)	281	904	885	35
milk powder	36	3	2	13
Cheese	14	7	6	7
Butter	19	14	1	3
Margarine	58	68	51	66

and fish higher as compared to southern Finland. Meat consumption is very high among the nomadic Mountain Lapps. The consumption of butter is very low and the use of milk even in the best Lapp groups does not rise to the level of the southern population. By far the largest part of the consumed meat is reindeer meat. The share of vegetables, berries, and fruits in the diet is minimal.

Table 3. Percentage contribution of major foodstuffs to total intake of energy

	Nomadic Mountain Lapps	Settled Mountain Lapps	Fisher Lapps	Skolt Lapps	Rural po- pulation in southern Finland
Grain products	36.2	39.8	40.5	50.1	32.8
Potatoes	3.7	4.4	5.2	4.1	6.4
Other vegetables	0.2	0.5	0.3	0.9	1.0
Berries and fruits	1.9	1.2	0.9	1.0	1.8
Sugar	11.0	9.4	10.3	11.9	10.4
Margarine	15.3	15.1	12.3	18.2	3.3
Butter	5.1	3.1	0.2	0.5	11.8
Other milk products	8.8	16.2	20.2	4.4	21.6
Meat and meat products	14.6	7.9	3.0	6.7	6.6
Fish	3.2	2.4	7.1	2.2	1.1

Considerable differences are observed between the Lapp groups in their consumption of different foodstuffs. Typical of nomadic Mountain Lapps is a moderate consumption of grain products and potatoes, a small consumption of milk, and a high consumption of reindeer meat. The settled Mountain Lapps use more grain products, potatoes, and much more milk, whereas their meat consumption is only about half of that of the nomadic Mountain Lapps. Characteristic of Fisher Lapps is, of course, a high fish consumption and a correspondingly low meat consumption. The consumption of milk, too, is high in this group, as can be expected in a settled population. The Skolts use much grain, but the use of meat and fish is rather low and almost no milk is used. This is understandable, because they do not keep cattle and milk cannot be bought easily.

Table 4. Intakes of calories and nutrients per person per day

	Nomadic Mountain Lapps	Settled Mountain Lapps	Fisher Lapps	Skolt Lapps
Energy, kcal	2755	3285	3030	2640
Proteins, g	147	134	122	96
Fats, g	93	118	93	76
Carbohydrates, g	371	465	435	413
Calcium, mg	1100	1360	1325	430
Iron, mg	28.4	24.2	19.0	23.3
Vitamin A, I.U.	4640	4020	2930	2920
Thiamine, mg	2.8	2.0	1.9	1.6
Riboflavin, mg	2.7	3.2	2.8	1.4
Nicotinamide, mg	23.2	18.6	17.1	13.6
Ascorbic acid, mg	35.1	49.8	56.2	32.4

Table 4 shows the intake of energy and different nutrients. Actually the values are somewhat lower than those presented in the table, since no deductions have here been made for waste and refuse. Together these deductions can probably be estimated as high as 15%, since part of the human food is always given to dogs. If this amount is deducted from the total consumption, the average energy intakes vary from about 2250 to 2775 kcal in the different groups. To estimate the adequacy of these intakes, the heights, weights, and skinfolds of 120 adult Lapps were measured. The average height of men was found to be 164 cm and that of women 151 cm, and the weight 64 kg and 57 kg, respectively. The skinfolds of the men were 9 mm on the upper arm and 11 mm on the scapula; of the women, 14 mm and 13 mm, respectively. Thus the Lapps are small in size and, as the above values indicate, trim and of normal physique. Evidently the energy intakes observed can be regarded as adequate.

Table 5. Percentage contribution of nutrients to total intake of energy

	Nomadic Mountain Lapps	Settled Mountain Lapps	Fisher Lapps	Skolt Lapps
Proteins	20.2	15.5	15.9	14.1
Fats	28.8	30.7	27.4	25.1
Carbohydrates	51.0	53.8	56.7	60.8

Table 5 shows the contribution of different nutrients to the total energy. In all the groups 50 to 60% of the total calories were derived from carbohydrates. The supply of proteins was very liberal in the nomadic Mountain Lapp group and quite high in the other groups, too. The biological value of the proteins was good, since two thirds of them were of animal origin. The share of fats in the total food energy varies between 25% and 30%. These figures can be considered very moderate now-a-days, when fat consumption generally tends to rise to much higher levels. Among the rural population in southern Finland the mean fat consumption is about 35% of the total calories (cf. 10).

Special attention should be given to the intake of calcium in the Skolt group, which is much below the generally used standards. According to newer knowledge (11, 12, 13), however, humans are able to adapt themselves to very low calcium intakes. Anyway, even the average figure of Skolts (approximately 370 mg per day, after deduction of waste) is quite low and, of course, the intake of a number of people must have been considerably below this average. Also the intake of riboflavin is much lower in the Skolt group than in the other groups, due to the small consumption of milk. Obviously a part of the studied population suffers from a shortage of riboflavin. Attention should also be directed to the intake of ascorbic acid of the nomadic Mountain Lapps and Skolts. Taking into consideration losses in food preparation, the observed figures must be regarded as very low.

The intakes of most other nutrients are evidently quite sufficient. The requirement of iron seems to have been well met owing to the abundant use of whole grain products, meat, and meat products. The intake of vitamin A, too, is adequate in all groups and even liberal in the Mountain Lapp group. At least half of the vitamin A is derived from animal products: from milk, dairy pro-

ducts, and liver in the Mountain and Fisher Lapp groups, and mainly from liver in the Skolt group. The intakes of B-vitamins and ascorbic acid are probably adequate in other groups except those mentioned above.

As a general observation it can be stated that the choice of foods of the Lapps is rather poor and their diet thus monotonous. The main courses are meat and fish soups, roasted reindeer meat, and cooked fish. The food is often prepared in a peculiar way. Soups are made by adding meat or fish to gruel made of flour or grain. The only spice used is salt. Roasted reindeer meat, called "käristys", is a very popular course. It is prepared by roasting small pieces of meat in plenty of fat. Fish is usually either salted raw or cooked in salted water.

The Lapps take their meals at irregular times. In the forenoon hunger is kept off with bread and butter and coffee or tea. Plenty of coffee is used; a grown-up Lapp may consume 1.5–2.0 liters per day. The main meal of the day is taken in the evening, and during summer, when mostly fish is eaten, dinner may be as late as 10 p.m. or even later. When tending reindeer the Lapps eat particularly great amounts of reindeer meat. The daily portion may amount to even 1–2 kg per person. In addition, the tenders drink plenty of coffee to keep warm, since they live in open huts.

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Summary

A dietary survey by the interview method was undertaken on the Finnish Lapps in 1960. Data on the food consumption of 135 families including 812 persons in all was collected.

The average energy intake varies from 2250 to 2775 kcal in the different Lapp groups, when estimating the waste and refuse at approximately 15% of the total food consumed. The intake of energy may be considered adequate, since the Lapps are of normal physique according to height, weight, and skinfold measurements.

The intake of some essential nutrients is scarce, especially that of calcium of the Skolt Lapps, which after deduction of waste is only 370 mg per day. The daily intake of ascorbic acid in the nomadic Mountain Lapp and Skolt groups is as low as 30 mg. Considering the losses of ascorbic acid in food preparation, the intake of this vitamin is very low in both these groups.

Of the groups studied, the food of the Skolt Lapps is clearly the poorest.

References

1. ITKONEN, T. I., Suomen lappalaiset vuoteen 1945, part I (Porvoo/Helsinki 1948). —
2. NÄÄTÄNEN, E. K., Über die Anthropologie der Lappen in Suomi (Helsinki 1936). —
3. MERTEN, D., personal communication (1958). — 4. VUORINEN, A. P. U. and V.-E. J. VIRKKUNEN, personal communication (1959). — 5. VIRKKUNEN, V.-E. J. and A. P. U. VUORINEN, Suomen Kemistilehti B 35, 35 (1962). — 6. MIETTINEN, J. K., O. PAAKKOLA, R. NÄSÄNEN, A. VUORINEN and D. MERTEN, Nature 189, 324 (1961). — 7. Komiteanmietintö No 12, Saamelaisasiain Komitean Mietintö (Helsinki 1952). — 8. TURPEINEN, O. and P. ROINE, Ruoka-ainetaulukko (Helsinki 1960). — 9. Statens Ernäringsråd, Näringsmiddel

Tabell (Oslo 1960). — 10. ROINE, P., M. PEKKARINEN, M. J. KARVONEN and J. KIHLEBERG, *Lancet* 1958 II, 173 (1958). — 11. HEGSTED, D. M., I. MOSCOSO and C. COLLAZOS, *J. Nutrition* 46, 181 (1952). — 12. NICOLAYSEN, R., N. EGG-LARSEN and O. J. MALM, *Physiol. Rev.* 33, 424 (1953). — 13. THORANGKUL, D., F. A. JOHNSTON, N. S. KIME and S. J. CLARK, *J. Amer. Dietet. Assoc.* 85, 23 (1959).

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Composition of the Bladder Bile of Young White Mice Reared on a Diet Causing Formation of Cholesterol Gallstones in Young Hamsters*)

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With 2 tables

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A fat-free diet with glucose as the carbohydrate component causes formation of cholesterol gallstones in young hamsters (1, 2). The bladder bile of young hamsters reared on such a diet has been analyzed with respect to cholesterol, lipid phosphorus, bile acids and pH. The results were compared with those obtained with bladder bile from hamsters reared on diets affording complete and partial protection against gallstone formation in this species (2).

White mice reared on the „fat-free glucose diet“ do not develop gallstones. It was, therefore, of interest to examine the composition of bladder bile of mice reared on this diet.

Experimental

The mice used in the present experiment were young from our stock colony of white mice, which was kept on the same diet and water:milk, as our hamster colony (3). Until the beginning of the feeding experiment the young mice had access to the stock diet and water:milk.

Three groups of mice (about equal numbers of males and females in each group) were used. They were housed in metal cages with wire screen bottom and given the „fat-free glucose diet“ (1, 2) for 48 to 56 days. In group 8 the experimental feeding began when the mice were 31-33 days old, in group 9 when the animals were 20-22 days old, and in group 15 when they were 22 to 24 days of age. Food and tap water were available *ad libitum*. Other experimental details were as in the corresponding experiment with hamsters (2), except that the chromatographic separation of bile acids was limited to the taurine conjugates.

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