American Reindeer Fat

A Contribution from The Oil, Fat and Wax Laboratory, Bureau of Chemistry and Soils, Department of Agriculture

By WALTER F. BAUGHMAN, GEORGE S. JAMIESON, and R. S. MCKINNEY

THE reindeer industry of Alaska which had its beginning many years ago ("Reindeer in Alaska, U. S. Dept. Agric. Bull. No. 1089 (1922), by S. Hadwen and L. J. Palmer) through the efforts of the U. S. Bureau of Education, has made rapid progress in its development during recent years, with the result that increasing quantities of the meat are sent to this country, where it is distributed through the meat markets in various states, particularly those of the Northwest. In view of the growing importance of the reindeer meat industry, primarily to the people of Alaska, a cooperative study of the composition, palatability, and methods of preparing and cooking the meat has been undertaken by the Bureaus of Animal Industry, Home Economics, and Biological Survey, of the Department of Agriculture.

The only reference to a previous examination of reindeer fat that could be found in the literature was that of Tistschenko (Zeit. angew. Chem. 1900, 167), who reported that the fatty acids from a sample of the fat which had an iodine number of 35.8 and a saponification value of 194.7 consisted of 60 percent of stearic acid, 1.5 of palmitic and 38.5 of oleic acid. The present investigation shows that the proportions of palmitic and stearic acids are entirely different from those that he reported.

These samples represent the fat of reindeer produced under the usual Alaskan conditions. It is known that the character of the feed may influence the nature of the fat deposited in animals. Without a study of the feed of reindeer and its influence on the composition of reindeer fat it is impossible to say to what extent the differences observed in these carcasses are the result of the feed or are inherent characteristics of the reindeer.

The five samples of reindeer fat listed below were taken from different parts of two carcasses of varying degrees of fatness, which were furnished by Mr. Loman of the Loman Reindeer Corporation of Alaska for the proposed study.

Sample I. Combined kidney fat from carcasses 351 and 352

Sample II. Combined rib fat from carcasses 351 and 352

Sample III. Combined chuck fat and brisket fat from carcass 351

Sample IV. Combined fats from rump, buttock, and flank of carcass 351

Sample V. Combined fats from loin end and short loin of carcass 351

TABLE I

Reindeer Fat

Chemical and Physical Characteristics

Samples	1	2	3	4	5
Softening point °C.	41.	41.	40.	40.	40.
Melting point °C.	47.4-48.6	46.0-46.6	46.0-46.2	45.8-46.0	46.0-46.6
Specific gravity $\frac{40°}{25°}$		0.8993	0.8981	0.8993	0.8981
Refractive index, 60°	1.4510	1.4510	1.4510	1.4510	1.4510
Acid value	8.6	2.0	3.7	2.7	3.7
Saponification value	194.3	199.2	197.5	197.3	197.6
Unsaponifiable matter (%)		0.4	0.4	0.4	0.4
Iodine number (Hanus)	34.3	34.5	39.4	37.1	33.7
Acetyl value		5.0	6.3	7.3	8.0
Reichert-Meissl number	0.3	0.0	0.0	0.1	0.1
Polenske number	0.3	0.4	0.4	0.4	0.5
Saturated acids (%)		59.2	53.6	55.8	59.9
Unsaturated acids (%)		35.9	41.4	39.4	35.2
Iodine number of unsaturated acid fraction		90	90	90	90

The important chemical and physical characteristics of the samples are recorded in Table I (Sample I was small and therefore as thorough an examination could not be made of it as of the others). The methods used for these determinations were the same as those employed for the examination of other fats and oils in this laboratory—Oil & Fat Ind. *5,* 202 (1928); *4,* 131 (1927); J. Am. Chem. Soc. *46,* 775 (1924).

The melting points, specific gravities, iodine numbers, saponification values and percentages of saturated and unsaturated acids of the different samples vary but little and resemble closely the same characteristics of beef tallow. (J. Agric. Research *26, 77,* (1923) The acid values show that the fats had undergone a slight degree of hydrolysis before they were examined. The acetyl values also are due to this hydrolysis and do not indicate the presence of hydroxylated fatty acids. The low Reichert-Meissl and Polenske numbers are similar to the results obtained with other animal tallows and indicate that the fats do not contain volatile fatty acids in appreciable amounts. The iodine numbers of the unsaturated acid fractions indicate that they consist of oleic acid.

The saturated acids were separated from a portion of Sample V by the lead-salt-ether method and esterified with methyl alcohol. This mixture of methyl esters, which weighed 108 grams, was fractionally distilled in a vacuum. A preliminary distillation divided the mixture into six fractions, which were all redistilled (the manner of making this distillation is described in the references given above). The fractions were analyzed, and their composition was calculated from the results. In order to test the correctness of the deductions made from these analytical data, the free fatty acids were recovered from the methyl ester fractions and the constituent acids were isolated by fractional crystallization from ethyl alcohol. Their identities were established by their melting points and by observing whether or not these melting points were lowered when the acids were mixed with equal quantities of the respective acids which they were suspected of being, the purities of which had been established previously by elementary analyses. In this way the percentage composition of the saturated acid fraction was found to be as follows: Myristic, 10.6; palmitic, 55.6; stearic, 32.7; and arachidic, 1.1 per cent.

The composition of Sample V was calculated from the results obtained by analysis and is recorded in Table II. It was considered that the percentage composition of the samples could differ but little because their chemical and physical characteristics show only slight variations and, therefore, it was regarded as unnecessary to determine the composition of the other samples.

The presence of arachidic acid and the large quantity of myristic acid in reindeer fat is noteworthy. Arachidic acid has not been found in the fat from domestic animals, except those that have been extensively fed on peanuts. Although the majority of the reports on the composition of beef tallow do not mention myristic acid, Myddleton and Barry (Fats; Natural and Synthetic, p. 111) found 2 and 2.5 per cent, respectively, in Australian and South American tallows. In regard to lard, Elsdon (Edible Oils and Fats, p. 356) states that at the present time the presence of acids lower in the series than palmitic acid must be considered doubtful.

The proportions of palmitic, stearic, and oleic acids which have been found in this sample of reindeer fat are similar to those reported for beef tallow.

TABLE II

Composition of Reindeer Fat

(Sample V)

		Per Cent
Glycerides of	Oleic Acid	36.8
	Myristic "	6.7
	Palmitic "	35.0
	Stearic "	20.5
	Arachidic "	0.7
Unsaponifiable matter		0.4

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No.	Location	Material	Purchase or Agency
39089	Habana, Cuba	Coconut oil, Refined	Agency
39101	Bremen, Germany	Lard	Agency
39176	Copenhagen, Denmark	Olein	Both
39339	Berehovo, Czechoslovakia	Oils and fats for soapmaking	Purchase
39341	Naples, Italy	Corn and cottonseed oil for soapmaking	Agency

It is reported that Lever Brothers plan to build a new $5,000,000 plant at Hammond, Ind., on a 13-acre plot fronting on the lake shore.