

EVALUATION OF FOOD ADEQUACY OF REINDEER MEAT TO NUTRITIONAL REQUIREMENTS OF INFANTS

Lipatov N.N., Kuznetsov B.B.
Scientific-Research Institute of Child Nutrition of Russian Academy of Agricultural Sciences, Moscow Region
Timoshenko N. V.
Open Joint-Stock Company "Meat-Packing Plant "Tikhoretsky", Krasnodar Region

Keywords: reindeer meat, nutritional requirements, chemical composition, mass fraction, aminoacid

During investigations, the results of which are given below, such indices of reindeer meat nutritional adequacy as its total chemical composition, aminoacid composition of its proteins, their digestibility "in vitro", fatty-acid composition, macro- and microelement composition were studied, as well as mass fractions of vitamins of group B and vitamin PP were determined.

Total chemical composition of reindeer meat. When investigating total chemical composition of reindeer meat, mass fractions of moisture, protein, fat, and ash in meat, as well as in aqueous extracts (distilled water, main water, and sodium chloride solution) were determined, the extraction parameters being: T = 100 °C, duration - 60 min.

The mean statistically processed results obtained at the Scientific-Research Institute of Child Nutrition (NIIDP) and Institute of Nutrition of Russian Academy of Medicinal Sciences (IP RAMN) are given in Table 1.

Parameter being measured	Values obtained during investigation at					
	NIIDP					IP RAMN
	natural reindeer meat		extracts of ground meat in			Ham
	ham	back	distilled wa- ter	main water	sodium chloride solution	
Moisture, %	74.40	75.10	-	-	-	75.24
Dry substances, %	25.60	24.90	1.70	1.70	-	24.76
Protein, %	21.10	21.00	1.20	1.20	2.80	20.80
on a dry basis, %	82.40	84.34	-	-	-	-
Total lipids, %	3.80	3.30	-	-	-	3.10
on a dry basis, %	14.82	13.25	-	-	-	-
Ash, %	1.20	1.20	0.43	0.43	2.93	1.20

Aminoacid composition of reindeer meat. It is common knowledge, that aminoacid composition of protein of the food raw material and finished products is the key index, on the basis of which their biological value is qualified.

The results of statistical processing of aminograms, undivided into the muscular and connective tissue of deer meat samples, as well as aminoacid composition of woman's milk, including its casein, for comparison, are given in Table 2.

Aminoacids, g/100 of protein	Reindeer meat				Woman's milk	Casein of woman's milk
	raw 1	raw 2	Boiled (*)	autoclaved (**)		
Isoleucine	4.00	4.26	4.23	4.16	5.24	5.40
Leucine	7.16	6.96	7.19	7.14	10.49	9.50
Lysine	7.91	8.01	8.07	8.06	9.74	8.10
Methionine + cystine	4.88	4.85	4.70	4.66	4.37	3.10
Phenylalanine	3.66	3.81	4.08	4.04	3.65	5.20
Tyrosine	3.18	2.93	3.19	3.17	3.37	5.80
Threonine	3.79	3.52	3.61	3.69	5.43	4.70
Tryptophan	1.06	1.10	0.80	0.88	1.50	
Valine	4.67	4.43	4.67	4.92	5.43	
Arginine	8.95	8.84	8.66	8.84	3.00	3.70
Serine	3.42	2.99	3.03	3.00		
Glutamine	17.39	17.25	18.47	18.20		
Proline	3.67	2.39	3.42	2.81		
Glycine	4.24	4.45	4.50	3.97		
Alanine	5.34	4.79	4.79	4.80		
Histidine	3.74	3.95	3.40	3.30	1.69	2.90
Arginine	5.92	5.83	6.06	6.07		
Ornithine	0.06	0.06	0.06	0.04		

Note: 1 - after 3 months of storage in the frozen state; 2 - after 6 months of storage in the frozen state; (*) - after the temperature raise of (98±1) °C in the centre of the sample heat-treated in the water boiling at atmospheric pressure; (**) - after the temperature raise of (118±2) °C in the centre of the autoclaved sample.

Analysis of the data given in Table 2 points to the fact, that the aminoacid composition of reindeer meat protein, within the limits of the objective error of the procedure for determination of the aminoacid mass fraction, is the constant value giving reliable evidence of aminoacid individuality of the reindeer meat. When giving qualitative and quantitative estimate of this individuality by means of such indices, as total mass fraction of essential aminoacids (ΣEAA), minimal score (C_{min}) and coefficient of aminoacid composition rationality (R_c)¹, special attention should be paid to non-trivial results that earlier, as far as it is known from the literature, were not discussed in the meat science, and it is necessary to note, that by the set of the above indices reindeer meat is better than pork, mutton, beef and horse-meat.

Digestibility of proteins. Along with the aminoacid balance, another important characteristic of reindeer meat proteins pointing to

¹ C_{min} and R_c - with respect to total protein of mature woman's milk.

their extremely high biological value, is their digestibility by proteases of the gastrointestinal tract, determined "in vitro". Digestibility was determined according to the Pokrovsky A.A. and Ertanov I.D., and the improved Lipatov N.N. (junior) and Yudina S.B. methods. Numerical values of digestibility are calculated according to the formula:

$$P = 10 \cdot \pi / T,$$

where: P is digestibility of protein of reindeer meat under investigation, % to the initial mass fraction of tyrosine;

π is digestibility of protein of reindeer meat, mg of tyrosine/100 g of protein;

T is mass fraction of tyrosine in reindeer meat protein, g/100 g of protein;

10 is proportionality constant factor, $(g_{\text{protein}} \cdot g \cdot \%) / (mg \cdot 100 \text{ g of protein})$.

Digestibility for raw meat of reindeer ham is 84...86 %, for heat-treated meat it increases up to 91 % to the initial tyrosine.

Fatty-acid composition of reindeer meat is of particular interest from the point of view of its usage during production of foods for child nutrition.

Analysis of results of the investigation, carried out at IP RAMN, of gas-chromatographic separation of methyl ethers of reindeer meat fatty acids after saponification and methylation of fat according to the standard IUPAC procedure, given in Table 3, discovered the unique ratio between saturated, monounsaturated and polyunsaturated fatty acids. The share of the latter in deer fat is 35 %. As compared with such a generally acknowledged standard for dietetic nutrition, as veal, the deer fat has 20-fold higher content of polyunsaturated linoleic acid and more than 25-fold higher content of polyunsaturated linolenic acid.

Table 3

Fatty acid	Code	Fatty acid content, g/100 g of total lipids	Fatty acid	Code	Fatty acid content, g/100 g of total lipids	Fatty acid	Code	Fatty acid content, g/100 g of total lipids
Lauric	C 12:0	0.10	Oleic	C 18:1	22.0	Eicosatrienoic	C 20:3	0.09
Myristic	C 14:0	1.02	Linoleic	C 18:2	21.77	Arachidonic	C 20:4	3.80
Pentadecenic	C 15:0	5.62	Linolenic	C 18:3	7.95	Eicosapentaenoic	C 20:5	0.56
Palmitic	C 16:0	16.42	Arachidic	C 20:0	0.87	Docosatetraenoic	C 22:4	0.30
Palmitoleic	C 16:1	7.41	Gadoleic	C 20:1	0.47	Docasahexaenoic	C 22:6	0.10
Stearic	C 18:0	11.40	Behenic	C 22:0	0.03	Total		100.0

Data on the ratio of total saturated, monounsaturated and polyunsaturated fatty acids $[\Sigma(\text{SFA}) : \Sigma(\text{MUFA}) : \Sigma(\text{PUFA})]$ calculated on the basis of experimentally obtained results and the information source are given in Table 4.

Table 4

Kind of raw material	Ratio $[\Sigma(\text{SFA}) : \Sigma(\text{MUFA}) : \Sigma(\text{PUFA})]$	Kind of raw material	Ratio $[\Sigma(\text{SFA}) : \Sigma(\text{MUFA}) : \Sigma(\text{PUFA})]$	Kind of raw material	Ratio $[\Sigma(\text{SFA}) : \Sigma(\text{MUFA}) : \Sigma(\text{PUFA})]$
Woman's milk fat	35 : 40 : 25	Horse-meat fat	35 : 50 : 15	Beef fat	50 : 45 : 5
Cow milk fat	65 : 32 : 3	Veal fat	45 : 40 : 15	Mutton fat	55 : 40 : 5
Reindeer meat fat	35 : 30 : 35	Pork fat	40 : 50 : 10	Soybean oil	10 : 25 : 65
Rabbit fat	40 : 35 : 25	Camel's meat fat	45 : 45 : 10	Peanut oil	20 : 45 : 35
				Sunflower oil	15 : 25 : 60

Analysis of the data of this Table gives evidence of the fact, that deer fat is one of the best given in it natural fat substitute of mature woman's milk

Element composition of reindeer meat. During investigation of chemical composition of reindeer ham samples it was established that the share of macro- and microelements is 0.01 of dry substances share.

Results of the experimental studying of element composition are illustrated by the following mean data given in Table 5.

Table 5

Microelements	Mass fraction, mg/kg	Microelements	Mass fraction, mg/kg	Microelements	Mass fraction, mg/kg	Microelements	Mass fraction, mg/kg
Potassium	3350...3600	Calcium	100...120	Zinc	37...43	Copper	1.3...1.5
Sodium	455...475	Phosphorus	194	Iron	38...45	Magnesium	22

Vitamin composition of reindeer meat. Samples of reindeer meat were investigated for the content of B₁, B₂ and B₆ vitamins.

Experimental and literary data on vitamin composition of deer meat are given in Table 6.

Table 6

Vitamins	Content in reindeer meat, mg/100 g		Vitamins	Content in reindeer meat, mg/100 g	
	experimental values	value according to literary sources ²		experimental values	Value according to literary sources ²
B ₁	0.347	0.30	B ₆	0.370	-
B ₂	0.377	0.68	PP	-	5.50

Analysis of these data shows that by thiamine content (vitamin B₁), ~ 35 mg/100 g of product, reindeer meat is twice better, than veal. It contains more, in comparison with veal, such vitamins as riboflavin (vitamin B₂) ~ 37 mg/100 g of product and vitamin B₆ ~ 37 mg/100 g of product. It follows from this, that by the content of the above micronutritional substances, 100 g of reindeer meat satisfies the recommended daily requirement of a child under 1 year old in vitamin B₁ ~140 %, in vitamin B₂ more than 100 %, vitamin B₆ ~ 160 %.

Summarizing the material of the present publication, it is safe to confirm, that by the complex of nutritive value indices, analysed by its authors, reindeer meat is, undoubtedly perspective for utilization during development and production of a wide range of products for ordinary, preventive and rehabilitation nutrition of children of different age groups, as well as herodietetic and special-purpose products.

² Manual "Chemical composition of foodstuffs". Book 1// M.: "Agropromizdat". 1987. P. 76.