

**Sanitary-hygiene evaluation of reindeer meat as raw materials for production of child nutrition products**

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The purpose of research the results of which are described below was obtaining and analysis of information, including the a priori one, necessary for sanitary hygiene evaluation of reindeer meat as raw materials for production of additional food and foods for children of early age.

It is connected with the fact that now the problem of provision of the interbranch industry of child nutrition production with ecologically pure raw material in Russian Federation attaches rather important value. Therefore study of possibility of use of reindeer meat that is obtained in districts of Far North of Russia in production of child nutrition foods is urgent.

In these districts nomadic reindeer breeding represents enormous economic potential. Three quarters (about 2.2 mln.) of world total number of reindeers is bred in the North of Russia. Here the reindeer meat is a traditional raw material for food products for hundreds thousands of people.

The close study of literary, patent and advertising sources of information has allowed to make a conclusion about growing interest to reindeer meat as the raw materials of meat industry in the countries of Western Europe, New Zealand and Canada. According to literary data this interest is caused by not ordinary dietary characteristics of reindeer meat – moderately low contents of fat, well balanced ratios of macroelements and high mass shares of hemopoietically active microelements – iron, zinc and copper, even as compared to such raw materials as horsemeat and beef.

Considering reindeer meat as a potential raw materials for industrial production of meat products, and especially of products for child nutrition, it is necessary to take into account the fact that the natural habitat of reindeers settles down in immediate proximity from territories on which sea level tests of the nuclear weapon in the beginning of 60s were carried out.

In this connection according to the order of the Institute of Child nutrition a precision study was carried out of reindeer meat as offered by OAO "Yamalgroinvest" for industrial use at meat processing plants of Russia on the contents of radionuclides in it. The research was carried out in a State Scientific Centre of Ministry of Health protection of Russian Federation – Institute of Biophysics.

According to statistically processed data the contents of radionuclides (as the atomic weight of most probable and regulated by the documents of Ministry of Health protection radioactive isotopes increases<sup>1</sup>) is in the limits specified in Table 1.

Table 1

Determined indices	Contents, Becquerels/kg			Normative documents
	Results of research of reindeer meat, specific activity (A)	Total error of research, ΔA	Allowable level, H	
Strontium-90	0.75	0.15	30	SR&N 2.3.2.560-96
Caesium-137	36.0	3.6	70	p. 8.1.4.1., p.1.4.4.
Radium-226	<1.0	0.5	3.7	NRB-96 p.7.3.6., p-2

On the basis of recommendation of SR&N 2.3.2.560-96 the value of the index of conformity (B) of the food object to the required level of radiological safety is determined by the formula:

$$B = \left( \frac{A}{H} \right)_{Sr-90} + \left( \frac{A}{H} \right)_{Cs-137} + \left\{ \left( \frac{\Delta A}{H} \right)_{Sr-90}^2 + \left( \frac{\Delta A}{H} \right)_{Cs-137}^2 \right\}^{0.5}$$

For reindeer meat the index of conformity (B) on Sr<sup>90</sup>, Cs<sup>137</sup> calculated on the basis of data of Table 1, makes 0.59 [a normative index (SR&N 2.3.2.560-96) should be <1.0].

In evaluation of suitability of reindeer meat on Ra<sup>226</sup> the regulations established by NRB-96 were taken as guidelines according to which the allowable activity for a foodstuff should not surpass 3.7 Bq./kg.

The contents of Ra<sup>226</sup> in the studied reindeer meat according to Table 1 is:

$$B = (A + \Delta A) \leq 1.5 Bq / kg$$

These data allow to make a conclusion that for years elapsed after termination of tests of nuclear weapon in North of Russia the contents of radionuclides (Sr<sup>90</sup>, Cs<sup>137</sup> and Ra<sup>226</sup>) in natural forages of reindeers: lichens and reindeer mosses reduced to a safe level ensuring bioconversion of the above radionuclides in the amounts providing considerable "safety margin" of reindeer meat as radiologically safe raw materials for the production of foods for child nutrition. Besides radionuclides the test centres of the Institute of child nutrition of RASKH and the Institute of Nutrition of RAN determined the contents of such potentially dangerous toxic elements as lead, cadmium, zinc and copper and also measured the contents of organochloric (sum of isomers of Hexachlorocyclohexane (HCCH) and a sum of DDT) and organophosphoric pesticides, antibiotics of tetracycline group and bacitracin, nitrosamines, nitrates, hormones. Results of the investigations are presented in Table 2.

<sup>1</sup> Sanitary Rules and Norms (SR&N) 2.3.2.560-96 "Hygiene requirements to quality and safety of food raw materials and foodstuffs"

Table 2

Contents of substances	Contents in deer meat	Normative
Toxic elements, mg/kg		
Lead	0.038	≤ 0.200 (○)
Cadmium	0.005	≤ 0.040 (○)
Copper	1.340	≤ 5.000 (○)
Zinc	40.100	≤ 60.000 (○)
Organochloric pesticides, mg/kg		
Sum of isomers HCCH	< 0.001	≤ 0.015 (○)
Sum of DDT and its metabolites	< 0.001	≤ 0.015 (○)
Organophosphoric pesticides, mg/kg	not detected	
Hormones, mg/kg:		
17-beta-estradiol	not detected	
diethylstilbestrol	not detected	
testosterone	≤ 0.001	
	<b>natural level</b>	
epi-testosterone	not detected	
trenbolon	not detected	
17- $\alpha$ -methyl-testosterone	0.0030	
Antibiotics, U/g		
tetracycline group	not detected	≤ 0.010
bacitracin	not detected	≤ 0.020
N-nitrosamines, mg/kg	< 0.001	≤ 0.001 (○)
Nitrites, mg/kg	0.630	
Nitrates, mg/kg	1.400	

Note: (○) – according to p. 8.5.4. of SR&N 2.3.2.560-96 "Hygiene requirements to quality and safety of food raw materials and foodstuffs".

Analysis of these results testifies that groups of pesticides and antibiotics as regulated by SR&N 2.3.2.560-96, in reindeer meat are practically absent. The concentrations of lead and cadmium are tenfold lower, and of zinc and cadmium – by 1.5 and 3 times, respectively lower than the levels allowed by the Ministry of Health protection of Russian Federation for child nutrition.

The microbiological investigations of reindeer meat on conformity to regulations of SR&N 2.3.2.560-96 for meat raw materials for production of products for child nutrition were carried out according to State standard 50474-93, State standard 50480, State standard 10444.15-94 independently in two organizations of the Scientific-Research Institute of Child nutrition and in the Institute of Nutrition. Results of these investigations are presented in Table 3.

Table 3

Indices	Contents in reindeer meat		Normative
	Analysis of Institute of Nutrition	Analysis of Institute of child nutrition	
Number of mesophilic aerobic and facultatively anaerobic microorganism	10 <sup>3</sup>	3 · 10 <sup>3</sup>	Not more than 1 · 10 <sup>4</sup>
Coliform bacteria, absence in deer meat (g/cm <sup>3</sup> )	Not detected in 0.01g	Absent in 0.01g	Not allowed in 0.01g
Pathogenic microorganisms, including Salmonella, in 25 g of deer meat	Not detected	Absent	Not allowed

From Table 3 it follows that coliform bacteria are absent in 0.01g, and pathogenic microorganisms, Salmonella among them – in 25g of the investigated samples. In a number of cases (in one of 5 samples selected from various carcasses of deers) the quantity of mesophilic aerobic and facultatively anaerobic microorganisms reached 10<sup>5</sup> CFU/g. In 80% of cases the quantity of the named microorganisms did not exceed 3 · 10<sup>3</sup> CFU/g. Such state of affairs is connected with probable endogenic contamination of deer meat during primary processing or transportation. Producers and suppliers of deer meat offering it for processing into child nutrition products should pay special attention to this fact.

At the same time summarizing the above-mentioned one can conclude that the meat of reindeers submitted by OAO "Yamalgroinvest" to the Scientific-Research Institute of Child nutrition with regards to the complex of sanitary-hygiene indices of radiological and toxicological safety can be used for designing and production of new generation of child nutrition products.