

# The effect of preparation of boiled foals' meat by the Yakut technique on the nutritional value of Yakut horse foals' meat

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**Abstract:** The results of the study on the effect of different cooking techniques of Yakut national meat products on the nutritional value of Yakut horse foals' meat.

**Keywords:** Foals' Meat, Preparation Technology of Meat Dishes, National Meat Products

## 1. Introduction

Nutritional value of foals' meat and Yakut horses' meat compared to other breeds of horses is high in protein, fat, easily digestible optimal ratio of essential amino acids and polyunsaturated fatty acids and also vitamins. [2-5]

However, the degree of preservation of the nutritional value of meat for production of meat products depends on the technique of their preparation. For example, when cooking meats on generally accepted industry technologies nutrient losses are huge. With this in mind, different people, including the Yakut who breed horses for meat, use their traditional technology of cooking meats that have been tested for centuries and ensure minimum loss of nutritional value of foals' and horses' meat.

Currently in Yakutia, people prepare various kinds of meats out of the meat of the Yakut horse foals', of which the most common technique for preparation of boiled and different types of grilled foals' meat by the Yakut technologies. However, so far not investigated the effect of different techniques on the nutritional value of meat products from Yakut horse foals' meat. The aim of the study is to investigate the influence of cooking boiled foals' meat on the nutritional value.

## 2. Materials, Facilities and Research Methodology

Investigations of changes in the nutritional value of meat

products from Yakut foals' meat depending on the manufacturing processes were performed in the laboratory of biochemistry and mass analysis of the State Scientific Institution The Yakut Scientific Research Institute of Agriculture. Samples of meat were taken from five foals enlarged type of Yakut horses slaughtered for meat in November, 2007, with the onset of -25 ° ... -30 ° C frosts below zero, since such frosts provide rapid freezing of meat, preserving its nutritional value [1].

Butchering carcasses produced by cuts in accordance with TU 9214-001-02069473-96 developed with experts PMU of the research laboratory "Tuymaada As" and The Yakut Scientific Research Institute of Agriculture.

Semi-finished products packaged under vacuum and frozen young horse's meat by natural cold at a temperature of -25 ° ... -30 ° C.

### 2.1. Methods of Study

Preparation of samples for research carried out by conventional methods GOST R 51447-99. The freshness of the meat was assessed according to GOST 7269-79, GOST 23392-78, GOST 19496-93 by chemical and microscopic analyzes. The pieces of the foal were packaged under vacuum. Boiled foals' meat was prepared from brisket by the Yakut technology with duration of cooking for 10 minutes [16; 18].

The biochemical composition of foals' meat was determined in the beef without acid digestion of samples in triplicate. Prior to determining the biochemical composition,

the pieces of frozen meat were thawed in the refrigerator, covered with a soft cloth to frozen meat regained its quality. Determination of biochemical composition of meat samples and boiled foals' meat were performed in the laboratory of biochemistry and mass analysis of the SSI The Yakut Scientific Research Institute of Agriculture on the infrared analyzer NIR SCANNER model 4250 (USA), calibrated using standard chemical techniques used by The Russian Scientific Research Institute of Meat Industry named after V.M. Gorbatov [8; 15].

For the purpose of determining the true nutrient losses in the production of national kinds of meat products from young horse, including cooked, all meat products were prepared without using of spices and seasonings. Boiled young horse meat prepared by Yakut technique by cooking meat pieces weighing not less than 200 g for 10 minutes or more.

The change in the nutritional value of cooked beef under the influence of the Yakut preparation technology was determined by comparing the nutrient content of frozen and boiled foals' meat.

Statistical analysis of the data using statistical software application package Windows 10. 0. Standard methods of variation statistics: calculation of average values, standard error, 95% of confidence interval. The significance of differences between means was assessed using Student's t test for independent samples. The data in the tables are presented as  $M \pm m$ , where  $M$  - the average,  $m$  - error of the average. Probability of the null hypothesis is accepted at  $P < 0.05$  [10].

### 3. Results and Discussion

#### 3.1. The Effect of Cooking on the Chemical Composition and Energy Value of Meat Foals

The results of the study on nutritional boiled meat in Table shows that in the preparation of foals' boiled meat for 10 minutes, the moisture in young horse increased by 4.36%, protein loss was 0.30%, fat - 4.90%, carbohydrate - 60.60% and ash - 0.89%, while cooking for 20 minutes, respectively, 6.90, 3.80, 10.40, 66.40 and 3.60%.

**Table 1.** The effect of cooking boiled foals' meat by the Yakut technology on the nutrient content of foals' meat (by wet weight)

Components	Foals' meat frozen (brisket)	Boiled foals' meat (10 minutes) by Yakut technology		Boiled foals' meat (20 minutes)	
		M±m	losses*, %	M±m	losses*, %
		The chemical composition and energy content per 100 g wet weight			
Water, g	63,59±0,19	66,36±0,39	+4,36	67,98±0,67	+6,90*
Protein, g	17,71±0,13	17,66±0,31	0,30	17,04±0,84	3,80
Fat, g	14,28±0,31	13,57±0,35	4,90	12,79±0,48	10,40*
Углеводы, г	3,30±0,16	1,30±0,09	60,60*	1,11±0,05	66,40*
Ash, %, g	1,12±0,01	1,11±0,03	0,89	1,08±0,05	3,60
Energy, kcal	217,04	202,37	6,75*	192,03	11,52*

Note: The "+" - increase.

\*  $P < 0.05$ .

Based on the data presented in Table 1, we conclude that:

- Increasing the water content in the preparation of cooked meat is associated with diffuse exchanges between broth (water) and fiber pieces of meat during cooking;

- Protein loss during cooking related to coagulation (clotting) proteins. As a result of coagulation proteins lose their ability to retain water (swell), resulting in cooking the meat of animals is reduced in volume [13]. Moreover, under high temperature proteins are converted into polypeptides that promote better protease cleavage of their gastrointestinal tract [6-7];

- During processing of meat products the sugar may be acidic and enzymatic hydrolysis and profound changes associated with the formation of colored substances. Heated disaccharides with acids or in the presence of enzymes hydrolyzed to monosaccharides. Therefore, when the increasing of the cooking time of young horse meat loses its tenderness and sweet flavor, as carbohydrates provide rapid maturation of horse meat [7; 14].

From these data, it follows that the preparation of boiled foals' meat by Yakut technique by boiling for 10 minutes

provides the lowest loss of protein, fat. This lost nutrients meat transformed into broth where nutrients are stored up to 40%. In this regard, when used broth nutrient losses in meat foals are minimal [7].

#### 3.2. The Effect of Cooking on the Content of Macro and Micronutrients in Foals' Meat

According to the Table 2 the foals' meat during cooking by the Yakut technique within 10 minutes the loss of macronutrients insignificant, except for potassium. Thus, when cooking for 10 minutes, calcium losses amounted to 0.7%, potassium - 13.1%, magnesium - 0.3%, sodium - 6.2%, phosphorus - 4.6%, chlorine - 8.4%, when cooking for 20 minutes loss increases in calcium - to 8.1%, potassium to 16.7% Magnesium up to 5.4%, sodium - 6.5%, phosphorus up to 4.6%, chloride up to 8.9%.

When cooking for 10 minutes, losing micronutrients - iron, iodine, cadmium, cobalt, manganese, selenium, fluorine, zinc - are insignificant, and 20 minutes in cooking loss of micronutrients is increased almost twice. Thus, the presented data can be concluded that when the cooking

time is over 10-minute - the loss of macro-and micronutrients are significant.

Thus, from the presented data it can be concluded that

when the cooking time over 10-minute the loss of macro-and micronutrients are significant.

**Table 2.** Effect of cooking boiled young horse on the Yakut technology for the maintenance of macro-and micronutrients in meat foals (by wet weight)

Macronutrients in % per 100 g wet weight					
Calcium	12,49 ±0,14	12,40±0,38	0,7	11,48±0,33	8,1*
Potassium	272,30±3,01	236,72±0,54	13,1	226,95±0,47	16,7*
Magnesium	20,57±0,16	20,50±0,47	0,3	19,46±0,28	5,4*
Sodium	105,69±1,61	99,17±0,2	6,2	98,80±0,38	6,5
Phosphorus	224,42±0,67	214,15±0,36	4,6	213,94±0,41	4,6
Chlorine	136,69±0,59	125,18±0,44	8,4	124,53±0,43	8,9
Micronutrients in 100 g wet weight					
Iron, mg	6,38±0,75	6,13±0,03	3,9	5,71±0,22	10,5*
Iodine, mcg	73,27±0,99	66,22±0,53	9,6	63,28±0,18*	13,6
Cadmium, mcg	6,39±0,75	6,01±0,19	6,0	5,70±0,22	10,8
Cobalt, mcg	9,14±0,58	8,86±0,14	3,0	8,16±0,41	10,7*
Manganese, mcg	38,41±0,67	34,45±0,4	10,3	30,57±0,35*	20,4
Copper, mcg	246,24±0,97	168,19±0,4	31,7	147,05±0,41	40,3*
Selenium, mcg	15,03±0,22	14,60±0,12	2,9	13,92±0,57	7,4
Lead, mcg	5,04±0,25	2,42±0,09	52,0	2,00±0,05	60,3*
Fluoride mcg	120,93±0,75	116,15±0,3	4,0	107,49±0,54*	11,1*
Zinc, mcg	6,02±0,30	5,64±0,19	6,3	5,31±0,26	11,8*

Note: "+" - increase, (-) – loss

\* P <0.05.

### 3.3. The Effect of Cooking on the Content of "Critical" Amino Acids in Meat Foals

Of all amino acids for animal nutrition are especially essential so-called "critical" amino acids. Those amino acids which are taken up by the animal feed only and are not synthesized in the gastrointestinal tract of animals. So

first of all, it is enough to define "critical" amino acids. Critical amino acids indispensable to include leucine, lysine, methionine, tryptophan, and from the interchangeable - tyrosine, and cystine. In this regard, we determined in their studies in meat foals only these six "critical" amino acids.

**Table 3.** The loss of "critical" amino acids and fatty acids in the meat of the foals in the preparation of boiled young horse by the Yakut technique

"Critical" amino acids, g / kg wet weight					
Essential amino acids, total	65,74±3,05	59,02±0,21	10,2	53,68±0,37	18,3*
Of which: leucine	13,64±0,55	12,50±0,11	8,3	11,43±0,41	16,2*
lysine	15,37±0,40	14,57±0,08	5,2	13,77±0,30	10,4*
tryptophan	2,19±0,05	3,27±0,04	+49,3	2,88±0,15	+31,5
Amino acids, total	95,72±3,05	1,86±0,03	98,1	1,61±0,06	98,3
Of which: tyrosine	5,69±0,20	5,27±0,04	7,4	4,88±0,15	14,2*
cystine	2,16±0,11	1,99±0,06	7,9	1,86±0,06	13,9*
Fatty acid, g/100 g wet weight					
Saturated, total	4,60±0,23	4,44±0,01	3,5	3,39±0,16	26,3*
Monounsaturated, total	5,72±0,28	5,61±0,25	1,9	4,11±0,22	28,2*
polyunsaturated:					
-linoleic (C18: 2)	1,91±0,05	1,08±0,04	43,5	0,76±0,03	60,2*
-linolenic (C18: 3)	0,10±0,01	0,04±0,01	60,0	0,03±0,01	70,0*
-arachidonic (C20: 4)	0,18±0,01	0,14±0,00	22,2	0,11±0,01	38,9*

Note: "+" - increase, (-) – loss

\* P <0.05.

As seen from the data in Table 3, during cooking young horse meat by the Yakut technique for 10 minutes negligible loss of essential amino acids than replaceable, and 20 minutes in cooking loss increased 2 times, except tryptophan. This increase of tryptophan content can be

attributed to biosynthesis of tryptophan from the precursor serine by cleavage at a high temperature which is synthesized tryptophan (Nechaev, A. et al, 2003).

Thus, from the data it can be concluded that the cooking of young horse meat by the Yakut technique for 10 minutes

provides high retention of "critical" amino acids. Similar results were obtained in studies of N.N. Lopatova (1996).

### 3.4. The Effect of Cooking on the Content of Fatty Acids in the Meat of Foals

The data from Table 4 shows that when cooking young horse for 10 minutes the saturated, monounsaturated fatty acids decreases slightly, and with prolonged cooking more than 20 minutes, the loss increased to 26.3 and 28.2%, and the loss of polyunsaturated fatty acids are significant. For example, when cooking for 10 minutes linoleic fatty acid collapsed by 43.5%, linolenic - by 60.0%, arachidonic - by 22.2%, and at 20 minutes of cooking to the loss of these fatty acids were, respectively, 60.2; 70.0 and 38.9%.

Such loss of fatty acids linked to the melting of young horse meat's fat on the point, which is +32 ° C, including melting point fatty acids begins with +11 ° to +20 ° C,

whereas the melting temperature of the beef fat begins with +47 ° C (A.F. Abramov, 2005; Gogoleva P.A., 2006).

### 3.5. The Effect of Cooking on the Vitamin Content in the Meat of Foals

When cooking for 10 minutes in a large losses occurred biotin content - 31.9; PP - 26.7 B6 - 21.5%, while increasing the cooking time to 20 minutes loss of vitamins (biotin, PP, B6) were respectively up to 44.7, 39.5 and 22.7%. When cooking for more than 20 minutes also increased loss of vitamin A to 26.7, vitamin B3 - up to 38.6%.

The minimum losses were set on vitamin D. For 10 minutes in the cooking loss was 2.0%, while increasing the cooking time to 20 minutes loss increased to 2.8%. The loss of vitamin B2 in cooking 10 minutes were 1.3%, and at 20 minutes of cooking - 8.1%.

**Table 4.** Changes in the content of vitamins in meat Yakut horse foals when cooking with different duration (100 g wet weight)

Vitamins, 100 g wet weight					
Vitamin A, mg	0,03±0,001	0,028±0,012	6,7	0,022±0,011	26,7*
Vitamin E, mg	0,42±0,013	0,408±0,005	2,9	0,388±0,016	7,6*
Vitamin D, mcg	0,25±0,009	0,245±0,003	2,0	0,243±0,008	2,8
B vitamins					
B <sub>1</sub> , mg	0,32±0,016	0,308±0,015	3,7	0,256±0,013	20*
B <sub>2</sub> , mg	0,16±0,008	0,158±0,007	1,3	0,147±0,007	8,1*
B <sub>3</sub> , mg	0,42±0,002	0,401±0,009	4,5	0,258±0,013	38,6
B <sub>6</sub> , mg	0,41±0,004	0,322±0,003	21,5	0,317±0,004	22,7
B <sub>12</sub> , mcg	0,43±0,021	0,417±0,009	3,0	0,374±0,019	13,0*
Bc, mg	0,50±0,025	0,490±0,008	2,0	0,452±0,023	9,6*
Biotin, mcg	0,53±0,025	0,361±0,018	31,9	0,293±0,015	44,7*
PP, mg	0,55±0,023	0,403±0,018	26,7	0,333±0,17	39,5*

## 4. Conclusions

From the results of the study, the following conclusions:

1. Preparation of boiled young horse by the Yakut technology by boiling for 10 minutes provides the highest retention of nutrients in young horse than cooking for 20 minutes or more.
2. Lost nutrients from meat during cooking go into the broth and stored it up to 40-60%, so the actual use of the broth nutrient losses will be minimal. Our data on the loss of nutrients during cooking young horse in agreement with literature data[4].
3. It is advisable to prepare a boiled young horse meat of the bran, where more connective tissue (from the neck, shoulder, spinal ribs, brisket, front and back drumsticks).

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