

Use of iodine preparation in rabbit breeding

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The territory of Ukraine is unique area in terms of iodine, which indicates the need for daily additional consumption of iodine along with the foodstuff. The major products applied for iodine deficiency prevention include salt and water optimized in terms of iodine and another microelements content. The thesis objective is to study influence of Iodis-Concentrate® preparation on rabbit meat quality parameters. Our aim was to find out the amino acid composition, the fatty-acid composition and mineral composition, as well as the iodine content in rabbit meat. There were two groups of two months old laboratory rabbits formed: the stud and control group (5 rabbits in each group). The rabbits of the control group were watered with the water taken from the well located in Obukhiv, Kyiv Oblast, while the rabbits of the study group were watered with the same water, although adding Iodis-Concentrate Preparation in the dosage of 0.35 mg/kg. In terms of organoleptic, physical and chemical indices, the rabbit meat corresponded to the fresh meat. The amino acid composition of the rabbit meat in the study and control group was slightly different. Subject to watering the rabbits with potable water with Iodis-Concentrate preparation added, the contents of certain indispensable and dispensable amino acids, and the aggregate contents thereof slightly increased, however, no trustworthy difference was recorded. No abnormal ratio of indispensable and dispensable amino acids was recorded. The biological value of the rabbit meat is preserved. As regards the fatty acids content, the meat of rabbits treated with Iodis-Concentrate preparation contained more fatty acids, as follows: lauric acid, myristic acid, Cys-10 heptadecenoic acid, elaidic acid, oleic acid, linolic acid, linolenic acid, Cys-11- eicosenic acid, Cys-8, 11,14- eicosatrienoic acid, Eicosatetraenoic acid, as compared to the control parameters, which indicates stimulation of lipid metabolism. During studying the influence of Iodis-Concentrate preparation on rabbit meat composition, the trustworthy high contents of the following microelements and microelements was ascertained: aluminum, calcium, chrome, ferrum, magnesium, manganese, natrium, strontium, and zinc. In the meat of rabbits treated with Iodis-Concentrate preparation, the researcher unveiled twice higher contents of iodine as compared to the performance in the control group of rabbits.

Key words: rabbit meat; Iodis-Concentrate; amino acid composition; fatty acids; microelements and microelements; iodine

Introduction

The territory of Ukraine is endemic area in terms of iodine, which indicates the need for daily additional consumption of iodine along with the foodstuff (Matasar et. al., 2014).

The iodine deficit is one of the humankind's global problems, which practical implication on the medicine and agriculture is extremely high. It is well known that the most widely proliferated human diseases (Steinhauserova, Rehurkova, Ruprich, 2014) and animal disease (van Hoek et al., 2015, Kollé, Schmidt, 2015), are caused by iodine deficiency in the foodstuff and fodders, respectively. The major products applied for iodine deficiency prevention include salt (Sorokman, 2016) and water (Melnychenko et al., 2004), optimized in terms of iodine and another microelements content.

Among the most widely offered iodine-treated potable waters are created using Iodis-Concentrate raw materials (Technical Specifications of Ukraine 15.9-30631018-007:2005), as developed by the professionals of Iodis Research and Development Company and YARK-Kyiv International Industrial Concern, as protected by the domestic and foreign patents. Iodis-Concentrate is a water complex of iodine compounds created based on artesian water saturated with polyatomic iodine ions, which shows high biological activity, being thermally-stable. Its is produced using ad-hoc technology employing the water properties in the field of associates creation (Karpovskiy, Maksin, Kryvoruchko et. al., 2011). Many scientists have studied the option of using iodine water preparations earmarked for treatment and prevention of iodine deficiency in animals and insects, and reaching the other positive effects on organism (Ong et al., 2014; Amarpal et al., 2015; Siddiqui et al., 2017; Veshkini, 2011; Zhang et al., 2017). However, there exist no similar studies covering influence of such preparation on the parameters quality of the animal origin products, which may be a source of iodine.

The thesis objective is to study influence of Iodis-Concentrate preparation on rabbit meat quality parameters. The aim was to find out the amino acid composition, the fatty-acid composition and mineral composition, as well as the iodine content in rabbit meat.

Methods

There were two groups of two months old laboratory rabbits formed: the stud and control group (5 rabbits in each group). Daily clinical condition of rabbits, activity of eating food and drinking water were determined. The microclimate parameters were measured in the premise using the generally accepted methods. The rabbits of the control group were watered with the water taken from the well located in Obukhiv, Kyiv Oblast, while the rabbits of the study group were watered with the same water, although adding Iodis-Concentrate Preparation in the dosage of 0.35 mg/kg.

The amino acids contents in the rabbit meat was measured using the ion exchanging chromatograph - amino acids analyzer AminoAcidAnalyzer (AAA-400), INGOS, Praha according to the DSTU ISO 13903:2009 and the DSTU ISO 13904:2008. For finding out biological activity of meat, A/E index was measured illustrating ratio of indispensable amino acids content (A) to the aggregate sum, and the amino acids SCORE – which computation relied on measuring percentage of each of the indispensable amino acids in the food protein, to the extent of contents thereof in the protein treated as ideal one according to the data of the Food and Agricultural Organization / World Health Organization (Yakubchak et al., 2012). The fatty acid composition in the rabbit carcasses' inner fat was measured in line with the DSTU ISO 5508-2001, the chromatographic analysis of fatty acids was carried out using gas chromatograph *TraceUltra* equipped with flame ionization detector and capillary column SP-2560, *Supelco*. Limit of detection – 0.01%. The mineral substance content in the rabbit meat was determined according to DSTU ISO 11885:2005. The iodine content was determined according to DSTU 4816:2007.

Results

For the purpose of determining quality of the rabbits slaughtering products, subject to use of Iodis-Concentrate preparation added to potable water, the contents of indispensable and dispensable amino acids were determined. The following amino acids were found among the indispensable amino acids in the rabbit muscles both in the study and control groups: threonine, valine, isoleucine, leucine, lysine, tryptophan, phenylalanyl and methionine.

Table 1. The amino acid composition of the rabbit muscular tissue, subject to watering with Iodis-Concentrate preparation in the dosage of mg/100 g of meat, M±m; n=5

Description	Group of Animals	
	Test	Control
Indispensable amino acids		
Aspartic acid	2.19±0.15	2.15±0.34
Serine	0.87±0.12	0.85±0.12
Glutanic acid	3.16±0.20	3.13±0.16
Proline	0.81±0.18	0.79±0.14
Glycine	1.03±1.15	1.01±0.09
Alanine	1.26±0.03	1.24±0.21
Thyrosinum	1.03±0.04	1.01±0.21
Histidinum	0.78±0.08	0.76±0.17
Arginine	1.46±0.20	1.43±0.04
Cystine	0.27±0.14	0.26±0.14
Sum of dispensable	12.86±2.29	12.63±1.64
Indispensable amino acid		
Threonine	0.99±0.17	0.97±0.07
Valine	1.25±0.09	1.23±0.06
Isoleucine	1.15±0.11	1.13±0.07
Leucinum	1.83±0.05	1.80±0.01
Phenylalanine	0.87±0.07	0.86±0.15
Lysine	2.16±0.11	2.12±0.09
Methionine	0.78±0.15	0.76±0.01
Tryptophane	0.18±0.02	0.16±0.11
Sum of indispensable	9.25±0.78	9.06±0.58
The indispensable/dispensable ratio	0.72	0.71
Sum of dispensable + indispensable	22.11	21.69

Analyzing the results of studying the indispensable amino acids contents in the rabbit muscles in the study group, it was found out that in terms of the amino acids composition the muscles in the control and the study group contain practically the same number of indispensable amino acids with slight prevalence in the study group. The aggregate contents of indispensable amino acids were slightly different. This value was 0.2 mg/100g higher than in the control group. The following amino acids were found among the dispensable amino acids in the rabbit muscles both in the study and control groups: aspartic acid, serine, glycine, alanine, glutamic acid, tyrosin, proline, histidine, cystine, and arginine. The contents of certain dispensable amino acids and the aggregate contents was slightly higher in the study group.

In general, the sum of dispensable and indispensable amino acids was 0.42 mg/100g higher than in the study group, as compared to the control group. No abnormal ratio of indispensable and dispensable amino acids was recorded. No statistical difference was found in the foregoing values. Moreover, the amino acid index and SCORE of the proteins were measured according to the comparative scale of the Food and Agricultural Organization / World Health Organization (Table 2).

Table 2. Amino acid index and SCORE of the indispensable amino acids in the rabbit muscles subject to use of Iodis-Concentrate preparation

Group	Valine	Isoleucine	Leucine	Lysine	Methionine	Threonine	Phenylalanine+Tyrosine
Amino acid index							
Scale of the Food and Agricultural Organization / World Health Organization*	139	111	194	153	97	111	167
Study	135	124	197	233	84	107	205
Control	135	125	198	234	83	107	206
Amino acid SCORE, %							
Scale of the Food and Agricultural Organization / World Health Organization*	5.0	4.0	7.0	5.5	3.5	4.0	6.0
Study	113	130	118	177	100	112	143
Control	114	130	118	177	100	112	143

*About "ideal" protein under the Scale of the Food and Agricultural Organization / World Health Organization, 1974

Calculation of the amino acid index indicated that as compared to the scale of the Food and Agricultural Organization / World Health Organization there was a recordable difference in the values. The rabbits of the study groups showed rather reduced index of valine, threonine and sulphur-containing amino acids (methionine + cystine) as regards the scale of the Food and Agricultural Organization / World Health Organization. The index of isoleucine, leucine, lysine and aromatic amino acids (phenylalanine + tyrosine) is changed (increased). No differences have been unveiled between the study and control group. Analyzing the results of calculating the amino acid SCORE we may assert that the rabbit meat contains no limiting amino acids. It is indication of rabbit meat proteins' full-featured nature.

The studies indicate that the biological value of the rabbit meat is retained, subject to watering with Iodis-Concentrate preparation. The results of the studies converting fatty acids content measurement in the rabbit meat showed that meat contains less saturated fatty acids as compared to the control group. Particularly, the contents of arachidic acid, stearic acid, heneicosanoic acid and palmitic acid decreased, and the contents of myristic fatty acid increased. However, in general the contents thereof were 2,98 % less as compared to the meat of control animals.

Among the mono-non-saturated acids, the contents of Cys-10 heptadecenoic acid and oleic acid slightly increased, and the contents of Myristoleic acid decreased. In general, the content of mono-non-saturated fatty acids was 0.4 % higher in the rabbit meat of the study group, as compared to the control group.

Among the poly-non-saturated fatty acids, the contents of linolic acid increased in the test. The sum of poly-non-saturated fatty acids was 2.43% higher in the rabbit meat of the study group, as compared to the control group (Table 3).

Table 3. The fatty acids content in the rabbit meat, subject to watering with Iodis-Concentrate preparation, %, M±m; n=5

Item Description	Fatty acids code	Group of Animals	
		Study	Control:
<i>Saturated</i>			
Capric acid	C 10:0	0.08±0.04	0.12±0.02
Lauric acid	C 12:0	0.21±0.02	0.19±0.02
Myristic acid	C 14:0	3.39±0.12***	2.39±0.12
Stearine acid	C 18:0	6.17±0.10**	7.22±0.22
Arachic acid	C 20:0	0.16±0.02*	0.29±0.02
Henicosanoic acid	C 21:0	0.06±0.02*	0.14±0.02
Palmitic acid	C 16:0	21.52±0.14***	24.10±0.30
Behenic acid	C 22:0	0.23±0.04	0.31±0.02
Heptadecanoic acid	C 17:0	0.55±0.02	0.59±0.04
Sum of saturated fatty acids		32.37±0.06	35.35±0.09
<i>Mono-non-saturated</i>			
Palmitoleic acid	C 16:1	1.90±0.06	2.10±0.10
Myristoleic acid	C 14:1	0.25±0.02*	0.32±0.02
Elaidic acid	C 18:1 n9t	0.63±0.06	0.62±0.04
Cys-10 heptadecenoic acid	C 17:1	0.32±0.02**	0.21±0.02
Oleine acid	C 18:1 n9c	22.61±0.06*	21.90±0.24
Cys-11- eicosenic acid	C 18:3 n3	0.40±0.04	0.33±0.04
Cys-11, 14- eicosenic acid	C 20:2	0.43±0.04	0.45±0.02
Cys-8, 11,14- eicosatrienoic acid	C 20:3 n6	0.31±0.02	0.28±0.02
Sum of mono-non-saturated fatty acids		26.85±0.04	26.21±0.06
<i>Poly-non-saturated</i>			
Linolic acid	C 18:2 n6c	33.68±0.20*	31.93±0.02
Linolenic acid	C 18:3 n6	3.52±0.08	3.09±0.02
Eicosatetraenoic acid	C 20:4n6	2.28±0.08	2.03±0.04
Sum of poly-non-saturated fatty acids		39.48±0.12	37.05±0.03
<i>Ratio of non-saturated fatty acids and saturated fatty acids</i>		2.05	1.78
<i>Ratio of poly-non-saturated fatty acids and saturated fatty acids</i>		1.22	1.04

Notes: *p ≤ 0.05, **p ≤ 0.01, ***p ≤ 0.001 compared to the control group

The increase in the ratios covering the sums of non-saturated fatty acids to saturated fatty acids and poly-non-saturated to saturated acids, indicates increase of the non-saturated fatty acids content in the meat of rabbits watered with potable water with Iodis-Concentrate preparation added. Thus, the meat becomes more dietary and useful. Since it is known that the poly-non-saturated fatty acids, including the linolic acid, are not generated in the human organism, therefore being irreplaceable for nutrition. These acids form a part of the biomembranes, taking part in the plastic processes (generation of the organism's own fats), supporting the functions of the cells membranes, facilitating cholesterol transformation into cholic acid and discharge thereof from the organism, normalizing condition of the blood vessels' walls, improving elasticity and reducing permeability thereof, etc.

Thus, the completed studies of fatty acids content in the rabbit muscle tissue showed that watering with Iodis-Concentrate preparation, influences the rabbits' organisms as a moderate stimulator of lipid metabolism.

In the course of measuring the mineral composition of the rabbit muscles in the study and control groups, it was found out that the rabbit muscles in the study group show increased contents of certain microelements and microelements: Aluminum (Al) by 54.8 % (p ≤ 0.05), calcium (Ca) – by 12.1 % (p ≤ 0.001), chrome (Cr) – 42.6 % (p ≤ 0.001), Iron (Fe) – 25.6 % (p ≤ 0.001), magnesium (Mg) – 4.2 %, manganese (Mn) – 35.0 % (p ≤ 0.01), natrium (Na) – 15.6 % (p ≤ 0.001), strontium (Sr) – 71.4 % (p ≤ 0.05), zinc (Zn) – by 81.5% (p ≤ 0.001), as compared to the control equivalents (table 4).

The study results show that use of Iodis-Concentrate has a positive effect on the metabolic processes and functions of the hematopoietic and other organs, as well as no disorders of mineral metabolism.

The completed studies of biologically active iodine influence on growth and development of rabbits indicated the most intensive growth in the rabbits treated with potable water containing Iodis-Concentrate. The above rabbits showed improved condition of the skin, nails and fur. The meat of rabbits treated with iodine beneficiated water contained twice as much iodine – 40.0±6.0 (p ≤ 0.05) as the rabbits of the control group (20.0±3.0), watered with ordinary water.

The study results indicate that the meat of rabbits treated with water containing Iodis-Concentrate shows higher contents of iodine, thus having treatment and prevention properties in the case of iodine deficiency and thyroid gland pathology.

Table 4. The microelements and macroelements content in the rabbit muscles, subject to watering with Iodis-Concentrate preparation, mg/kg, M \pm m; n=5

Item Description	Group of Animals	
	Study	Control
Aluminum (Al)	2.23 \pm 0.05*	1.44 \pm 0.24
Calcium(Ca)	41.21 \pm 0.51***	36.75 \pm 0.53
Chrome (Cr)	0.164 \pm 0.002***	0.12 \pm 0.002
Copper (Cu)	0.31 \pm 0.01	0.30 \pm 0.03
Ferrum (Fe)	9.93 \pm 0.16***	7.90 \pm 0.26
Magnesium (Mg)	219.98 \pm 0.85	211.14 \pm 10.72
Manganese (Mn)	0.27 \pm 0.05**	0.06 \pm 0.01
Natrium (Na)	467.54 \pm 3.80***	404.41 \pm 9.59
Strontium (Sr)	0.12 \pm 0.001*	0.07 \pm 0.01
Zinc (Zn)	16.76 \pm 0.06***	9.23 \pm 0.24

Notes: *p \leq 0.05, **p \leq 0.01, ***p \leq 0.001 compared to the control group

Conclusions

Subject to watering the rabbits with potable water with Iodis-Concentrate preparation added, the contents of certain indispensable and dispensable amino acids, and the aggregate contents thereof slightly increased. The sum of dispensable and indispensable amino acids was 0.42 mg/100g higher than in the study group, as compared to the control group. It is indication of the protein metabolism boosting. No abnormal ratio of indispensable and dispensable amino acids was recorded. The biological value of the rabbit meat is preserved.

Subject to watering the rabbits with potable water with Iodis-Concentrate preparation added, the meat thereof has trustworthy more mono and poly-non-saturated amino acids (Cys-10 heptadecenoic acid, oleic acid and linolic acid) and less saturated amino acids (Arachidic acid, Stearic acid, Heneicosanoic acid, and Palmitic acid), which indicates stimulation of lipid metabolism and makes the rabbit meat more useful food product.

Upon studying influence of Iodis-Concentrate preparation on rabbit meat composition, the trustworthy high contents of the following microelements and macroelements was ascertained: aluminum, calcium, chrome, ferrum, magnesium, manganese, natrium, strontium, zinc.

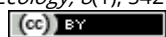
In the meat of rabbits treated with Iodis-Concentrate preparation the researcher unveiled twice-higher contents of iodine as compared to the performance in the control group of rabbits. Thus, the rabbit meat may be considered as a treatment and prevention product to be administered in the case of iodine deficiency and thyroid gland pathology.

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