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Effect Of Natural Antioxidants On Commodity Research And The Assessment Of The Quality Of Semi-Finished Products Of Broiler Meat.

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ABSTRACT

The effectiveness of the use of dihydroquercetin bioflavonoid in comparison with other natural antioxidants in the recipe of semi-finished products from broiler chicken meat, which testifies to its high biological activity, positive influence on the quality characteristics and yield of the finished products, without reducing their organoleptic characteristics was studied.

Keywords: semi-finished products, quality, indicators, antioxidant

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INTRODUCTION

One of important problems by production of food, in particular meat and lactic, is extension of a period of validity and the maximal maintaining their quality. But in production of food use of antioxidants is regulated by the wide list of requirements and restrictions. They should not be mutagen, not exert the negative impact on organoleptic indicators of a product, to be steady against different types of influence, to be harmless and to have high activity even at introduction in small doses. Unlike dihydroquercetinum (DHQ), the majority of the existing antioxidants don't meet all qualifying standards. It opens possibilities of its broad application both as preservative and as separate nutritional supplement [2].

Processes of oxidation of fats make adverse effect not only on food, but also on a human body. The most dangerous at the same time is emergence and accumulation of the free radicals capable to accelerate its aging, to cause Alzheimer's disease and Parkinson and also arthritis and asthma. The ability of dihydroquercetinum to intercept and connect such radicals interferes with development of these diseases [1].

Comparison of DGK with other antioxidants, such as α-tocopherol (vitamin E), ascorbic acid (vitamin C), a butyloxytoluene, rosemary extract, tea catechols, shows the best stability and the greatest activity of dihydroquercetinum. Even at rather equal indexes with Acidumascorbinicum or a butyloxytoluene, DHQ remains more preferable due to its naturalness and ability to reduce the content of oxygen. Application of DHQ allows not only prolonging shelf-lifes of food by 2-4 times, but also to keep and improve their organoleptic indicators (taste, consistence, color). These indicators are important consumer properties therefore addition of dihydroquercetinum allocates food with additional competitive benefits [3, 4].

MATERIALS AND METHODS

The most widespread types of raw materials in production of semi-finished products are meat of broilers of a mechanical boning, fillet and skin which contain fatty tissue in a hypodermic fat and, in this regard, are considerably subject to oxidizing decay.

Therefore a main objective of our researches was comparative assessment of the main qualitative characteristics of these types of raw materials of a poultry-processing industry and in a semi-finished product, in connection with addition of the natural antioxidants applied to decrease of extent of influence of subcutaneous fat by formation of oxidates in the course of storage.

According to a research goal, objects of experiments were:

- asantioxidatic nutritional supplements: Dihydroquercetinum., «Vitamin E », «Vitamin C», «Routines» which application is regulated by the Methodical recommendations of the State sanitary and epidemiologic rationing of the Russian Federation no. 2.3.1.1915-04 of 2004. «The recommended consumption levels food and biologically the active materials», the establishing adequate and top admissible levels of consumption of dihydroquercetinum in number of 25 and 100 mg a day, redoxon - 70 and 700 mg a day, reproduction vitamin - 15 and 100 mg a day, a routine - 30 and 100 mg (in transfer to Rutinum) [5, 6, 8, 9, 10];

- the cooled meat of broilers of 1 grade with pH_{24} 6,2 - 6,5, in accordance with GOST P 52702-2006;

- meat of a mechanical boning in accordance with GOST 31490-2012;

- skin from carcasses of broilers.

During the researches, within 28 days of storage, raw materials test pieces with addition of the studied natural antioxidants on the basic physical and chemical, structural and mechanical and to functional running characteristics were weekly studied. At the same time, organoleptic assessment of chopped semi-finished products, from the studied raw materials of a poultry-processing industry, with addition of antioxidants was carried out.

Antioxidants were added according to the recommended dosage (tab. 1).

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Table 1: Content of natural antioxidants in test pieces of raw materials of a poultry-processing industry

Antioxidatic	Hydration	Raw materials			Semi-finished product
		Fillet	Meat of a Mechanical Boning	Skin	
Rutinum, mg/kg	1:3	0,59	0,57	0,56	0,39
Vitamin C, mg/kg	1:2	0,57	0,56	0,53	0,68
Vitamin E, mg/kg	-	0,57	0,56	0,52	0,24
Dihydroquercetinum, mg/kg	1:3	0,62	0,58	0,57	0,72

Antioxidatic medicines, except reproduction vitamin, before an importation in raw materials, were exposed to hydration for more uniform distribution. In the course of storage of exemplars at a temperature of 3±1 °C, for 28 days were conducted, in 3-fold frequency, researches of the main physical and chemical, structural and mechanical and functional running characteristics, according to the practical reference standards. By the received results mean values which are processed by methods of mathematical statistics are calculated.

RESULTS AND DISCUSSION

The comparative analysis and complex assessment of test pieces objective confirm influence of natural antioxidants on change of the studied indexes and organoleptic characteristics in objects of researches, but with different effectiveness (tab. 2).

The moisture connecting ability of meat (VSS) influences a product yield, loss of weight at storage and also stability of a product concerning development of a sour microflora.

VSS is one of the most important functional properties of raw materials and characterizes extent of communication of meat protein with the immobilized and free water. VSS is defined by a number of factors: the quantitative ratio of moisture and fat, depth of an avtoliz of raw materials, freezing conditions, hydrogen ionization value, amount of proteins, their composition and properties, including contents and degree of solubility of the myofibrillar proteins having sharply expressed ability to swelling.

Introduction of antioxidants to raw materials ambiguously influenced change of their moisture connecting ability (VSS). If, in exemplars with addition of reproduction vitamin E, vitamin C and Rutinum this indicator increased on average by 3,37, 4,04 and 5,94%, respectively, that in exemplars with addition of dihydroquercetinum was even higher - for 7,50%, rather control specimen.

The received results convince that addition in raw materials of antioxidants positively influences its moisture connecting ability.

The importation of antioxidants provided increase as well to water-retaining power (VUS) of raw materials. In exemplars with the content of dihydroquercetin this indicator was higher on average for 8,79%, concerning monitoring, and in exemplars with reproduction vitamins E and C and Rutinum increased on 2,03, 4,65 and by 6,87%, respectively.

Table 2: Main functional processing behavior of raw materials

	Monitoring	Vitamin E	Vitamin C	Rutinum	DHQ
VSS, %					
Skin	48,61±0,92	52,06±0,81	53,28±0,51	56,16±0,39	56,67±0,20
MMB	52,72±0,39	55,87±0,41	56,40±0,37	57,22±0,23	58,09±0,16
Fillet	53,41±0,48	56,91±0,35	57,18±0,49	59,17±0,43	62,48±0,15
VUS, %					
Skin	37,12±0,61	39,16±0,06	41,59±0,72	42,85±0,45	45,80±0.28

MMB	38,59±0,30	40,21±0,47	43,01±0,43	45,24±0,29	46,05±0,13
Fillet	40,16±0,52	42,60±0,18	45,22±0,51	48,39±0,15	50,39±0,10
EE, %					
Skin	51,55±0,38	53,27±0,59	54,98±0,48	57,18±0,61	58,50±0,72
MMB	48,17±0,59	50,24±0,32	52,24±0,31	54,07±0,45	55,32±0,66
Fillet	45,15±0,18	48,19±0,48	51,60±0,16	52,18±0,94	53,71±0,41
SE, %					
Skin	68,15±0,28	71,60±0,14	74,49±0,38	76,48±0,71	77,16±0,27
MMB	70,20±0,29	73,76±0,27	75,35±0,27	77,22±0,28	78,04±0,12
Fillet	73,49±0,15	75,05±0,38	77,92±0,18	80,14±0,93	82,69±0,52

Increase in such important functional and technological indexes as VSS and VUS provides improvement of a number of important touch characteristics of a semi-finished product - its juiciness, tenderness and promotes increase in an exit of a finished stock.

Introduction of DGK to test pieces of raw materials influenced also increase in their emulsifying efficiency (EE) and also the stability of an emulsion (SE). Unlike monitoring, EE of the test piece containing dihydroquercetinum increases on average by 7,55%, and in other exemplars for 2,28, 4,65 and 6,19%, respectively.
Similar to this index, also increase in SE in all types of raw materials - for 2,86, 5,31, 7,33 and 8,68%, respectively is noted. Increase in EE and SE demonstrates improvement of functional processing behavior of raw materials that causes also quality of a finished stock.

Influence of natural antioxidants on chemical composition of test pieces of raw materials is presented in table 3.

At addition of dihydroquercetinum in test pieces of raw materials the mass fraction of moisture raised, on average for 7,46% and this index in other exemplars exceeded. The exemplar with reproduction vitamin addition which is 1,26% higher than this index in a control specimen as it did not contain hydrated additives differed in the least humidity. Increase in humidity was observed in direct dependence on the level of addition of antioxidants in exemplars that it is bound to hydration of medicines. So, at vitamin C addition, the humidity of test pieces increased by 4,65%, and at addition of Rutinum, respectively, for 6,19%.

Table 3: Chemical composition of test pieces of raw materials, % to the mass of raw materials

Indexes	Monitoring	Vitamin E	Vitamin C	Rutinum	DHQ
Moisture	61,90±0,33	62,68±0,92	64,78±0,89	65,73±0,56	66,52±0,62
Drymatter	38,10±0,26	37,32±0,23	35,22±0,42	34,27±0,58	33,48±1,16
Protein	25,79±0,34	25,42±0,47	23,30±0,51	22,40±1,07	21,77±0,40
Fat	10,97±0,12	10,49±0,11	10,45±0,07	10,38±0,06	10,19±0,09
Ashes	1,34±0,04	1,41±0,01	1,47±0,04	1,49±0,03	1,52±0,08
Caloric content, kcal	204,47±0,38	198,63±0,61	189,58±0,23	185,26±0,45	180,97±0,78

Increase in humidity naturally led to decrease in contents in model forcemeats of nonvolatile solids.

Table 4: Change of viscosity of test pieces of raw materials, Pa·s

	Monitoring	Vitamin E	Vitamin C	Rutinum	DHQ
Beginning of researches					
Skin	738,50±20,69	682,33±1,78	623,67±1,47	588,33±1,78	551,00±3,94
MMB	261,12±3,69	225,33±2,86	217,67±2,48	205,67±1,78	204,67±2,86
Fillet	247,92±12,68	220,67±3,56	212,67±3,56	164,33±4,60	123,67±3,19
In 7 days of storage					
Skin	783,92±5,65	708,53±3,84	645,67±2,86	627,37±3,52	614,40±9,49

MMB	329,30±3,72	313,00±3,24	302,67±4,32	296,33±3,19	275,67±2,86
Fillet	258,42±2,28	246,33±0,82	239,67±4,02	238,67±1,47	232,33±3,19
In 14 days of storage					
Skin	839,30±11,72	795,33±10,11	773,00±5,34	681,67±13,44	673,33±13,08
MMB	397,54±5,61	347,67±3,63	332,33±8,84	318,00±1,87	302,67±4,32
Fillet	322,86±3,90	293,67±5,31	281,67±4,71	256,33±6,38	244,33±4,02
In 21 days of storage					
Skin	892,73±12,10	849,86±11,24	831,95±6,94	752,62±5,49	728,27±6,31
MMB	567,82±10,25	528,47±8,12	416,93±6,74	388,50±3,21	373,67±1,26
Fillet	412,17±9,79	389,45±7,35	361,18±6,85	342,40±4,71	329,63±2,63
In 28 days of storage					
Skin	925,38±10,34	898,52±13,49	878,31±10,66	826,74±6,02	792,12±6,79
MMB	591,76±9,68	572,30±6,02	493,28±7,25	459,17±5,06	429,48±2,83
Fillet	459,32±8,91	427,86±8,06	392,38±5,75	381,20±5,09	354,72±3,35

In nonvolatile solid of exemplars of raw materials of a poultry-processing industry, increase in a mass fraction of ashes, concerning monitoring, on 0,07 is noted; 0,13; 0,15 and 0,18%, respectively.

The mass fraction of fat decreased, but more - on 0,48; 0,52; 0,59 and 0,78%, respectively.

Change of a mass fraction of the main feedstuffs naturally affected the power value of test pieces of a semi-finished product. In connection with decrease in contents in them in fat, the caloric content of forcemeats of the test pieces containing dihydroquercetinum decreased on average by 23,50 kcal, concerning monitoring, the power value of other test pieces also decreased on 11,68; 14,89 and 19,21 kcal, respectively.

By results of researches it is established that introduction of natural antioxidants positively affected the size of adhesion and viscosity of the test pieces of raw materials of a poultry-processing industry presented in table 4 and 5.

The obtained data convince of positive influence of antioxidants on viscosity of raw materials. The test pieces consisting of skin from carcasses had the greatest value of this index. In these exemplars containing reproduction vitamin E, vitamin C and Rutinum within 28 days of storage this indicator on average increased on 6,03; respectively, that in exemplars with addition of dihydroquercetinum was even higher than 10,60 and 17,09% - for 19,92%, rather control specimen.

The exemplars containing fillet of carcasses of broilers had the least value of viscosity. During the researches, increase in this index in exemplars with reproduction vitamin E on average for 7,41%, vitamin C, Rutinum and dihydroquercetinum - on 12,24 is noted; 19,18 and 25,47%, respectively (tab. 4).

The conducted researches demonstrate that the largest size of adhesion was characteristic of a control specimen from skin (tab. 5) which value it exceeded test pieces with reproduction vitamins E and C with on 1,78 and 9,65%, with Rutinum and dihydroquercetinum – for 16,75 and 31,19%, respectively.

Therefore, the adhesive power of all test pieces of raw materials decreases, on average by 21,24% that improves rheological characteristics of semi-finished products, causing more dense consistence of a finished stock (tab. 5).

Table 5: Change of the adhesive power of test pieces of raw materials, Pa

	Monitoring	vitamin E	vitamin C	Rutinum	DHQ
Beginning of researches:					
Skin	208,35±14,99	194,34±9,82	191,34±6,220	166,65±2,20	159,03±9,82
MMB	205,35±16,20	151,48±8,98	144,03±16,10	137,02±13,01	135,62±6,72
Fillet	201,35±12,41	149,76±2,46	142,21±3,21	129,26±10,67	127,62±5,41
7 days of storage:					
Skin	201,59±9,71	178,39±6,95	166,17±11,39	155,08±11,12	152,92±2,28

MMB	189,73±9,95	175,31±5,45	158,44±14,45	153,56±7,87	143,96±4,21
Fillet	167,30±5,25	131,83±6,77	115,49±6,60	106,22±5,10	103,12±4,32
14 days of storage:					
Skin	231,40±5,76	212,74±6,98	200,37±1,82	175,85±11,51	170,23±18,30
MMB	203,19±7,80	185,86±3,40	179,09±6,89	166,75±2,57	163,92±7,14
Fillet	181,33±3,80	147,95±7,96	137,23±1,56	123,99±4,12	110,80±5,13
21 days of storage:					
Skin	265,61±7,30	257,71±6,49	239,03±8,64	219,83±9,64	197,51±6,14
MMB	242,64±8,23	227,97±6,95	215,17±5,15	208,78±4,32	189,65±1,63
Fillet	228,30±9,05	215,26±5,25	179,54±3,24	168,38±2,75	152,18±3,67
28 days of storage:					
Skin	302,93±8,05	297,54±5,02	273,70±5,32	252,18±6,28	208,45±5,72
MMB	281,72±7,92	263,39±5,24	249,91±4,34	230,49±6,22	204,50±2,82
Fillet	269,87±6,50	240,16±4,27	218,68±3,17	197,75±3,40	171,83±1,28

Results of organoleptic assessment often happen final and solving when determining quality of production, especially new types of products. Data of the organoleptic analysis allow to judge influence of the studied factors on quality of products.

The five-point rating scale including the key organoleptic indicators received by expert assessment is applied to the organoleptic characteristic of the studied exemplars of semi-finished products from meat of broilers, according to GOST 9959-91.

Tasting led the commission to a conclusion that on the key organoleptic indicators reliable differences between options of semi-finished products (tab. 6) were observed.

Organoleptic indicators of meat products are defined by a number of factors. Introduction of DHQ differently influences quality indicators of a finished stock, its flavoring and chromatic characteristics, structure.

Table 6: Organoleptic indexes of finished stocks (points)

Indicators	Control	Vitamin E	Vitamin C	Rutinum	DHQ
Appearance	9,04±0,18	7,19±0,15	9,60±0,09	9,52±0,07	9,68±0,03
Smell, aroma	9,16±0,05	6,38±0,12	9,46±0,12	9,79±0,00	9,89±0,06
Taste	8,69±0,08	5,94±0,15	9,12±0,24	9,62±0,10	9,58±0,01
Consistence	7,47±0,14	8,24±0,20	8,75±0,20	9,15±0,07	9,42±0,05
Juiciness	5,08±0,06	7,58±0,16	8,05±0,20	9,61±0,00	9,79±0,01
Overall quality assessment	7,89±0,06	7,07±0,09	8,99±0,09	9,54±0,04	9,67±0,04

CONCLUSION

In researches it is objective established that manufacture of semi-finished products with application of DGK, certainly promotes improvement of their rheological characteristics, defining, thus, increase in processing and consumer behavior of a finished stock.

Results of tasting assessment allow to judge that the exemplars of semi-finished products made with addition of DHQ, surpassed control and test pieces in appearance, color, a smell, aroma, consistence and juiciness that demonstrates positive influence of this antioxidant on the majority of tasting indexes. And the product, with the content of reproduction vitamin, was the inferior on all indexes of tasting assessment. Respectively, the semi-finished product exemplars made with reproduction vitamin addition conceded to exemplars with addition of other antioxidants on all organoleptic indexes.

Therefore, the complex research of characteristics of test pieces of raw materials of a bird and semi-finished products from meat of broilers convinces that the most expedient is use in their compounding of dihydroquercetinum [7].

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