Ministry of Education and Science of Ukraine

ODESSA NATIONAL ACADEMY OF FOOD TECHNOLOGIES

International Competition of Student Scientific Works

BLACK SEA SCIENCE 2021

PROCEEDINGS

ODESSA, ONAFT 2021

Ministry of Education and Science of Ukraine

Odessa National Academy of Food Technologies

International Competition of Student Scientific Works

BLACK SEA SCIENCE 2021

Proceedings

Odessa, ONAFT 2021

UDC 001.8(063)

Recommended for print by the Academic Council of
Odessa National Academy of Food Technologies
on April 6, 2021, Protocol No. 13

Black Sea Science 2021: Proceedings of the International Competition of Student Scientific Works / Odessa National Academy of Food Technologies; B. Iegorov, M. Mardar (editors-in-chief.) [*et al.*]. – Odessa: ONAFT, 2021. – 731 p.

Proceedings of International Competition of Student Scientific Works «Black Sea Science 2021» contain the works of winners of the competition.

The author of the work is responsible for the accuracy of the information.

Organizing committee:

Prof. Bogdan Iegorov, D.Sc., Rector of Odessa National Academy of Food Technologies, Head of the Committee

Prof. Maryna Mardar, D.Sc., Vice-Rector for Scientific and Pedagogical Work and International Relations of Odessa National Academy of Food Technologies, Deputy Head of the Committee

Prof. Stefan Dragoev, D.Sc., Vice-Rector for Scientific Work and Business Partnerships of University of Food Technologies (Bulgaria)

Prof. Baurzhan Nurakhmetov, D.Sc., First Vice-Rector of Almaty Technological University (Kazakhstan)

Prof. Mircea Bernic, Dr. habil., Vice-Rector for Scientific Work of Technical University of Moldova (Moldova)

Prof. Jacek Wrobel, Dr. habil., Rector of West Pomeranian University of Technology (Poland)

Prof. Michael Zinigrad, D.Sc., Rector of Ariel University (Israel)

Dr. Mei Lehe, Ph.D., Vice-President of Ningbo Institute of Technology, Zhejiang University (China)

Prof. Plamen Kangalov, Ph.D., Vice-Rector for Academic Affairs of "Angel Kanchev" University of Ruse (Bulgaria)

Dr. Alexander Sychev, Ph.D., Assoc. Professor of Sukhoi State Technical University of Gomel (Belarus)

Dr. Hanna Lilishentseva, Ph.D., Assoc. Professor, Head of the Department of Merchandise of Foodstuff of Belarus State Economic University (Belarus)

Prof. Heinz Leuenberger, Ph.D., Professor of the Institute of Ecopreneurship of University of Applied Sciences and Arts (Switzerland)

Prof. Edward Pospiech, Dr. habil., Professor of the Institute of Meat Technology of Poznan University of Life Sciences (Poland)

Prof. Lali Elanidze, Ph.D., Professor of the Faculty of Agrarian Sciences of Iakob Gogebashvili Telavi State University (Georgia)

Dr. V. Kozhevnikova, Ph.D., Senior Lecturer of the Department of Hotel and Catering Business of Odessa National Academy of Food Technologies, Secretary of the Committee

1. FOOD SCIENCE AND TECHNOLOGIES

STUDY OF THE CHEMICAL COMPOSITION AND SAFETY OF WILD POULTRY MEAT IN THE REPUBLIC OF KAZAKHSTAN

Authors: Aidana Kalbayeva
Guldana Kenes
Advisor: Ainur Zheldybayeva
Almaty Technological University (Republic of Kazakhstan)

Abstract. *The article investigates the chemical, amino acid and fatty acid composition of mallard meat, organoleptic evaluation is carried out, and safety indicators of wild poultry meat are determined. And a comparative analysis of the norm for ND and the actual values of wild birds and domestic ducks is given.*

Key words: *poultry, meat of wild birds, wild duck meat, mallard duck, domestic duck*

I. INTRODUCTION

Currently, special attention is paid to the problem of healthy nutrition of the population in Kazakhstan. Leading scientists of Kazakhstan in the field of rational nutrition solve the problem of finding environmentally safe and cost-effective products. Which allow you to create a new generation of products that contain the right amount of useful components necessary for the human body. One of the promising options for the development of the meat industry can be the production of non-traditional types of meat. It is worth noting the richness of the vast territory of our country in terms of production of such exotic raw materials as meat of wild birds. According to research by Kazakh scientists, the formation of such an industry could bring undeniable benefits, allowing the country to use its competitive advantages.

Wild animal meat is considered a delicacy product, so it is most often recommended for use in the restaurant business. Game is an exclusive and expensive product. Therefore, the prestige of this dish and its dietary qualities (especially the ecological purity of the meat of animals that live in hunting farms far from civilization) contribute to the fact that the demand for game in the world is increasing.

One of the solutions to this problem is the complex use of animal proteins. An effective source of raw meat can be the meat of birds such as mallards that live on the territory of Kazakhstan. The population of various regions of the country widely use meat of non-traditional types of animal raw materials obtained during the extraction of birds such as mallards as food sources. The range of products made from wild animal meat is extremely limited [1]. And in this regard, the study of the biochemical composition, functional properties and safety of wild bird meat is relevant.

The purpose of this work was to conduct a comparative analysis of the chemical composition and safety of wild and domestic duck meat on the territory of the South Kazakhstan region.

For the first time, a comparative analysis of the chemical composition of Mallard meat living in the territory of the South Kazakhstan region was carried out; morphological characteristics of meat raw materials were studied, and the quality of game was studied.

II. LITERATURE ANALYSIS

Wild fowl is supplied to food enterprises: steppe, bog, swamp and waterfowl. According to the habitat, feathered game is divided into Borovoi - forest (grouse, capercaillie, grouse, white partridges, gray and red, pheasants, etc.); steppe (quail, bustards, gray partridges); mountain (mountain Turkey - ullars and mountain partridges - kekliki); swamp (snipes, sandpipers, hollows, woodcocks); waterfowl (geese, ducks). The most common game is hog.

Harvesting plump feathered game is produced in October - November, and the rest-later, usually with the onset of frost.

All types of the most common game, except swamp and waterfowl, sold in the production areas, are transported and sold in remote areas of the country.

Game meat differs from poultry meat with a slightly higher protein content (22-25%) and less fat (1 - 3%). It has a darker and denser muscle tissue, a specific taste and aroma, a peculiar taste, which is mainly affected by the type of food. For example, the meat of wild boar game has a slight taste of bitterness and resinous aroma, while the meat of waterfowl is dominated by fish flavor.

Game meat is used mainly for cooking second courses and cold appetizers, since the broth is tasteless, with a bitter taste.

They extract game by shooting (shot game) and snaring (crushed game). In poultry carcasses, the intestines are removed, after which they are set and frozen.

Only frozen game (except for swamp and waterfowl) in plumage, which determines its type and gender, is available for sale. Males differ from females in bright plumage and larger sizes. The meat of females is more tender and soft. Game is sold frozen [2].

2.1 Classification of wild birds

Wild poultry meat is understood as a carcass or part of a carcass obtained after slaughter and primary processing of poultry and representing a set of different tissues - muscle, connective, fat, bone, etc.

Meat of feathered game is classified by type, age, method of processing, temperature in the thickness of the muscles and fatness.

The main types of wild birds include: partridges, grouse, pheasant, capercaillie, grouse, quail, wild ducks and geese.

All of them are characterized by high precocity, reaching slaughter weight in 2-3 months of age, as well as with a high yield of the edible part (55-65%). By age, distinguish between adult poultry (carcasses of grouse, partridges, pheasants, grouse, grouse) and young, respectively.

Carcasses of young birds have neokostenevshiy (cartilaginous) keel of the breast bone, neogrubevshiy beak, the lower part of which is easily bent, soft elastic skin. The carcasses of an adult bird have an ossified (hard) keel of the breast bone, and a Horny beak.

According to the method of technological processing, carcasses of all types of birds sent for sale are semi-gutted, gutted, gutted with a set of giblets and a neck.

The semi-gutted ones include carcasses that have their intestines removed with a cloaca and a filled goiter.

Gutted-carcasses that have all internal organs removed, the head on the 2nd cervical vertebra, the neck (without skin) at the level of the shoulder joints, the legs on the flattened joint or below it, but no more than 2 cm. the Internal fat of the lower abdomen is not removed. It is allowed to sell gutted carcasses with lungs and kidneys. Gutted carcasses with a set of giblets and a neck include gutted bird carcasses, in the abdominal cavity of which a set of processed giblets (heart, liver, muscle stomach) and a neck is embedded.

According to the thermal state of the bird carcass can be cooled, chilled and frozen. The temperature in the thickness of the chest muscle of cooled carcasses should not be higher than 25°C; chilled-from 0 to 4 ° C, frozen-no higher than -8°C.

Depending on the fatness and quality of post - slaughter processing, carcasses of all types of poultry (except old roosters) are divided into 2 categories-1st and 2nd. the fatness Category is determined by the degree of development of muscle tissue and allocation of the crest of the breast bone (keel), the number of subcutaneous fat deposits and the quality of surface treatment.

According to the quality of post-slaughter processing, carcasses must meet the following requirements: well-drained, properly set, with clean skin without remnants of feather, down, stumps and hair-like feathers, wax, scratches, tears, spots, bruises and intestinal residues.

In gutted carcasses, the mouth and beak are cleared of food and blood, and the legs are free of dirt and calcareous growths. Single stumps and light abrasions are allowed, no more than two skin breaks 1 cm long each, but not on the fillet; minor peeling of the skin's epidermis.

Depending on the quality, feathered game is divided into 1st and 2nd grades. Carcasses 1 and 2 nd grades must be clean, unwrinkled, fresh, clean plumage, strong and sturdy undergrowth (tail in the lower part of the abdomen), right set: head tucked under wing, wings pressed to the body and elongated along the tail.

Carcasses of the 1st class may have light gunshot damage, and the 2nd-small damage during extraction, they may also be incorrectly mounted, with slightly polluted plumage and weak podnarostom. Carcasses of the 2nd grade are sold without a foot. Game is Packed in dry, clean, wooden boxes without foreign odors. The bottom and walls of the boxes are lined with paper, and the protruding ends of it are covered on top of the carcass. In boxes, game is placed in rows, separately by species and varieties, in a certain number (in pieces): capercaillie-9, capercaillie-15; white partridges - 50, gray - 70 - 80, mountain-100, red (stone or keklik) - 60; grouse-80, grouse and pheasants-30. The gross weight of each box must not exceed 30 kg.

On the end side of each box should be marked with the name of the organization-in the middle; the conditional name of the game (GL-capercaillie, T-grouse, CS-grey partridge) and the variety - in the upper left corner; the number of pieces - in the upper right corner; the PCT designation-in the lower right corner.

Wild bird offal is divided into internal-heart, muscle stomach, liver and external-head, neck, wings, legs. The most valuable offal is the neck and internal giblets [3].

An important indicator of the quality of meat raw materials is the technological value, which is understood as the degree of its suitability for producing high-quality culinary products. Meat of different types of birds, and within the same carcass of different cuts, has different technological value, which is determined by technological properties and nutritional value. The group of basic nutrients consists of water, proteins, lipids, carbohydrates, and macro and microelements.

Food products also contain biologically active substances-vitamins, hormones, enzymes, and substances that are not used by the body in the processes of life, the so-called non-alimentary substances.

The body's need for each of these substances ranges from a few milligrams to hundreds of grams. The nutritional value of products is determined by the content of the main substance and its digestibility, depending on the physical and chemical properties, the degree and nature of processing of the product. Energy value is determined by the energy that is released during the biological oxidation of food substances in the human body and is used to ensure the physiological functions of the body.

III. OBJECT, SUBJECT, AND METHODS OF RESEARCH

Experimental studies were conducted on the basis of the Almaty technological University of the Department of "food Safety and quality" in the accredited research laboratory of the University "Food safety".

The objects of research were:

- meat raw materials of birds grown and living on the territory of the South Kazakhstan region:
- Mallard ducks or mallards (Anas platyrhynchos Linnaeus);
- domestic ducks.

In this laboratory, the chemical composition and organoleptic, physical and chemical indicators, as well as safety indicators of the studied objects were studied.

Organoleptic evaluation of game meat showed that the consistency of chilled meat is elastic, and the smell is characteristic of fresh meat. The meat of wild animals and game is characterized by a delicate consistency, juiciness, and a more pronounced flavor compared to control [4].

The broth obtained after cooking is transparent, with a small number of small fat drops on the surface, without foam, not thick, the smell is more pronounced in comparison with chicken broth.

Game broths cause increased secretion of digestive juices and, therefore, contribute to better absorption of food.

IV. RESULTS

The maximum rating of game meat products on a five-point scale was 4.5 points, which corresponds to the regulatory requirements for organoleptic indicators of meat products from traditional types of meat (Table 1).

Table 1. Organoleptic characteristics of game meat

Indicators	Commodities	
	Mallard meat	House duck meat
Color	4,5	5
Taste	4,5	5
Smell	4,5	5

Cutting of carcasses of wild birds (mallards) was made according to GOST 21784-76-poultry (carcasses of chickens, ducks, geese, turkeys, Guinea fowls).

The assessment of the quality of wild and domestic duck meat was carried out in accordance with GOST 21784-76, and the assessment of the quality of meat safety was carried out in accordance with the requirements of technical regulations TR/TS 021-2011 [5]. The studied objects were classified as carcasses of adult birds.

According to the requirements of GOST 21784-76 for fatness and quality of processing, carcasses of all types of birds are divided into the first and second categories.

The results of the study of the characteristics of fatness and quality of the studied objects are shown in Table 2.

Table 2. Characteristics of fatness and quality of the studied objects

Indicators	Type of bird	
	Domestic duck meat (1st category)	Domestic duck meat (2nd category)
Fatness (presence of muscle tissue and subcuta-neous fat) Bottom	Muscle tissue is well developed. The pectoral muscles and the keel of the pectoral bone form a roundness. The breast keel bone slightly stands out. Deposits of subcutaneous fat on the chest, abdomen and in the form of a solid strip on the back, as well as there are significant deposits of fat in the abdominal area.	Muscle tissue is satisfactorily developed. The keel of the thoracic bone stands out and together with the pectoral muscles forms an angle without depressions on its sides. Minor deposits of subcutaneous fat in the lower back area. There is no fat deposition.
Smell	Characteristic of the smell of fresh meat of this bird	Peculiar smell of game meat
Color: Muscle tissue Skin Subcuta-neous fat and fat in the abdo-minal area	Light pink It has a yellow pink tint Light yellow	Dark red It has a dark red hue Yellow

continuation of table 2

Skin condition	The skin is clean, without gusts, without abrasions, without spots and bruises	Small abrasions and spots are allowed on the skin, as well as small gusts of 3 mm
The condition of the bone tissue	Bone tissue without breakage and curvature	Small wing and finger cavities are allowed
The smell and tran-sparency of the broth	Transparent, peculiar smell, light brown color	

The chemical composition of wild duck meat is not inferior to that of domestic duck. The meat of domestic duck is tender, with a high fat content of meat. According to literature sources, it is known that the composition of each muscle tissue of different places of the bird carcass has a different composition. And so we investigated the chemical composition of the muscle tissue of the chest and thigh.

By examining the chemical composition of the muscle tissue of the chest and thigh parts of wild and domestic ducks, we obtained the following results, which are shown in table 2 and 3.

Table 3. Chemical composition of the femoral muscle tissue of wild and domestic ducks

№	Object of research	pH	Protein %	Fat, %	Carbo-hydrates, %	Water %	En. value, kJ
1	Meat of domestic duck	6,1	15	28,5	0, 88	64,26	372,2
2	The meat of wild ducks	6,4	10,05	4,19	0,79	63,25	82,67

Table 3 shows the pH of domestic and wild ducks that are equal to 6.1 % and 6.4 %, and they correspond to the norm specified in the standards. The humidity of the femoral part of the domestic duck is-64.26 %, and in the wild duck is-63.25 %, relatively the humidity of the wild duck meat is lower than the meat of the domestic duck, which shows the dryness of the wild duck meat, respectively. The protein content is 15% in the meat of domestic duck, and 10.05% in wild duck. The fat content in the meat of domestic duck is 28.5%, and in wild duck 4.19 %, respectively, the energy value of the meat of domestic duck is higher than that of wild duck.

We also studied the chemical composition of the muscle tissue of the thoracic and femoral parts. The chemical composition of the muscle tissues of the pectoral part of the bird carcass is shown in Table 4.

Table 4. Chemical composition of the pectoral muscle tissue of wild and domestic ducks

№	Object of research	pH	Protein %	Fat, %	Carbo-hydrates, %	Water %	En. value, kJ
1	Meat of domestic duck	6,2	19,01	32	0,88	62,26	289,08
2	The meat of wild ducks	6,6	20,5	3,19	0,79	61,25	119,71

Table 4 shows the pH index that is equal to 6.2% and 6.6%, which correspond to the norm specified in the standards. The humidity of the leg of domestic duck is-62.26%, and in wild duck is-61.25%, relatively the humidity of wild duck meat is lower than the meat of domestic duck, which shows the dryness of wild duck meat, respectively. The protein content is 19.01% in the meat of domestic duck, and 20.5% in wild duck. The fat content in the meat of domestic duck is 32 %, and in wild duck 3.19%, respectively, the energy value of the meat of domestic duck is higher than the meat of wild duck.

Studies have shown that game meat has a higher protein content and a lower fat content compared to controls. Game meat, in comparison with domestic duck meat, contains less intermuscular fat, as a result of which it has a lower energy value.

Determination of the amino acid composition was carried out by hydrolysis of the sample to amino acids and subsequent quantitative determination of the formed amino acids on an amino acid analyzer on an amino acid analyzer, determination of the fatty acid composition - by separation of methyl esters of fatty acids obtained from dietary supplement lipids using gas-liquid chromatography.

The paper provides a comparative analysis of the chemical composition of wild and domestic duck meat. Poultry meat is a good source of high-grade protein, has a low content of connective tissue, less than in beef and pork, which contributes to easier digestion and assimilation.

The analysis of the amino acid composition (table 5) showed a higher content of the essential amino acids leucine, isoleucine, and lysine. According to the quantitative ratio of amino acids, the meat of the studied game species compares favorably with the meat of domestic animals and birds. First of all, this is due to the higher content of tryptophan, which is 0.3 and 0.64% more in Mallard meat than in the control.

According to the content of essential amino acids, poultry proteins correspond to the reference protein of chicken eggs, which indicates their high biological value. The total number of interchangeable amino acids in game meat was less than in the control, the amount of essential amino acids did not differ significantly and was within the error of the experiment. The higher the tryptophan/oxyproline ratio, the more complete proteins in the meat and the higher the biological value of the meat.

Table 5. Amino acid composition of game meat, g/100 g of protein

Indicators	Name of raw materials		FAO/BO3 scale, g / 100 g of protein
	Mallard	Duck meat (1st category) control	
The essential acids:			
Summarily	38,49	37,28	
Valine	5,38	4,85	5
Isoleucine	4,57	4,19	4
Leucine	8,32	8,09	7
Lysine	8,34	8,40	5,5
Methionine	2,68	2,34	3,5
Threonine	4,34	4,46	4
Tryptophan	1,63	1,10	1
Phenylalanine	3,23	3,85	6

continuation of table 5

Nonessential amino acid:			
Summarily	48,67	49,20	
Alanine	5,67	6,67	-
Arginine	7,45	7,16	-
Aspartic acid	8,65	8,88	-
Histidine	1,76	1,83	-
Glycine	7,34	7,01	-
Glutamic acid	16,88	16,69	-
Oxyproline	0,92	0,96	-
The ratio of tryptophan/hydroxyproline	1,80	1,14	

Protein quality index of game meat is higher than in the control. Meat lipids contain high levels of saturated and polyunsaturated fatty acids. The content of saturated fatty acids exceeds almost two and a half times the amount of unsaturated fatty acids (Table 6).

Table 6. Fatty acid composition of game meat, g / 100 g

Indicators	Name of raw materials	
	Mallard	Duck meat (1st category) control
Saturated	7,68	10,32
Including: C12:0 (lauric)	<0,001	0,04
C14:0(myristic)	0,3	0,37
C16:0(palmitic)	4,28	7,01
C 18:0 (stearic)	3,1	2,9
Monounsaturated		
C18:1 (oleic)	5	14,04
Polyunsaturated	3,81	6,58
C18:2 (linoleic)	3,49	6,29
C18:3(α- linolenic)	0,32	0,29
Fatty acids (sum)	16,49	30,94
The ratio of acids: Saturated/ Polyunsaturated	2	1,6

Among the saturated fatty acids of game meat, palmitic and stearic acids predominate. The content of palmitic acid in game meat, in comparison with the meat of domestic duck is more than 2-4 times, which indicates a low shelf life of chilled game meat and a tendency to rancidity.

Also, the determination of heavy metal salts was carried out according to standard methods. for the determination of mercury, GOST 26927-86 [6] was used, for arsenic - GOST 26930-86 [7], for tin - MEST 26932-86 [8], for cadmium – MEST 26933-86 [9]. The results of studies of heavy metal indicators are shown in Table 7.

Table 7. Indicators of toxic elements of wild duck meat

Indicators	ND norm	Actual value
Toxic elements: no more than, mg/kg		
Mercury	0,03	Not detected
Arsenic	0,1	Not detected
Cadmium	0,05	0,02
Tin	0,5	0,04
Radionuclides: no more than, mk / kg		
Caesium-137	200	8,24

According to the results of the study of heavy metal salts such as mercury and arsenic were not found, and the indicators of cadmium and lead salts did not exceed the norm specified in TR CU 021/2011. Of the radionucleids, the amount of cesium-137 also did not exceed the norm specified in the ND.

Also, microbiological indicators were examined [10], [11] research objects, the results of which are shown in Table 8.

Table 8. Microbiological indicators of wild duck meat

Indicators	ND norm	Actual value
Microbiological indicators:		
KNAFAiM, CFU/g, cm^3, not more	$1*10^3$	$5*10^2$
CGB (coliforms) in 0.1 g/cm^3	Not permitted	Not detected
Sulfitereducing clostridia to 0.1 g/cm3	Not permitted	Not detected

As a result of research, the Cmafaim in wild duck meat is equal to $5 * 10^2$, which does not exceed the norm specified in the regulatory documentation. Indicators sulfitereducing coliforms and clostridia in the meat of wild birds was not detected, which is not allowed according to the normative documentation.

V. CONCLUSIONS

As a result of the above research, it was found that the meat of the Mallard in terms of energy value and quality is a full-fledged type of meat, and is not inferior in quality to the meat of domestic duck. Therefore, wild duck meat can be used as a valuable raw material in the preparation of dietary dishes or functional products.

VI. REFERENCES

1 Tsikin, C. C. development of technology and evaluation of properties of natural frozen semi-finished products from meat of wild animals and game: autoref. Diss. . Cand. Biol. sciences'. Eagle, 2012. - 24c.

2 Ragimova T. R. Development of technology for a specialty dish made from wild poultry meat enriched with plant additives. dises. magist. technical sciences. - Baku, 2015. -80 c.

3 GOST 21784-76. Poultry meat. Technical conditions. Moscow, Russian State Committee for product quality management and standards, 1991.-10c.

4 GOST 7702.0-74 poultry Meat. Sampling methods. Organoleptic methods of quality assessment.

5 TR CU 021/2011 "on food safety" technical regulations of the Customs Union, dated December 9, 2011, no. 880.

6 GOST 26927-86 raw Materials and food products. Method for determining mercury.

7 GOST 26930-86 raw Materials and food products. Method for determining arsenic.

8 GOST 26935-86 raw Materials and food products. Method for determining tin.

9 GOST 26933-86 raw Materials and food products. Method for determining cadmium

10 GOST 10444.7-86 food Products. Methods for determining the number of mesophilic aerobic and facultative anaerobic microorganisms.

11 GOST 29185-91 food Products. Methods to identify and quantify sulfitereducing clostridia.