PERSPECTIVE TRENDS OF SECONDARY COLLAGENCONTAINING RAW MATERIALS PROCESSING IN MEAT AND POULTRY PROCESSING INDUSTRY

L.V.Antipova, I.A.Glotova, S.V.Polyanskih, V.K.Kurchaeva
Voronezh State Academy of Technology, Revolution av., 19, Voronezh, Russia, 394000

INTRODUCTION

Meat and poultryprocessing branches are essential sources of collagen in the form of animal and birds connective tissue. New ideas about the functional role of the collagen as the food fiber in nutrition opens new perspectives of this protein in the creation of traditional and original products for giving them desease-preventive qualities. Well-known medico-biological properties the ability to save molecular structure at its isolation from tissues and separation from other components make it the perspective biopolymer both in the development of non-traditional and improving the existent technologies of collagen substances of diverse functionality. Applied apects, connected with the manufacture of food products, non-traditional disease-preventive products obtained, special ingredients, mainly biopolymers are the most perspective ones.

The aim of this work is the systematization of data about tissues properties and proteins going into them, theoretical foundation of trends of the expedient use of the secondary collagencontaining resources for food and special aims, the development of recommendations on the formation of the raw material groups in accordence with the preferable applied significance.

MATERIALS AND METHODS

The objects of study were the secondary by-products of cattle slaughter and poultry processing (hens, broiler chickens) obtained at the meat plant "Voronezhkii", poultry plant "Voronezhkii", integrated poultry farm "Ramonskaya" during autumn period of slaughter in 1996. Collagen substances were obtained by the enzymatic treatment of the collagencontaining raw materials to be used as the base for the production of edible food coverings, sausage casings, wound-healing films.

Mass share of components was defined by the following method: moisture - by thermogravimetrical method, fat - by the method of Socslet and refractometrically, protein - by photometric method, ash according to [1]. Fractional composition of proteins histological study - according to the technique [1, 2, 3]. The content of the heavy metals ions and arsenic in raw materials and food half-finished products - on the atom-absobtion spectrophotometer C-115M. The level of nitrates and nitrites in the raw materials and food half-finished products - ionometrically on the ionometer I-130. The content of chlororganic pesticides in the raw materials by the method of gaseous-liquid chromatography on the chromatographer "Varian-3400" according to the method $CHCl_3$ [4]. Preparation of samples for study - according to the technique [5].

RESULTS AND DISCUSSION

Total evaluations of all proteins, their qualitative and quantitave composition, protein - fat ratio, reological and cohesive qualities, indices of food and energy values with the account of structure pecularities and mass share of collagen fibers allowed to form two groups of by-products according to the perspectives of preferable aplication (table 1). By-products of the first group have common pecularities: worsedeveloped collagen threads, rather high content of fat with the prevelance of polyunsaturated fatty acids in the composition of by-products of poultry treatment [6]. This causes the expediency of complex use of all protein fractions for food aims, including the production of natural functional additives in the composition of meat products. Here may be attributed secondary by-products of meat-fat production and bird slaughter: by-products of the 2nd category: tankage, swine skin, skin from

Table

Total chemical composition and content of main protein fractions in some by-products of meat production

Samples name	Mass content of components, % to raw materials mass							
	moisture	fat (F)	protein (P)				ash	Ratio F:P
			total	water soluble	salt soluble	alkaline soluble		
Group 1								
Stomach of poultry	67,16	6,40	21,03	2,56	5,12	8,95	3,56	0,3
Poultry legs	63,19	8,05	17,90	3,08	4,53	8,69	3,69	0,4
Skin of poultry	66,55	10,19	18,30	3,10	4,65	10,59	4,70	0,5
Swine skin	50,60	17,90	29,60	1,00	2,90	25,70	1,20	1,2
Beef tankage	89,50	2,20	7,30	2,50	0,30	4,50	1,00	
By-products cattle):								
tripe	80,00	4,20	14,80	0,90	7,10	6,80	0,50	0,2
lung	80,00	4,20	11,30	5,00	1,80	4,50	1,10	0,3
spleen	79,80	3,89	10,10	6,20	1,40	2,50	1,20	
Group 2								
Comb	68,83	9,26	19,77	3,80	5,44	9,59	5,33	0,4
Nasal crests	69,45	6,68	19,14	2,98	3,37	12,79	4,73	0,3
Blend of hide (cattle)	77,00	1,40	20,00	1,90	6,90	11,20	1,30	
By-products of guts (cattle)								
great guts	75,20	4,50	19,20	2,20	3,70	13,30	1,00	0,2
little guts	80,80	2,30	16,30	4,90	4,40	7,00	1,20	0,1
bladder	80,40	1,50	17,00	3,80	2,50	10,70	1,20	0,0
Tendons (cattle)	54,50	6,00	37,00	2,50	2,40	32,90	1,70	
Blend of veins								
and tendons	39,50	6,90	33,00	5,60	7,40	20,00	1,10	0,2
Cattlehide split	74,60	1,10	23,40	0,10	0,20	23,10	0,90	0,0

the bird neck, stomach, specially treated legs and heads.

By-products of the 2nd group are characterized by high share of collagen fractions with well-developed fibrillar structure, rather low content of non-collagen proteins and fat. These kinds of raw materials: cattle hides and products of the primary treatment (edge parts, cattl hide cuttings), guts and by-products of natural casings, tendons, veins from sausage and canning production; combs and nasal crests of birds have interest for ingredients isolation (collagen proteins and attedant fractions of mucopolysacharides), known for their therapeutic and rejuvenating effect (hyalurunic acid), filmforming and wound-healing characteristics (collagen biomaterials). These substances possess diverse functioality and are the excellent base for the production of food coverings, films, moulding materials, medical and cosmetic preparations.

The possibility of their contamination by different toxicants is the serious limiting factor in founding applied aspects for the animal raw materials use including food and therapeutic trends. In order to evaluate harmlessness of the studied raw materials and half-finished products we determined: the level of heavy metals ions in the raw material, arsenic, nitrate and nitrite-ions and chlororganic pesticides (table 2). The level of metalls in the raw materials and in the collagen half-finished products (0,05 mg/kg), does not exceed the MLC for meat and meat products, excluding ions of Cd for experimental masses on the basis of by-products of cattle gut raw materials (0,19 mg/kg), and on the basis of edge parts of cattle hides (0,07 mg/kg), but however is in the limits of MLC for inner organs. Such ions of heavy metals as cadmium, cobalt, lead, arsenic and mercury were absent in the investigated raw material. Nitrate-ions do not exceed MLC for poultry meat, nitrite-ions - were not found.The results of the chromotographic analysis showed the presence of chlororganic pesticides: HCH, pp'DDE, pp'DDT, which total content is from 0,015 to 0,111 mkg/kg of fat that meets the standard European demands for meat and fish products (0,3 mkg/kg).

The evaluation of harmlessness of the secondary collagencontaining raw materials of meat and poultryprocessing industries showed the absence of chemical toxicants accumulation in the connective tissues of animals unlike the muscle tissue and parenchimatoze tissue of the inner organs, and positively answered the question about wide application possibilities of secondary resources for the production of usefull products. The results of complex studies allow to reccommend it for the manufacture of food and special products including desease-preventive and therapeutic biopreparations.

CONCLUSION

The classification of secondary collagen-containing resources according to their structure and propeties, functional analysis of properties in biological and technological aspects allowed to form groups of by-products according to the primary applied significance directed to saving and development of the branch production potential: food products (complex use of tissues, additives of polyfunctional action): ingredients for therapeutic preparations, medical materials (collagen substances, hyaluronic acid).

REFERENCES

1. Zhuravskaya M.K., Alehina L.T., Otryashenkova L.T. Study and control of meat and meat products quality. - M, Agropromisdat, 1985. - 296 p.
2. Laboratory practicum on the technology of ferment preparations/I.P.Gracheva, et.al. - M.: Light and food industries, 1992.
3. Merkulov A.A. Course of pathological methods. - M., 1969. - 250 p.
4. USA Analytical Chemistry Laboratory Guidebook, 1991.
5. Folch J.M., Lees M.A., Stanley G.H.// J. Biol. Chem. - 1971. - 226. - P. 497.
6. Antipova L.V., Glotova I.A., Polianskikh S.V., Sidelnikov V.M. New Approaches to Developing of Processing Technologies of Secondary Collagen - Bearing Sourse Materials of Meat and Poultry Industry // 41 st Annual International Congress of Meat Science and Technology, San Antonio, Texas, U.S.A., August 20-25, 1995, Proceeding Volume II, P. 525-526.

Table 2

Level of heavy metals

Raw material name	Content, mkg/kg of the raw material									Content, mkg/g of fat		
	Ions of heavy metals								Nitrate -ions	Chlororganic pesticides		
	Zn^{2+}	Cd^{2+}	Pb^{2+}	Cu^{2+}	Fe^{3+}	Mn^{2+}	Cr^{3+}	Hg^{2+}	NO_3^-	pp'DDE	pp'DDT	HCH
Comb	1,40	-	-	1,05	7,50	-	0,10	-	18,00	0,017	0,035	-
Stomach	2,70	-	-	0,85	9,89	0,10	-	-	12,40	0,023	0,036	-
Skin of poultry	1,20	-	-	0,35	4,50	0,05	-	-	10,60	0,044	0,067	-
Legs of poultry	2,00	-	-	0,50	7,00	-	0,06	-	18,00	0,058	0,064	-
Guts of poultry	1,60	0,03	-	0,20	6,00	-	0,10	-	49,60	0,089	0,078	-
Collagen masses on the base of :												
cattlehide split cattle (control)	0,50	0,01	0,01	1,18	0,01	0,05	0,25	0,03	-	-	-	-
by-products of beef trimming	2,00	0,01	0,02	0,57	5,00	0,03	0,08	0,01	-	-	-	0,015
by-products of cattle guts	11,20	0,19	0,05	0,97	8,30	0,01	1,25	0,01	-	-	-	0,018
swine skin	1,60	0,04	0,01	0,60	3,00	0,01	0,25	0,01	-	-	-	-
cattle hide cuttings	7,80	0,01	0,05	0,97	13,50	0,05	0,23	0,01	-	-	-	-
blend of edge parts of cattle hides	3,70	0,07	0,05	1,40	35,00	0,10	0,38	0,01	-	-	-	-
MLC for products:												
meat and meat products	70,00	0,05	0,50	5,00	-	5,00	-	0,03	150,00	0,300	0,300	-
inner organs	100,00	0,30	0,60	20,00	-	-	-	-	150,00	0,300	0,300	-