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A STUDY INTO THE INFLUENCE OF MECHANICALLY DEBONED MEAT ON THE DIETETIC QUALITIES OF MEAT PRODUCTS

A.V.USTINOVA, E.G. BOBRIKOVA*, A.A.VLEZJKO and B.P.SUKHANOV**

* The All-Union Meat Research and Designing Institute, Moscow, USSR
** The 1st Moscow Medical Institute, Moscow, USSR

SUMMARY

Using quantum-plasmic and atomic-absorption spectrometry, the mineral composition of mechanically deboned beef (MDB) and of meat products with MDB added was analyzed. MDB was found to be a good source of macro- and microelements for meat products. The incorporation of 20% of MDB into meat products ensures the optimum ratio of calcium salts, phosphorus, fortifies them with magnesium, iron, copper and zinc salts. The MDB-added meat product developed by the authors is of a high biological value, has hypocholesteremic and alkalizing effects, all this allowing to recommend the product as a dietetic one.

INTRODUCTION

A high cost-price of meat creates an important economic problem of the rational utilization of meat resources. At the same time, in deboning beef and mutton carcasses a considerable amount of meat stays adhered to the bone (up to 20%), which is difficult to use for edible purposes. Therefore, a search of the possible ways of removing residual meat from the bones is an important task which solution allows to enlarge meat resources with practically no extra expenses. By now, in many countries this problem has been solved through applying presses of various types for mechanical deboning. As a result, the meat is yielded, called meat slurry or MDM which is quite widely used in the manufacture of a great variety of meat products.

According to specialists, one of the main factors limiting the use of MDM in dietetic products is feasibility of the presence of heavy metal salts, as well as the insufficient reliability from the hygienic viewpoint, based on the results of the biological evaluation of MDM-containing meat products.

MATERIALS AND METHODS

- As test objects served
- MDB derived from the neck, back, lumbar and sacral bones of the carcasses of 18-21-month beef animals, the residual meat on these bones being about 20%. The animals were raised in a special region controlled by the plant manufacturing baby-foods by the technology which ensures the minimal level of harmful chemicals in raw meat;
- model meat products containing 20, 40, 60 or 80% of MDB;
- a dietetic meat product with MDB added.

The mineral composition was studied by means of quantum-plasmic and atomic-absorption spectrometry, biological evaluation was performed on growing white rats according to the FAO/WHO procedure involving some featur-

res characterizing metabolic processes.

RESULTS AND DISCUSSION

Table 1 gives the chemical composition of MDB, of desinewed meat usually processed into canned meats for children or dietetic canned meats. Significant differences are found in fat and ash (minerals).

Table 1. The chemical composition of the raw meat and finished product

Characteristics,%	MDB	Desinewed meat	Dietetic canned meats
Moisture	56.2±1.48	69.9±1.89	77.7±1.40
Fat	23.3±0.25	11.8±1.14	5.8±0.96
Protein	14.8±0.15	16.2±0.66	11.9±0.14
Ash	5.7±0.09	2.1±0.06	1.6±0.10
Carbohydrates	-	-	3.0

As is seen from Table 2, MDB contains Ca 200 times as high, phosphorus 100 times as high and magnesium about 15 times as high as compared to desinewed meat. It contains a considerable amount of microelements, especially iron and copper. Such microelements as manganese, niobium, titanium, cerium, zirconium, tungsten, chromium, nickel, cobalt, strontium were not found in the test samples. Zinc and arsenic salts were absent or were found only in trace amounts in MDB only.

A successive increase of MDB (from 0 up to 100%) in model meat products improved their mineral composition. Thus, in an all-meat product the level of calcium was much lower than that of phosphorus, though in all the model meat products calcium content was increasing and exceeded that of phosphorus and the ratio of these two elements was approaching the optimum one from the physiological point of view. In raw meat it is very unsatisfactory and constitutes 1:4.4, the recommended one being 1:1. With 20% of MDB added to replace the same amount of meat, the ratio equals 1:0.7, which is favourable hygienically and medico-biologically.

Accounting for MDB favourable effect on meats mineral composition, it is useful to incorporate MDB into meat products. This can contribute both to solving the problem of enlarging meat resources and to improving the man's health.

Table 2 indicates that the addition of 20% of MDB into a meat product fortifies it with calcium, magnesium, copper, zinc, iron and provides their favourable ratio in the product from the point of view of nutrition hygiene.

Test products with and without MDB were biologically assessed on the growing male rats; 10% of the protein moiety of their ration for 28 days was represented by the experimental products. The experiment completed, the animals were killed by decapitation, the blood was collected and biochemically analyzed (Table 3).

MDB incorporation was shown to improve the biological value of the meat product by, on the average, 7.2%. From the total protein, al-

Table 2. The mineral composition of model meat products containing MDB

Constituent	Unit.	MDB level in meat products, %						Dietetic canned meats
		100	80	60	40	20	0	
Ca*	%	2.025± 0.010	1.776± 0.007	1.487± 0.004	1.067± 0.008	0.431± 0.002	0.019± 0.003	0.035± 0.001
P*	%	0.914± 0.005	0.693± 0.004	0.617± 0.005	0.484± 0.001	0.305± 0.001	0.083± 0.001	0.017± 0.0007
Mg*	%	90.817± 3.41	70.200± 2.86	62.214± 1.74	50.000± 1.47	30.852± 1.01	5.830± 0.09	15.290± 0.32
Al*	mg%	42.305± 1.46	38.300± 1.06	27.111± 0.99	20.074± 0.96	16.847± 0.78	7.266± 0.03	8.800± 0.02
Cr**	mcg%	8.404 0.04	7.911± 0.03	5.740± 0.02	4.209± 0.02	3.352± 0.01	2.680± 0.01	3.971± 0.009
Cu*	mcg%	0.204± 0.001	0.181± 0.001	0.154± 0.001	0.100± 0.001	0.077± 0.0006	0.028± 0.0007	0.047± 0.0007
Zn*	mcg%	0.432± 0.002	0.360± 0.001	0.314± 0.001	0.222± 0.001	0.147± 0.002	0.088± 0.001	0.156± 0.0007
Fe*	mg%	79.654± 3.26	60.865± 2.74	51.670± 2.45	40.451± 2.73	23.370± 1.41	2.384± 0.01	9.162± 0.45

* Quantum-plasmic spectrometry.
** Atomic-absorption spectrometry.

bumins, globulins, nitrogen, urea in blood serum, it can be concluded that MDB has no negative effect on the protein metabolism or on the carbohydrate metabolism. At the same time MDB favourable effects the cholesterol level: the latter was by 23.5% lower in rats fed with MDM-containing products. The dynamics of the mineral metabolism was also favourable. The consumption of MDB-added meat products caused a 19% reduction of phosphorus in blood, this favouring changes in the Ca:P ratio.

Table 3. The biological value of MDB-added meat products

Characteristics	Dietetic canned meats	
	with MDB	without MDB
PER	2.90±0.17	3.11±0.24
Blood serum:		
total protein, g%	7.20±0.20	7.00±0.32
albumins, g%	3.72±0.14	3.60±0.19
globulins, g%	3.48±0.22	3.40±0.11
urea nitrogen, mg%	20.14±3.11	17.30±2.40
glucose, mg%	88.30±5.50	93.30±4.61
cholesterol, mg%	117.40±6.13	89.90±5.36
Ca, mg%	6.27±0.24	6.80±0.18
P, mg%	9.11±0.77	7.40±0.41
CO ₂ , mg%	22.30±4.13	18.32±3.21

CONCLUSIONS

The experimental results obtained indicate that MDB can be a good source of minerals in meat products. The incorporation of up to 20% of MDB ensures a physiologically optimum ratio of Ca:P, increases magnesium by 2.5 times, helps to significantly increase the level of iron (by thrice), of zinc (by twice) and of copper (by about twice). In addition, because of this additive the meat product can influence favourably some metabolic processes: it exhibits hypocholesterinemic and alkalinizing effects which are very important for humans under modern living conditions. MDB does not increase the level of zinc and arsenic salts in meat products. No manganese, vanadium, chromium, nickel, cobalt, niobium, cesium, zirconium, tungsten or strontium were detected in MDB.

The use of MDB in meat production allows to balance meats chemical composition with respect for the man's need for nutrients and to provide dietetic and, if necessary, medicinal effects ensuring their complete safety.