# Determination of the biological properties of meat and body organs of slaughter animals in relation to some microelements and ascorbic acid contents under adequate feeding regimes

Iv. ROUSSEV

Meat Technology Research Institute, Sofia
Bulgaria

The problems related to the proper and rational nutrition of the population, in accordance with the achievements of the science of nutrition, should be solved basically by technical progress of food industry, and especially of meat industry. The scientific foundation of technical progress in this field should proceed from the biological positions, as well as base itself on fundamental investigations in biochemistry, physiology and hygiene of nutrition. The most important, certainly, is the realization of the production of foods, possessing high or even hightened nutritive value, in comparison with natural products. Biological properties of foods, and of meat and meat products as basic protein foods, in particular, are determined not only by the basic quantity of proteins and fats. Quality aspect is not less important: the content of individual amino acids in protein, of essential polyunsaturated fatty acids in fats, as well as the capacity of proteins, fats and carbohydrates to be attacked by the enzymes of the intestinal tract. The idea of the necessity of different vitamins, mineral substances and microelements in particular, became considerably wider and more precise. Microelements can be called »mineral vitamins» (1). It becomes clear, that the principles of ballanced nutrition cannot be confined to the narrow range of essential substances only. This is why one of the main problems of meat research workers is to obtain different kinds of meat and meat products, possessing the highest possible biological value. The development of such meat and meat products with hightened biological value, differentiated according to the needs of the representative groups of the population, is considered to be one of the most important problems.

Industrial breeding of slaughter animals is connected with the properties the quality and the biological value of meat, as well as with the problems of feedstuffs and feeding regimes of animals. Fertilizing with microelements is widely applied in feedstuff production for the improvement of the quality

and quantity of feedstuffs. The usage of microelements, according to their type and quantity, leads to a change in their content and ratio in feeds. Besides, a change in the amount of some vitamins is arrived at. All that cannot but influence some biological properties of meat in respect of the vitamin and microelement contents. In recent years, molybdenum fertilizing of pastures and meadows is widely applied in this country, as well as abroad, with scientifically determined norms in conformity with the soil structure of the individual countries and regions. But the way in which those feedstuffs taken by animals, act on some biological properties of meat and viscera, derived from them, is still insufficiently investigated. In most cases, studies in this field relate to searching the toxic effect.

The aim of the present work is to define the effect of the consumption of feeds fertilized with molybdenum micro-fertilizer, on the contents and distribution of molybdenum, copper and iron, and ascorbic acid in the meat and viscera derived from treated animals. A necessary prerequisite for this is apparently the knowledge of the real needs of human organism for microelements and vitamins, the interdependence of molybdenum, copper and iron, and ascorbic acid, as well as some technological properties and requirements towards the meat and viscera obtained.

It is well known, that a reciprocal antagonism exists between molybdenum, copper and iron in organisms. Intake of a certain quantity of any of them leads to changes in the quantity and distribution of the rest of the elements in the meat and body organs of the animals (2, 3, 4, 5). Variations in the amount of taken molybdenum produce deviations in ascorbic acid level and distribution, in animals. The problems of the effect of high doses of molybdenum on the accumulation of ascorbic acid, were studied by Malevannaya E. M. (6) with laboratory experimental animals. Holod V. M. *et al.* (7) studies the effect of molybdenum on ascorbic acid content of blood, in sheep. In the literature we have at our disposal, no data could be found, on the content and distribution of the said microelements and ascorbic acid in meat and viscera of animals fed molybdenized feeds, in the light of the requirements for biological value and technological properties.

## MATERIALS AND METHODS

The investigation was carried out with two groups of seven sheep each, levelled out in weight and age by the method of analogues. The animals were put to twenty days' levelling period.

The animals from the two groups received equal rations of concentrated feed, with the difference that the control group received common alfalfa hay, and the experimental group, molybdenized alfalfa hay. The latter was obtained by fertilizing with 100 g of commercial sodium molybdate, containing

20 per cent molybdenum, per acre. The animals received 1 kg of hay daily. After 120 days the animals from the two groups were sacrificed and analysed for yield, molybdenum, copper, iron, and ascorbic acid content.

Samples were burned by the method of Rinkis G. Ya; (8). The quantitative determination of molybdenum was carried out with molybdo-rhodanide complex. Copper and iron were estimated by the methods, described by Tautsin E. Ya. (8, 9), and ascorbic acid, by the method of Roen u. Knether.

The results obtained were processed variationally statistically.

## DISCUSSION

The differences in the values of the yields at slaughtering of the experimental and control animals are statistically unreliable, which means that the consumption of molybdenized feed by animals does not lead to changes influencing the yield.

It can be seen from the data, shown in Table 2. concerning the distribution of molybdenum, that the latter's content in both goups is highest in liver, followed by that in spleen, kidneys, blood and meat. Molybdenum level in blood and meat of experimental animals (fed molybdenized feed) is higher than that in controls. The differences in the rest of the organs are unreliable.

The distribution of copper in both groups is as follows- its content is highest in liver, followed by that in kidneys, spleen, heart, blood and meat. A higher level is observed in blood and meat of experimental animals, while copper level in liver shows a tendency towards a slight decrease. The differences in the rest of the organs are statistically unreliable.

In both groups, iron level is highest in blood, followed by that in spleen, liver, kidney, and meat. Iron level in spleen and kidney is higher for the sheep fed molybdenized hay. In the rest of the organs the differences are unreliable.

As can be seen from Table 3., the amount of ascorbic acid in the blood of the experimental animals is nearly 1,5 times as great as that in the controls.

Table 1. *The Mo, Cu, and Fe contents of alfalfa hay for the two groups of animals*

| *Type of hay* | *Molybdenum mg per kg of dry substance* | *Copper mg per kg of dry substance* | *Iron mg per kg of dry substance* |
|---|---|---|---|
| Common ..... | 0,184 | 13,38 | 55,74 |
| Molybdenized ..... | 0,739 | 11,70 | 26,24 |

Table 2. *The Mo, Cu, and Fe contents of meat and body organs of the two groups*

| *Group* | *Mg per kg kg of dry substance* | | | | | |
|---|---|---|---|---|---|---|
| | *Blood* | *Meat* | *Liver* | *Spleen* | *Kidney* | *Hear* |
| MOLYBDENUM | | | | | | |
| Control | 0,41 | 0,17 | 6,71 | 3,31 | 3,17 | 0,37 |
| Experimental | 1,92 | 0,57 | 7,11 | 3,47 | 3,42 | 0,49 |
| COPPER | | | | | | |
| Control | 3,04 | 2,47 | 239,07 | 4,68 | 12,42 | 4,76 |
| Experimental | 5,25 | 5,06 | 198,10 | 4,71 | 11,77 | 5,08 |
| IRON | | | | | | |
| Control | 3111,9 | 87,6 | 254,6 | 504,1 | 206,3 | 105,3 |
| Experimental | 3138,9 | 88,3 | 248,8 | 637,1 | 264,8 | 115,6 |

In the experimental group, greater amounts of ascorbic acid are cumulated in liver and spleen. The second highest increase, after that in blood, is established in spleen, followed by that in liver. Ascorbic acid level in meat shows a slight tendency towards increase.

According to Pokrovskii (1), the average daily need of an adult for molybdenum is 0,5 mg; for copper, 2 mg, and for iron, 7 mg. This quantity of microelements the organism has to take through food, and part of it should be supplied by meat and meat products. As is shown by the results, the usage of molybdenized feed leads to an increase of the level of molybdenum,

Table 3. *The content and distribution of ascorbic acid*

| *Type of animals* | *Mg per cent. against fresh mass* | | | | | | *Statistical Data* |
|---|---|---|---|---|---|---|---|
| | *Blood* | *Liver* | *Spleen* | *Kidney* | *Heart* | *Meat* | |
| | 1,49 | 24,44 | 22,31 | 11,31 | 3,28 | 1,24 | $M_K$ |
| *Control* | 0,23 | 0,90 | 2,40 | 2,33 | 0,24 | 0,34 | $\delta_K$ |
| | 0,09 | 0,45 | 1,20 | 1,03 | 0,10 | 0,15 | $m_K$ |
| | 2,25 | 30,82 | 30,05 | 12,74 | 3,85 | 1,80 | $M_{Mo}$ |
| *Experimental* | 0,23 | 3,90 | 1,66 | 1,76 | 0,83 | 0,61 | $\delta_{Mo}$ |
| | 0,09 | 1,95 | 0,73 | 0,88 | 0,41 | 0,27 | $m_{Mo}$ |
| | 6,03 | 3,19 | 5,50 | 1,05 | 1,35 | 1,48 | t |
| | 0,001 | 0,02 | 0,001 | 0,5 | 0,2 | 0,2 | p |

copper and iron in a degree and quantity that would favourably influence the biological properties of meat and viscera, especially when it comes to the production of dietetic foods.

Meat and meat products are not the basic source supplying human organism with the necessary ascorbic acid. The increase, however, of ascorbic acid level in blood and viscera, and the tendency towards its increase in meat, are important for the biochemical changes post mortem and during storage of meat. The question is about the outer appearance and especially about the colour and aging of meat. As we saw, when molybdenized feed is used, an increase is achieved of copper level in blood and meat, as well as an increase of ascorbic acid level. It is known, that copper ions are necessary for the activation of tyrosinase, ascorbic oxidase and some other oxidation-reduction enzymes, containing SH-groups. All this could have a favourable effect on aging of meat, proceeding under the action of proteolytic enzymes, which are influenced by the levels of copper and ascorbic acid.

It is also known, that ascorbic acid possesses strong reduction properties and has a favourable effect on the restitution and preservation of myoglobin in meat and in this way the latter preserves its fresh colour, demanded by the consumer.

In conclusion it can be said, that only a part of the problems to be solved are treated in this work. Investigations in this field will go deep in future.

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