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The effect of ammonia preserved fodder on the quality of pork.

SWULINSKA-KATULSKA A., DZIERŻYNSKA-CYBULKO B., MARUNIEWICZ W.

Department of Food Technology of Animal Origin, Agricultural University, Poznań, Poland

Constant pressure on the increasse in hog raising makes it necessary to seek all possible fodder sources. As the bulk of cereal crops harvested in this country is of rather high humidity, it has been a problem for years how to reduce the losses resulting from the deterioration of those nutritious plant materials. The methods of drying grain as well as of storing it hermetically sealed in containers in anaerobic conditions or adding such preservatives as propionic acid or formic acid proved to be rather expensive, which gave rise to searching for cheap and easily available preservatives. The results of many years research work indicats, that ammonia both in gaseous state and in aqueous solution can be such a preservative. Preserving the grain of both barley and maize with ammonia water brings about a decrease in the microflora developing not only externally but also internally / 9 /. The preserving mechanism of ammonia has not been fully recognised yet. Small amounts of ammonia are not noxious to organisms; its toxicity rises as its concentration and the pH of the medium do. The experiments in this country were made not only on maize grain but also on barley which makes up a main proportion of fodder for farm animals. The problem is of great economical importance, as the humidity of grain varies greatly and heavy rainfalls at harvest time are characteristic of this climatic zone.

The preliminary investigations on feeding revealed that the daily increases in the flesh mass of the pigs fed on ammoniated grain making up a 25 % proportion of the fodder were similar to those of the controls, but at higher proportions /50%/ of the ammoniated barley they were distincly larger / 8 /. The evaluation of the health condition of the animals based on the pathological changes found in the inner organs on slaughter pointed out that their health deteriorated as the proportion of the ammoniated grain in the fodder increased /7,8/.

As known from literature, an excess of ammonia may give rise to metabolic changes in the organism of the animals, inhibiting the tricarboxylic acid cycle, handicap the processes of biological oxidation, harmfully affect the central nervous system /2,3/.

The results obtained from the preliminary investigations / 10 / point out the purposefulness of studies on the quality of meat from the pigs fed on ammoniated barley and maize grain.

Experimental

The studies were made on 110 flesh type pigs. Before the feeding started, care was taken that the animals included in the groups were of approximately the same weight and genetic constitution. The fodder was prepared every day according to the requirements of each group of animals. The feeding value of 1 kg of fodder was exactly defined. All the animals were slaughtered at the age of 6 months on reaching 110 kg of body weight.

The pigs under study were divided into 7 groups according to the following feeding schedule.

I group - control group : barley 100 % + provit
II group - barley 75 % + ammoniated barley 25 % + provit
III group - barley 50 % + ammoniated barley 50 % + provit
IV group - barley 50 % + maize silage 50 % + provit
V group - maize silage 100 % + provit
VI group - barley 75 % + ammoniated maize 25 % + provit
VII group - barley 50 % + ammoniated maize 50 % + provit

The chemical and physical analyses were performed on m. longissimus dorsi excised from the carcass cooled for 24 hours at $\pm$ 2°C . The following were analysed
- pH changes at 45 min. and 24 hours after slaughter
- water, fat and total N contents
- aminoasid composition
- chemical indexes of protein value

To obtain a fuller picture, there were also analysed : non-protein N content, amine N content, nitrites and nitrates, technological value of meat. The results will be presented in the next paper.

Methods

The pH was determined potentiometrically using a pH-meter type N 511 with joint glass calomel electrode, The water content was determined by drying the samples at 115°C to solid mass. Fat and total-N were determined by Soxhlet 's method and Kjeldahl 's method respectively. The contents of aminoacids were determined by means of column ion-exchange chromatography on aminoacids analyser Multichrom Beckman according to the method of Moore et al. / 5 /. Proteins were hydrolyzed to aminoacids and on developing colour compounds of aminoacids with ninhydrin they were determined photometrically.

Tryptophan was determined after alkaline hydrolysis /4 /.
Basing on the aminoacid composition, chemical score /CS/ according to Block et al / 1 /, essential aminoacid /EAA/ according to Oser and biological value /BV/ were calculated / 6/.

Results

The pH measurement taken 45 min. after slaughter indicates that nearly all the pigs of the exprimental groups at the moment of slaughtering have accelerated glycolysis /Table 1/, which qualities their muscles as PSE. The pH value in the pigs under study varied from 6,8 - 5,3 pH. The water content in all the muscles of the 7 feeding groups was alike, the proof of which was the abcence of statistically significant differences beetween them / α =0,005/. The fat content in the muscle tissue varied from 2,1 - 3,0 %. The uniform water and fat contents show that the fodder used in the experiment had no effect upon the chemical composition of the muscles /Table 1/. The total N content in the muscle tisue showed statisticaly significant differences in the groups, but this differentiation does not seem to indicate that the incease in nitrogen content in a group undisputably results from a specific way of feeding /Table 1/. For example, beetween the I group, which is the control group an the III group, in which the animals were fed on fodder inchiding ammoniated barley 50 %, a statistically significant difference can be seen, but it is not observed between the I group and the 7 group in which same proportion of fodder /50 %/ was made up by ammoniated maize grain. This interrelation need not occur, however, as barley and maized differ in their chemical compositions and the processes of N compounds in the latter may have a different course. Differences are also observed beetween the group and the IV and V groups in which the animals were fed on fodder nichiding maize grain silage.

Table 2 presents the amounts of aminoacids in the muscles examined and the chemical score /CS/ calculated. On the whale, the contents of particular aminoacids in the muscles of the pigs under study is fairly uniform in all the feeding groups, except in the IV and V groups where the amounts of aminoacids are somewhat lower. In all the feeding groups, in the control one too, isoleucine is a limiting aminoacid, its index varying in between 51,4 - 54,4. The index of exogeneous aminoacids /EAA/ is pretty high, its value in the I group and in the II, VI and VII groups /the pigs fed on ammoniated fodder/ being very much alike. It is the lowest in the IV and V groups /the pids fed on maize grain silage/. The index of biological value of protein /BV/ is also the lowest in the muscles from the pigs of the IV and V groups. It can generally be stated that the feeding of pigs on barley and maize grain in the proportion up to 50 % of the fodder does not reduce the biological value of protein.

Conclusions

- The muscles from the pigs fed on fodder of different proportions /25 % and 50 %/ of ammoniated barley and maize grain and maize grain silage do not differ from one another in water and fat contents.
- In pigs from the groups fed on ammoniated grain lower pH values / $<$ 6.0/ are observed at the moment of slaughter.
- The feeding of pigs on grain preserved with ammonia does not reduce the biological value of the muscles studied.
- Isoleucine is a limiting aminoacid in all the muscles of the feeding groups studied and the CS index varies in between 51.4 - 54.4.
- The EAA index for the muscles of the pigs fed on ammoniated grain much alike.
- The muscles of the IV and V groups of pigs fed on maize silage have a reduced EAA value. The biological value /BV/ index of the protein in the IV and V groups is lower too.

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Table 1

Aminoacid contents and chemical indexes characterizing the protein value of muscles from pigs of different feeding groups /in g/16g N total/

Investigated groups	pH, value, 45′	24 h	N-total /%/	H_2O /%/	fat /%/	D.M./%/
I	6,3	5,4	3,4	74,4	2,7	22,9
II	5,9	5,4	3,5	74,7	2,1	23,3
III	6,1	5,5	3,7	74,3	2,4	23,3
IV	5,8	5,3	3,7	74,0	3,0	23,1
V	5,8	5,3	3,7	74,5	2,5	23,1
VI	5,9	5,3	3,7	74,6	2,6	22,9
VII	5,9	5,4	3,5	74,6	2,4	23,0

Table 2

pH and N-total values characterizing the muscles from pigs of different feeding groups. Mean values designated with the same letters are statistically significant for $\alpha \leq 0,05$.

No	Aminoacid	Investigated groups						
		I	II	III	IV	V	VI	VI
1.	Cysteine	1,1	1,4	1,0	0,8	1,1,	0,6	1,2
2.	Methionine	2,1	3,0	2,7	2,5	2,2	3,2	2,2
3.	Asparagine	10,7	9,7	10,3	9,7	9,7	9,3	10,3
4.	Threonine	4,9	4,2	4,7	4,4	4,7	4,5	4,3
5.	Serine	4,7	3,8	4,1	4,1	4,2	4,2	4,9
6.	Glutamine	14,5	13,9	14,2	14,2	15,0	14,7	13,8
7.	Proline	4,9	3,7	3,8	3,9	5,6	4,9	4,5
8.	Glycine	4,7	4,5	4,6	4,4	4,4	4,1	3,9
9.	Alanine	6,6	5,8	6,1	5,2	5,5	5,7	5,3
10.	Valine	4,8	5,0	4,8	4,1	4,4	5,0	5,0
11.	Isoleucine	3,6	3,4	3,4	3,5	3,5	3,5	3,5
12.	Leucine	7,5	7,3	7,5	7,3	7,3	7,1	7,2
13.	Tyrosine	3,4	3,4	3,0	3,1	2,8	3,0	3,4
14.	Phenyloanaline	3,4	3,6	3,2	3,1	3,0	3,4	3,7
15.	Lysine	9,9	7,8	9,0	8,1	8,5	8,5	8,6
16.	Histidine	4,4	3,5	4,6	3,4	3,8	3,6	4,2
17.	Arginine	4,7	3,7	5,6	5,4	5,2	4,3	4,7
18.	Tryptophan	1.1	0,9	0,9	1,0	1,1	1,1	1,0
Limiting aminoacid		Isoleucine						
CS - calculated chemical score		54,4	52,2	52,0	51,4	52,9	53,4	52,8
EAA - index of exageneous aminoacids		72,4	72,5	70,3	68,0	67,7	72,2	73,3
BV - biological value of protein		67,2	67,2	65,0	61,6	62,0	66,8	68,1