RESEARCH ON THE CHANGES OF pH VALUES AND SOLUBLE PROTEIN CONTENT IN DIETS BASED ON BEEF MEAT

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Abstract

The purpose of this study is to analyze the changes of pH values and soluble protein content in diets based on beef meat after their ingestion. The biological material used was represented by mini pigs female, bred Göttingen, which were alimented with diets that had in their composition beef meat and after ingestion the stomach contents was collected in kinetics. Beef meat used was represented by the Triceps brachii muscle collected from a Charolaise bull. Analyzing the data on the pH variation between 15 and 330 minutes after ingestion, there was observed a downward trend of the values, the maximum value being achieved in the first 15 minutes (6, 10) and the minimum was of 1.28 at 240 minutes. In terms of protein content it has been observed a reverse trend compared to the one of pH from 0.2348 mg / ml and reaching a maximum of 0.5722 mg / ml.

The obtained results analysis indicates that as the pH decreases the amount of soluble protein increases, the animal factor having a great influence.

Key words: gastric pH, protein content, diet, beef meat

INTRODUCTION

Proteins are the basic functional components of various food products, defining the textural, sensory and nutritional properties. One of the most important functional properties of proteins, with application in food industry, is the solubility [3].

These properties are influenced by the environmental pH and processing temperature [1]. The chemical composition of meat has a considerable impact on its quality because it determines the properties that are valued by consumers [2]. The purpose of this study was to analyze the changes in pH value and protein content in food rations based on bovine meat, after their ingestion.

MATERIAL AND METHODS

As biological material we have used six mini pigs females, bred Göttingen (identified as A, B, C, D, E, F) equipped with a permanent cannula at the out of the stomach, which have received food rations composed of bovine meat. The stomach content was collected in kinetics at 15, 45, 90, 150, 240, 330 minutes after ingestion. The surgery of cannulas placement was conducted with three weeks before the experience. With 24 hours before performing the experiment food administration was interrupted and the access to water was halted in the morning of the experience. Rations were administered after performing a stomach emptying.

The bovine meat used was the muscle *Triceps brachii* collected from a Charolaise bull, aged 13 days in vacuum at +4°C. In order to be use the meat was subjected to grinding, weighing, vacuum operations and boiling in a *baie marie* at a temperature of 72±0,3°C to achieve in the interior a temperature of 70±1°C for 30 minutes. Preparation of food rations was done by mixing (15 seconds at minimum speed, 45 seconds at medium speed) various ingredients: boiled beef (120g), sunflower oil (40 mL), cellulose (7 g), starch (70 g), egg yolk (3 g), pectin (1 g), water (30 mL).

Stomach content samples were analyzed in terms of pH and soluble protein amount, the pH was determined using a Hanna digital pH-meter and the protein content through the Bradford method. The Bradford colorimetric method is based on the absorbance reading of

dye Coomassie Brilliant Blue G-250 which forms a blue color in acid environment by binding with the proteins. 1 g of stomach content was stirred with 10 mL phosphate buffer 0,025 M (K_2HPO4 + KH_2PO4) and kept at +4°C for 12 hours. The prepared samples were centrifuge, 100 µL of the obtained supernatant was sampled and put in contact with 5 mL Bradford solution prepared in advance (1mL Bradford reagent + 4 mL deionized water). The reading was performed at 595 nm using a spectrophotometer against a blank consisting in phosphate buffer. Previously it will be prepared a standard range consisting in a bovine serum albumin solution of varying concentrations (0; 0,05; 0,1; 0,2; 0,5; 0,75; 1 mg/mL) to determine the extinction coefficient that will be used to determine the samples concentrations.

RESULTS AND DISCUSSION

The analysis of gastric pH values changes showed, in general, a downward trend (Tab.1).

The pH values determined after 15 minutes from the moment of food rations administration ranged around 6, the only exception was observed in the case of the samples colected from the mini pig E.

The maximum value was determined at the mini pig A at the sampling carried out at 15 minutes (6,22), while the minimum was 1,28 (240 minutes) at the animal D (Fig. 1).

As the duration of digestion increases up to 240 minutes, the pH decreases. After this moment, the curve of variation for this parameter presents a slightly upward trend, except the value determined at 330 minutes at the mini pig F (2,93), which was lower than that obtained at 240 minutes after ingestion (3,03).

Protein solubility is crucial in the processing of meat. The amount of soluble protein increases with the digestion period progress until a certain moment (90 minutes) after ingestion. After this moment it decreases, being recorded exceptions depending on the animal (Fig. 2).

The maximum of this parameter was obtained at the mini pig D at 90 minutes after ingestion (0,5722 mg/mL) and the minimum value was recorded at 240 minutes at the animal C (0,1544 mg/mL) (Tab.2).

Table 1 The evolution of gastric pH

Time (min)	Mini pig A	Mini pig B	Mini pig C	Mini pig D	Mini pig E	Mini pig F
15	6,22	5,90	5,75	5,56	4,1	6,1
45	6,05	4,85	4,7	4,7	4,2	5,4
90	6,00	4,14	4,2	4,54	4,13	5,34
150	4,80	2,68	3,65	2,42	3,88	4,93
240	2,66	1,84	2,89	1,28	3,35	3,03
330	3,38	2,10	4,77	3,36	3,88	2,93

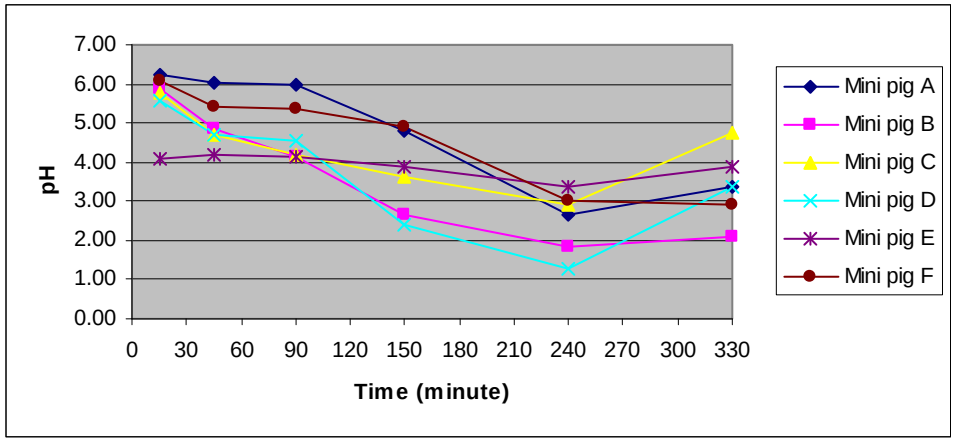

Fig. 1 Gastric pH variation

Table 2 The soluble protein content evolution

Time (min)	Soluble protein content (mg/mL)					
	Mini pig A	Mini pig B	Mini pig C	Mini pig D	Mini pig E	Mini pig F
15	0,3527	0,3333	0,3697	0,2923	0,2348	0,2595
45	0,3761	0,3425	0,3289	0,3003	0,291	0,2868
90	0,4922	0,4836	0,3464	0,5722	0,2428	0,2609
150	0,4533	0,1754	0,2920	0,1538	0,2799	0,2331
240	0,4164	0,1824	0,1544	0,16	0,3228	0,2201
330	0,2818	0,2342	0,1070	0,2054	0,379	0,1204

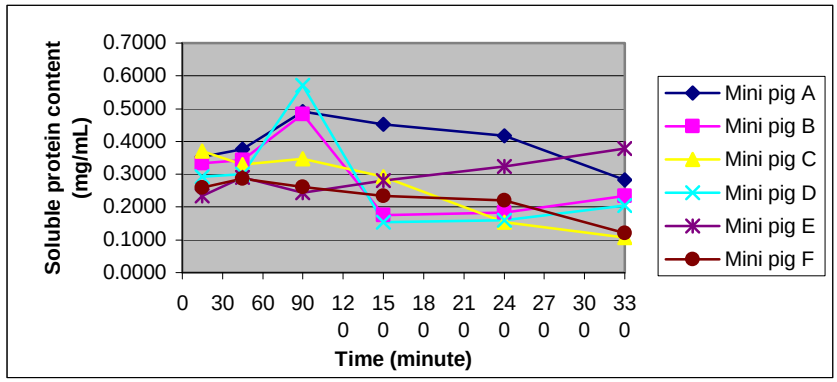

Fig. 2 The variation of soluble protein content from diets

The lower amounts, depending on the animal factor at mini pigs, were obtained at the animal F, starting from 0,2595 mg/mL and reaching a maximum of 0,2868 mg/mL. The minimum was recorded at 330 minutes, 0,1204 mg/mL.

It is generally observed that the soluble proteins are found in higher levels after 15 minutes of ingestion compared to the values determined at 330 minutes.

The analysis of obtained data shows that as the pH decreases there is an increased in the amount of soluble protein, these two indicators are in an inverse relationship.

CONCLUSIONS

With the progress of digestion time, the pH value of the stomach content drops to a certain point after which it increases moderately.

Soluble protein contents of the digesta, obtained by the administration of diets based on beef meat, grows with the digestion time duration to a certain point and then decreases.

The animal factor has a great influence, being observed a variation of the indicators determined by it.

This study was performed using this biological material in order to observe the changes that occur in the stomach, because the study on people would have been very costly, being known that digestion in pigs is similar to that of humans.

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