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INCREASING PROFITABILITY OF MEAT PROCESSING UNITS BY ADDING VALUE FOR MEAT TRIMMINGS

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Abstract

In the meat industry, after the cutting, deboning and trimming phases, meat trimmings result from which minced meat is usually made. From an economic point of view, the superior utilization of meat trimmings is of interest. A method analyzed in this paper consists of the injection of trimmings in the meat muscle. The results obtained indicated a lower weight gain if the meat is injected with brine emulsion (between 8.37% and 9.84%) compared to samples injected only with brine (41.20% for pork ribeye and 45.7% for beef ribeye). However, protein content is inversely correlated with weight gain (r^2=-0.88). The main disadvantage of the method lies in the fact that it decreases the preservability of the meat injected with meat emulsion compared to the control samples.

Key words**:** *meat, injecting, trimmings, emulsion, economic, processing*

INTRODUCTION

Meat and meat products are valuable sources from a nutritional point of view, and their consumption shows an increasing trend [3].
For various meat products, larger pieces of meat are used, which must be salted. In most cases this salting process is carried out by injection with brine [5]. The brine used contains, in addition to salt, different ingredients such as: dextrose, citric acid, phosphates [9]. Later, the notion of extender was used, for brines with the addition of various substances to reduce the costs of meat processing [7]. These extenders can be extracted from various sources. For example, hydrocolloids can be added to improve the functional properties of meat products [1]. Starch from various sources and modified starch are also frequently used to increase the water retention capacity of meat [2, 8].
Fu *et al.* (2022) showed that marinating meat with edible mushroom powder leads to improved meat tenderness and water retention capacity [4]. For the same purpose, Hu *et al.* (2019) injected chicken breast with brine containing whey [6].
The desire of consumers is to add ingredients of other origin as little as possible to meat products. Meat processing units want the highest possible profit, and this goal can be achieved by adding value to low-cost components [12]. An example of this components is the pieces of meat that result from operations such as cutting, deboning and trimming meat. By fine chopping these pieces of meat, obtaining of a brine emulsion and injecting it into the meat brings added value to these by-products and simultaneously meets consumer demand. In this way, meat trimming is sold at the price of a meat product obtained from a whole muscle instead of being marketed at the price of minced meat
Until now, there are processing lines that allow the injection of meat with brine emulsion, but the results of this type of processing are missing in the scientific literature.
The purpose of the present paper is to analyze from a technological and economic point of view the injection of trimmings in whole muscle.

MATERIALS AND METHODS

For the analysis, ribeye obtained from pork carcass and beef carcass was used. From pork and beef trimmings an emulsion was obtained by using brine with 15% salt, in a ratio of 1:2. Emulsification was done using IKA, T 25 digital ULTRA-TURRAX (Germany).
The samples obtained are shown in Table 1.

Table 1. Sample codes and description

Samples	The method of obtaining the samples
PR	Pork ribeye as a control sample
PR_S	Pork ribeye injected with brine with 15% salt
PR_P	Pork ribeye injected with an emulsion consisting of pork trimmings and brine with 15% salt, in a ratio of 1:2
PR_B	Pork ribeye injected with an emulsion consisting of beef trimmings and brine with 15% salt, in a ratio of 1:2
BR	Beef ribeye as a control sample
BR_S	Beef ribeye injected with brine with 15% salt
BR_P	Beef ribeye injected with an emulsion consisting of pork trimmings and brine with 15% salt, in a ratio of 1:2
BR_B	Beef ribeye injected with an emulsion consisting of beef trimmings and brine with 15% salt, in a ratio of 1:2

Source: Original data.

Weight gain was determined by weighing before and after injection, and the result was expressed as a percentage. The moisture content of the samples was determined by drying at 103°C, with a moisture analyzer ML-50, A&D Company, Limited (Japan). According to SR ISO 937:2007, the nitrogen in the samples was determined by the Kjeldahl method and using the conversion factor equal to 6.25, the protein content of the samples was determined. The preservation of the samples was established by determining the easily hydrolysable nitrogen according to SR 9065-7:2007 [10, 11]. This determination was made on the first day after injection and then after 2 days, during which time the samples were kept at 4°C.

RESULTS AND DISCUSSIONS

After brine or emulsion injection, weight gains were recorded as seen in Figure 1.

It is observed that the samples injected only with brine have the highest weight gain, the values being 41% and 46% respectively. Since beef has a higher water retention capacity than pork, it is normal for injected beef samples to have a higher weight gain than pork. For samples injected with emulsion, the weight gain was similar, but much lower than in the case of samples injected with brine. For them the weight gain varied between 8.37% and 9.84%. This observation can be explained by the change in viscosity and the increase in pressure required during emulsion injection compared to brine injection.

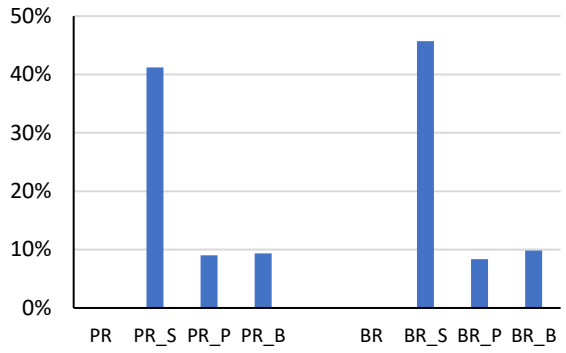

Fig. 1. Weight gain percentage after injection compared to the initial amount
Source: Author's determination.

Taking into account that the price of injected and heat-treated meat products is 2 to 3 times higher than the price of the raw material, it follows that from an economic point of view it is much more profitable for the injection to be done with brine.

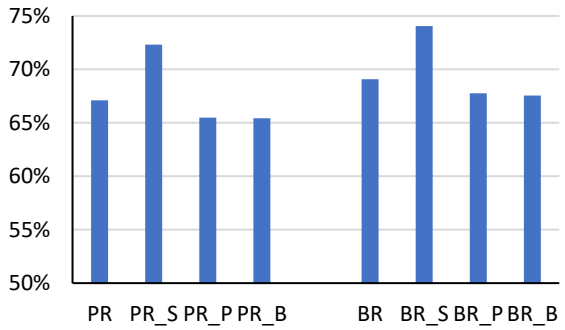

Fig. 2. The percentage of moisture in the samples
Source: Author's' determination.

The increase in weight is mainly due to the increased moisture content of the injected samples. From Figure 2 it can be seen that in the case of injection with brine, the humidity of the samples has the highest values (72.33% and 74.06% respectively) and these values are higher than those of the control samples (67.12% and 69.08%). All samples injected with meat emulsion have lower moisture content than the other samples, which means that they have a higher content of nutrient compounds.

The results shown in Figure 3 support this assumption.

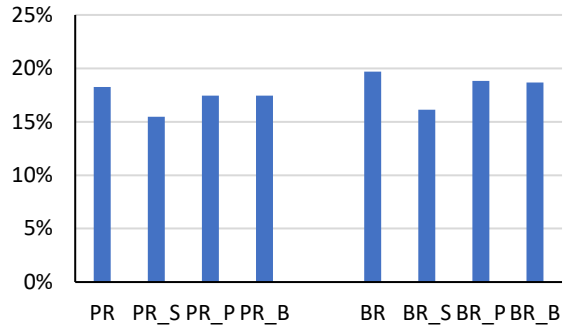

Fig. 3. The percentage content of protein and protein related to dry matter
Source: Author's determination.

The highest protein content is observed in the control samples. Due to the injection with brine, there is a decrease in the protein percentage by 84.82% and 81.96%, respectively, compared to the 2 control samples. The decrease is much smaller in the case of the samples injected with meat emulsion and varies, for the 4 samples, between 94.84% and 95.69% compared to the protein in the control samples.
This means that, from a nutritional point of view, injecting with brine containing an emulsion of trimmings is much more advantageous, especially since the injected protein is a good quality protein.
Regardless of the product and the brine recipe used, for microbiological reasons, the meat is injected at temperatures as low as possible.
On the other hand, as previously shown, after the injection of the meat, the moisture increases which leads to a reduction in the shelf life. In Romania, the determination of easily hydrolysable nitrogen is an objective and standardized method (SR 9065-7:2007) for monitoring the freshness of meat and meat products [12]. The obtained results are shown in Figure 4. Normally, as time passes, the values of easily hydrolysable nitrogen increase. From Figure 4 it can be seen that after 2 days the values of easily hydrolysable nitrogen increased for all the samples, but the most significant increase was registered for the samples injected with trimmings emulsion. The highest value was obtained for the BR_B sample, namely 36.20 mg/100g. Expressing as a percentage the evolution of the values recorded after 2 days compared to the first day, the range in which they fall is between 27.98% and 45.13%, while for the control samples the values were 6.19% for PR and 18.88 % for BR.

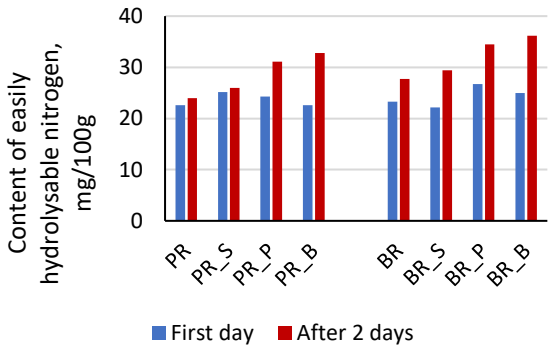

Fig. 4. Content of easily hydrolysable nitrogen on the first day and after 2 days
Source: Author's' determination.

From these data it can be concluded that in the case of trimmings emulsion injection, it is necessary to pay more attention to the quality of the raw material and the ingredients, and the processing and hygiene conditions to be much stricter.
To these results must be added the fact that, from a visual point of view, the injection of pork with beef emulsion and the injection of beef muscles with pork emulsion are not recommended due to the difference in color of the muscle tissues.
Analyzing the results presented previously, correlation coefficients are obtained presented in Table 2. From these data, there is a direct correlation between the weight gain due to meat injection (r^2 =0.85) while the protein content of the injected samples decreases proportionally to the weight gain (r^2=-0.88).
From an economic point of view, it is desirable that after the injection the weight gain is as high as possible. By comparing the prices displayed online, the ratios shown in Figure 5 can be calculated.
All values are above units, and in the case of finished products, depending on their type, the ratio can be double. It should also be noted that this analysis did not take into account the other factors that influence prices.

Table 2. Correlation coefficients for the obtained results

	Weight gain percentage after injection compared to the initial amount, %	Moisture %	Protein %
Weight gain percentage after injection compared to the initial amount, %	1		
Moisture, %	0.85	1	
Protein, %	-0.88	-0.55	1
The percentage variation of easily hydrolysable nitrogen content	-0.11	-0.32	0.20

Source: Own calculation.

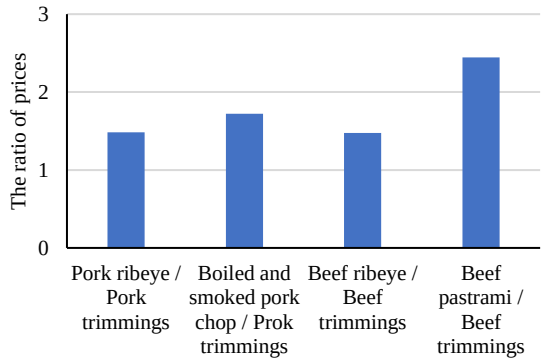

Fig. 5. Reporting the price of ribeye muscle and the price of a finished product to the price of trimmings
Source: Author's determination.

CONCLUSIONS

Using meat trimmings comes in meeting the demands of consumers and processors. Currently, consumers prefer that there are no ingredients of other origin in meat products. Processing units want the highest possible profit, and one way to achieve this goal is to add value to meat trimmings. The obtained results show that following the injection into the muscles of the brine with meat trimmings emulsion, the weight gain percentage is significantly lower (below 10%) than in the case of injection with brine (over 40%). At the same time, the good quality protein content is higher in emulsion brining compared to brine injection. the correlation coefficient between weight gain and good quality protein content is -0.88. From an economic point of view, the price for ribeye muscles is 1.5 times higher than the price of meat trimmings, while the ratio between the price of an injected finished product and the price of meat trimmings can vary between 1.72 and 2.45 depending especially on the way the muscles are processed.

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