# EFFECT OF BEEF BLOOD COLLECTION PROCEDURES AND STORAGE CONDITIONS ON BLOOD QUALITY AND PLASMA YIELD

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## SUMMARY

This paper deals with the effect of beef blood collection procedures and storage conditions on the quality and quantity of blood collected and blood plasma obtained.

Comparative investigations were performed of: - Open (standard knife and funnel) and closed (hollow knife) collection procedures;

- Storage temperatures;

- Storage duration.

Microbiological and organoleptical analysis have shown that the blood quality and plasma yield do not vary significantly from the time of collection to 3,6, 11 and 24 hours later.

Blood quality for storage over an 11 hour period at 4°C does not differ from storage at room (21-25°C) temperature.

A 30% differential in the average yield of high quality blood suitable for processing into blood plasma favoured the open collection procedure.

## INTRODUCTION

Blood and its products (plasma, serum, colourless globin) as raw materials in the production of functional proteins used for the production of meat products have become very important in recent years. Blood characteristics and blood fractions, especially their influence on technological, organoleptic and hygienic properties of meat products, have been the subject of many authors, research (Suter et al. 1984; Mielnik et al. 1983; Nakamura et al. 1984; Shahidi et al. 1984; Autio et al. 1984; Hovel et al. 1987).

Blood plasma usage in Yugoslav meat industry conditions has a great importance. In certain meat products blood plasma is used as liquid, although powdered blood plasma has wider and more significant usage. The quality of plasma used in production of meat products must fulfill the meat industry requirements (hygienic, technological and organoleptic characteristics). It is obvious that plasma quality is closely connected with the quality of blood from which it is obtained; therefore, it is necessary to take corresponding measures during the slaughter of the animal from which blood is collected, and to provide corresponding blood storage conditions till the processing period.

This research had the aim to find optimal beef blood collection procedures and storage conditions, and to notice the quality and quantity of plasma intended for either direct usage in meat products or initial material in protein preparation production.

## MATERIALS AND METHODS

In this work we examined the blood collected on the bleeding line in two ways:

1. Open collection procedure: after skin preparation and cutting the blood vessel with a standard sterile knife, blood was collected by a metal funnel connected with a vessel by means of a plastic hose.

2. Closed collection procedure: the skin preparation was done by a standard knife while blood vessel cutting and blood collecting was done by means of a hollow knife connected with the collecting vessel by means of a plastic hose.

10% water solution of sodium nitrate quantity added - 1.6% was used for the stabilizing of blood.

Blood was analysed by microbiological, physicochemical and organoleptic methods. It was collected and stored in sterile one-litre bottle for the purpose of this research.

The examination was one half an hour after bleeding marked "0", then 3 hours, 6 hours, 11 hours and 24 hours after bleeding. All examinations were done with the blood stored at room temperature (21 - 25°C) as well as with the blood stored in a refrigerator at 4°C.

The total of aerobic mesophilic bacteria in 1 ml of blood and the presence of pathogenic microorganism, sulfite reducing Clostridiae, enterobacteria, Staphylococcus

Minimal and maximal whole bacteria number values in blood

Table 1.

| Blood samples* | | Total bacteria number at the examined time | | | | |
|---|---|---|---|---|---|---|
| | | 0 | 3 | 6 | 11 | 24 |
| 1 | min. | Ø | Ø | Ø | Ø | $3x10^2$ |
| | max. | $7x10^3$ | $3x10^3$ | $1,8x10^3$ | $1,2x10^2$ | $7x10^4$ |
| 1c | min. | - | Ø | Ø | Ø | Ø |
| | max. | - | $2,8x10^3$ | $1,6x10^3$ | $1,3x10^2$ | $1,2x10^2$ |
| 2 | min. | Ø | Ø | Ø | Ø | $2,3x10^2$ |
| | max. | $8x10^3$ | $3,5x10^3$ | $1,5x10^3$ | $1,3x10^2$ | $5,8x10^4$ |
| 2c | min. | - | Ø | Ø | Ø | Ø |
| | max. | - | $2,9x10^3$ | $1,7x10^3$ | $1,2x10^2$ | $1,2x10^2$ |

*n = 10

1 - blood collected by a funnel, stored at room temperature

1c blood collected by a funnel, stored at 4°C

2 - blood collected by a hollow knife, stored at room temperature

2c blood collected by a hollow knife, stored at 4°C

Blood plasma and formed elements correlation

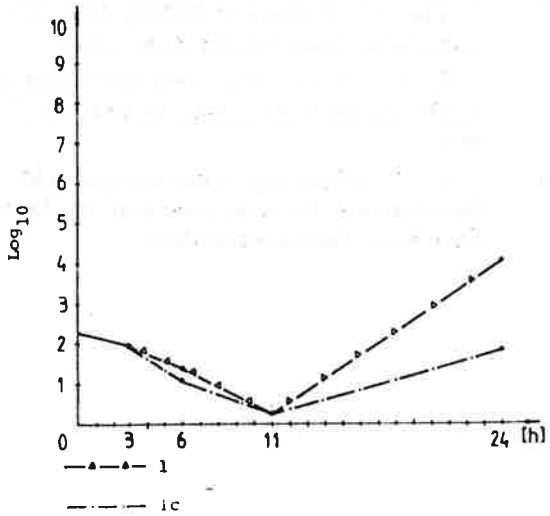
Table 2.

| Flood samples* | Examination period | | | | |
|---|---|---|---|---|---|
| | 0 | 3 | 6 | 11 | 24 |
| 1 | 72:28 | 72:28 | 72:23 | 72:28 | 71:29 |
| 1c | - | 72:28 | 72:28 | 71:29 | 70:30 |
| 2 | 72:28 | 72:28 | 72:28 | 72:28 | 71:29 |
| 2c | - | 72:28 | 72:28 | 71:29 | 70:30 |

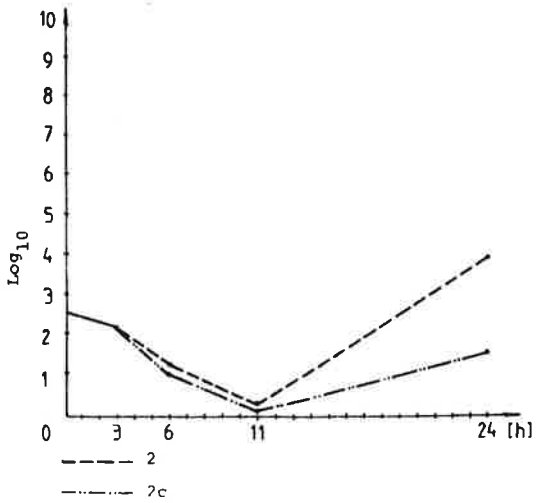
*n = 10

Explanation: The same as in the Table 1.

Graph.1. AVERAGE BACTERIA NUMBER IN BLOOD COLLECTED BY A FUNNEL REPRESENTED AS LOG.10.




Graph.2. AVERAGE BACTERIA NUMBER IN BLOOD COLLECTED BY A HOLLOW KNIFE REPRESENTED AS LOG.10.




and faecal Streptococcus were determined by standard microbiological methods.

Plasma yield was read directly from a haematocrit blood value measuring tube immediately after blood was centrifuged for 15 minutes at 4000 rpm (centrifuge-Tehnica-Zelezniki, Yugoslavia LC-320).

The blood and plasma colours were estimated visually by five experts.

The second part of our examination was about blood quantity measuring average blood yield per animal. For this purpose, blood was collected from ten animals approximately of the same weight (450 kg.each) and it was done by means of a funnel and a hollow knife.

## RESULTS AND DISCUSSION

Minimal and maximal number of anaerobic mesophilic bacteria in 1 ml of blood and in examined intervals are given in Table No.l.

The results obtained show that it is possible to collect blood in both examined ways and that aerobic mesophilic bacteria are not found by microbiological methods applied. The presence of bacteria, no matter the way of blood collecting and storage conditions, was not noticed even 3, 6, 11 or 24 hours later. Blood storage at 4°C did not show the presence of mesophilic bacteria after 24 hour period, too.

The lowest bacteria number in blood stored 24 hours at room temperature was $3 \times 10^2$, or $2.3 \times 10^2$ (Table 1), and that is a high hygienic quality both for direct blood usage and further blood processing.

Maximal microorganism number for the initial number was $8 \times 10^3$ and it decreased during 11 hour storage period; it was $1.2 \times 10^2$ (Table 2). It was noticed that there were no changes of maximal microorganism number both in blood at room temperature and in blood after 11 hours of storage at 4°C up to the 11 th hour.

Average microorganism numbers are represented in Graph.l. as decimal logarithm and temperature and storage period respectfully.

Total count of microorganism decreases during blood storage and it is minimal after 11 hour storage period (less than 10 in 1 ml). These results are noticed both in blood stored at room temperature, no matter the way it is collected. The temperature influence on the microorganism growth is significant after this storage period (Graphs l and 2).

The presence of pathogenic bacteria, sulfite reducing Clostridiae, enterobacteria, Staphylococcus and fecal Streptococcus is not noticed by microbiological examination of blood samples.

Results of average haematocrit values in blood samples examined "0", 3, 6, 11 and 24 hours after collection are presented in Table 2.

High quantity of plasma yield was caused by adding of 10% water solution sodium nitrate which was present in blood plasma after centrifuging. Average blood plasma yield does not vary from the moment of collection to 11 hours later at room temperature. 24 hours later, however, plasma yield decreases at room temperature. The plasma yield decrease is noticed at 4°C 11 hours later. The way of blood collecting does not influence blood plasma yield.

Results of microbiological examination and results of haematocrit values are important for wider and more economical blood plasma usage in meat industry as well as for protein preparation production. All this shows that blood collected under the appropriate hygienic conditions do not have to be cooled and should be processed between 6 th and 11 th hour. This is based on the fact that average total microorganism number is minimal in the interval mentioned, while blood plasma yield is equivalent to the one at "0" examination time.

The way of blood collecting does not cause any differences in blood colour which was concluded by visual estimate of blood immediately after bleeding. The blood had the colour characteristic of artery-vein mixture. The blood stored at room temperature gradually became dark, while the blood samples stored at 4°C became more red. The difference between the cooled blood and not

cooled one was significant 24 hours later. The most important fact is that blood plasma colour was the same in all examinations. That means that blood plasma colour was equivalent to the one at "0" time even 24 hours later, no matter the way of collecting and storage.

The second part of our research was aimed to define the influence of collecting way on the quantity of blood collected, and the results show the advantages of the open collection procedure. Approximately 11.2 L were obtained from an animal while blood was collected by a funnel. When blood was collected by a hollow knife 7.2 L approximately was obtained from an animal, and that is a 30% differential.

## CONCLUSIONS

The results of our research under certain conditions show that:

1. The way of blood collecting does not influence the blood quality and blood plasma yield.

2. Blood used for processing into blood plasma should not be cooled if the storage period is not longer than 11 hours.

3. A 30% differential in the average yield of high quality blood suitable for processing into blood plasma favoured the open collection procedure.