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# THE MONITORING OF PORK AND BEEF CHILLING PROCESS

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## SUMMARY

*The aim of the chilling of carcasses is to decrease the temperature in the deepest parts of muscles as fast as possible while maintaining its weight as high as possible. However, some losses of the weight are desirable because dried surfaces are more resistant to the microbial spoilage. Monitoring of pork and beef chilling process at the slaughterhouses in period 2006 – 2007 was performed in our experiment. Temperature was measured in the muscles, in the chilling rooms and also duration of the process was taken into account. Finally, in two cases (13.3 %) of pork carcasses temperature exceeded required +7 °C in deep part of muscles at the end of process.*

**Key words:** chilling process, pork, beef

## INTRODUCTION

The lowering of carcass temperature initiates a complex of processes of meat preservation, which can suppress different forms of meat decomposition. The chilling of carcasses at the slaughterhouse is a knowing necessity and many of technological operations depend on cool environment. The process of meat chilling can be divided into two phases, chilling of carcasses from body temperature to refrigerated temperature and meat storage under chilling conditions (Matyáš, 1995).

The goal of the chilling of meat is to decrease the temperature in the deepest parts of muscles from tempera-

ture of 39 – 42°C as soon as possible while maintaining its weight as high as possible. Some losses of the weight are necessary and even desirable because dried surfaces are more resistant to the microbial spoilage (Bystrický, 1997).

The chilling standards of the meat and meat storage in chilling rooms markedly influence total qualitative standard of meat industry production, namely of meat and final meat products (Turek, 1992).

Food business operators must ensure that the storage and transport of meat of domestic ungulates take place in accordance with the requirements of Regulation (EC) No 853/2004 (Anon., 2004).

Unless other specific provisions provide otherwise, post-mortem inspection must be followed immediately by chilling in the slaughterhouse to ensure a temperature throughout the meat of not more than 3°C for offal and 7°C for other meat along a chilling curve that ensures a continuous decrease of the temperature.

Meat may also be boned and cut prior to reaching the temperature listed above when the cutting room is on the same site as the slaughter premises. In this case, the meat must be transferred to the cutting room either directly from the slaughter premises or after a waiting period in a chilling or refrigerating room. As soon as it is cut and, where appropriate, packaged, the meat must be chilled to the temperature of not more than 7°C.

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▼ **Table 1.** The monitoring of pork carcasses chilling process

No.	Slaughterhouse	Probe site	Time necessary to reach + 7 °C	Average temperature in chilling room
1.	1	Thigh	8 hrs and 20 min	0.5 °C
2.	1	Loin	4 hrs and 21 min	0.6 °C
3.	1	Thigh	7 hrs and 55 min	0.6 °C
4.	1	Thigh	10 hrs and 4 min	2.9 °C
5.	1	Thigh	9 hrs and 22 min	4.9 °C
6.	3	Thigh	11 hrs and 48 min	4.9 °C
7.	4	Thigh	11 hrs and 37 min	4.3 °C
8.	5	Thigh	14 hrs and 35 min	4.1 °C
9.	5	Thigh	15 hrs and 52 min	4.6 °C
10.	5	Thigh	16 hrs and 13 min	5.5 °C
11.	5	Thigh	14 hrs	3.8 °C

During the chilling operations, there must be adequate ventilation to prevent condensation on the surface of the meat (Regulation (EC) No 853/2004; Anon., 2004).

## MATERIAL AND METHODS

During 2006 and 2007, the monitoring of the chilling process of pork and beef carcasses at the slaughterhouses in Košice region was performed. 15 measurements were carried out, namely 11 measurements in pork carcasses (9 in thigh, 2 in loin), and 4 measurements in beef carcasses (3 in thigh, 1 in shoulder). On the base of this monitoring the chilling curves were created.

The module ELPRO, type Ecolog TN 4 (Kucian, Switzerland; produced by ELPRO-BUCHS AG, Switzerland) was used for the monitoring of temperatures (temperature in the muscle, temperature of the environment). The module measures, stores and documents temperature (from –

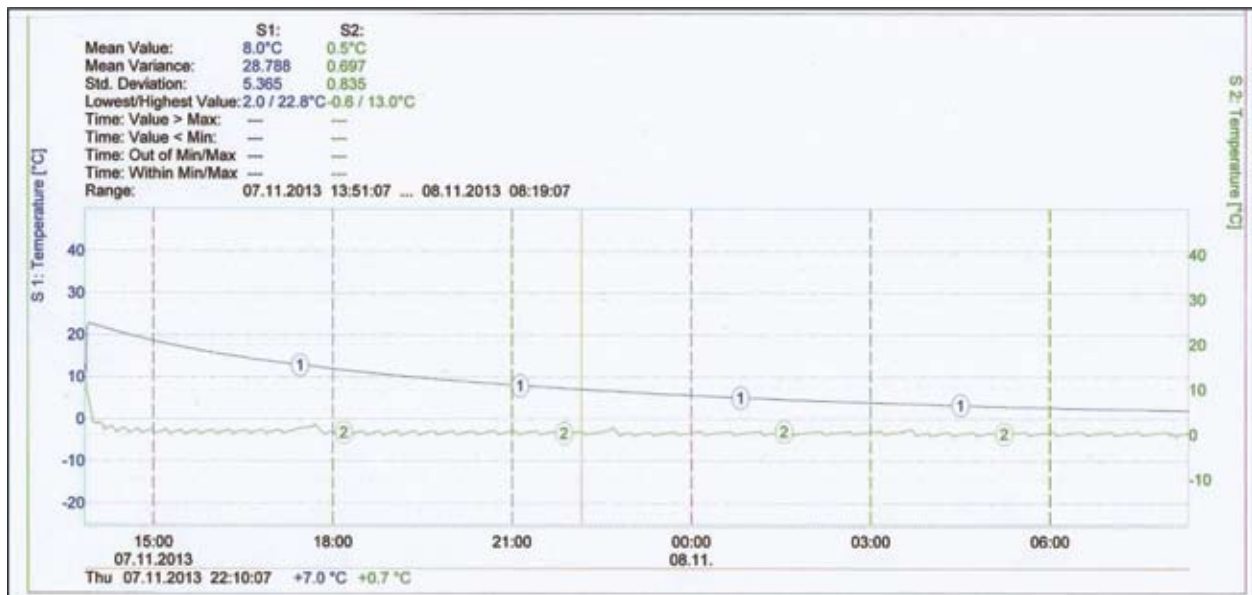
50°C to + 140 °C) in the environment and in the meat. The module was hanged on the carcass (temperature of the environment) and the probe was inserted into the muscle. Using the corresponding elproLOG Win software, the data collected by the ELPRO metering module can be read into a PC and evaluated. It is possible to display the data as a curve or as a table.

## RESULTS AND DISCUSSION

The monitoring of pork carcasses chilling process at the particular slaughterhouses (1, 3, 4, and 5) is presented in Table 1. The chilling process of pork carcasses, when the required temperature in the muscles (7°C) was achieved, lasted 4 hours and 21 minutes (Fig. 1) in loin (slaughterhouse 1), and from 7 hours and 55 minutes (slaughterhouse 1) to 16 hours and 13 minutes (slaughterhouse 5) in thigh.

▼ **Table 2.** The monitoring of beef carcasses chilling process

No.	Slaughterhouse	Probe site	Time necessary to reach + 7 °C	Average temperature in chilling room
1.	1	Thigh	9 hrs and 52 min	1.2 °C
2.	2	Shoulder	13 hrs and 32 min	4.3 °C
3.	2	Thigh	15 hrs	3.6 °C
4.	5	Thigh	17 hrs	3.9 °C

▼ **Figure 1.** Chilling curve of pork carcass (thigh, measurement No. 1)

The lowest average temperatures during the chilling process were measured at the slaughterhouse 1 and the highest average temperatures at the slaughterhouse 5. This fact is in compliance with the time needed to reach the temperature of +7°C. In two cases (measurements 8 and 9), the temperatures were higher at the end of chilling process (8.1°C, 9.3°C, respectively) (Fig. 2).

The monitoring of beef carcasses chilling process

at the particular slaughterhouses (1, 2, and 5) is showed in Table 2. The time necessary to reach the temperature of +7°C in thigh ranged from 9 hours and 52 minutes (Fig. 3) (slaughterhouse 1) to 17 hours (slaughterhouse 5). The required temperature in the shoulder was reached during 13 hours and 32 minutes.

According to the literature data (Matyáš, 1995; Bystrický, 1997), for the fast chilling of the meat the following condi-

▼ **Figure 2.** Chilling curve of pork carcass (thigh, measurement No. 9)

tions are required: the air temperature from  $-1^{\circ}\text{C}$  to  $+2^{\circ}\text{C}$ , relative humidity 85 – 95 % and air circulation rate from 0.5 to 3  $\text{m}\cdot\text{sec}^{-1}$ . The higher speed of the air, the higher are weight losses. The time needed to maintain the temperature below  $+7^{\circ}\text{C}$  is 12 – 24 hours for pork carcasses, and 18 – 36 hours for beef carcasses. The average air temperature exceeding  $+4^{\circ}\text{C}$  (max.  $5.5^{\circ}\text{C}$ ) was recorded in less than half of measurements (7). Matyáš recommends application of fast chilling (temperatures about  $0^{\circ}\text{C}$ , or lower) together with rapid air circulation for longer shelf life and lower weight losses.

## CONCLUSION

Monitoring of the chilling process of pork (11 measurements) and beef (4 measurements) in slaughterhouses (5) in the Košice region in 2006 – 2007 was performed. For the measurements (temperature in the muscle, temperature in environment) the module ELPRO, type TN4 (Kucian, Switzerland) was used. In two cases (13.3 %), the temperatures in the muscles exceeded  $+7^{\circ}\text{C}$  at the end of chilling.

## ZUSAMMENFASSUNG

### BEOBSACHTUNG DES ABKÜHLUNGSVERFAHRENS VON SCHWEINE- UND RINDFLEISCH

Der Zweck der Abkühlung von Frischfleisch ist die Verminderung der Temperatur in den tiefsten Muskelteilen in möglichst kurzer Zeit, jedoch soll dabei das Fleischgewicht

in möglichst hohem Maße aufbewahrt werden. Doch, manche Gewichtverminderungen sind wünschenswert, weil die trockenen Flächen auf mikrobiologische Blutung widerstandsfähiger sind. In unserem Experiment wurde die Beobachtung des Abkühlungsverfahrens von Schweine- und Rindfleisch durchgeführt, dies in Schlachthöfen in der Zeitspanne von 2006 bis 2007. In den Abkühlungsräumen wurde die Temperatur in den Muskeln gemessen, in Betracht wurde auch die Dauer des Verfahrens gezogen. Am Ende des Verfahrens hat die Temperatur in zwei Fällen (13.3%) des frischen Schweinefleisches die verlangenen  $+7^{\circ}\text{C}$  in tiefen Muskelteilen überschritten.

**Schlüsselwörter:** Abkühlungsverfahren, Schweinefleisch, Rindfleisch

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▼ Figure 3. Chilling curve of beef carcass (thigh, measurement No. 1)

