BLAST CHILLING METHOD FOR MEAT DISHES COOKING

Baiba Gingule, Martins Rucins*, Viesturs Rozenbergs

*Latvia University of Agriculture, Jelgava, LV-3001 Latvia, Tel.63005647, *e-mail: martins.rucins@llu.lv*

Abstract

In order to ensure hygienic end-product realization, it is necessary as soon as possible to the chilling, using efficient methods, such as the blast chilling equipment. Blast chilling equipment provides food chilling, optimum, 90 – 120 minutes to +3°C, reaching an internal temperature of food, especially important to say, the perishable ready-to-eat product groups (first course, main courses and dressings, snacks), including meat dishes, which are used as a reference model in this study. Given the fact that in recent years, technology increasingly refuse from discrete point, switching to the fuzzy temperatures, a study was conducted as a separate meat dishes microbiological indicators, they are not chilling technology to the +3 °C and +7 °C and +11 °C. Research was carried out in Amica Ltd professional kitchen, using blast chilling equipment, and Microbiology Laboratory of Faculty of Food Technology, Latvia University of Agriculture. The study used two types of Amica Ltd catering companies more often used for meat dishes - pork goulash and minced meat sauce. Research results show that, by combining the food safety standards and cost-efficiency, chilling end temperature of blast chilling in the range of +3 – +11 °C, followed by further storage in freezer. It was recommended to stop the blast chilling +7 – +11°C temperature range, depending on the required shelf life for the finished product. It is therefore essential that the limit, to encourage the blast chilling process, reducing the length to be able to optimize the overall process.

Key words: chilling, blast chillers, ready-to-eat products

Introduction

Fast chiller as the method used in the world catering meals for more than 10 years, Latvian, this technique is used in recent years. In Latvia this technology gained popularity in recent years. It is related to the operation of the installation, production, knowledge which is needed to apply the equipment, as well as the Latvian accession to the European Union, which imposes requirements related to the food business involved parties. This is defined by Regulation EC Nr.2073/2005 The microbiological criteria for foodstuffs, the Regulation EC No. 852/2004 on the hygiene and food industry good hygiene practice guidelines for closed-catering, mobile and temporary facilities (General Legislation of ..., 2010).

The aim of research is to create innovative solutions for fast chilling processes in food services industry.

Microbiological hazards are the most common major source of food related disease and therefore the microorganisms in food may not be in quantities that pose risks to human health. (Marčenkova T., 2010; Effect of Bacterial Growth ..., 2010). Fast chilling is a way to reduce microbiological hazards in food. However, to cool the facility dishes are familiar, a chilling method used, because each dish has its own characteristics associated with both the food structure, the moisture content and production technology (Ruciņš M., 2001).

Previously we don`t have research on how the food is safe for the consumer if the food cool for a blast chilling to a temperature of +3 ºC and higher, reaching +10 ºC and more. There are also no studies on how the chilling temperature affect processing food shelf life. From a business perspective, it is important to minimize costs. Using a method that provides a specific time, as needed cook and cool, can reduce electricity costs.

Hot dishes can be cooled in two ways, through the fast chilling units and traditional to be refrigerated after cooking left to cool a cold water bath, in a container on the work tables, as well as some food companies are positioned on the sill and to which it is cooled at room temperature, placing them in cold rooms.

There are many reasons why chilling with the blast chilling equipment is needed, such as health security, the efficiency of the building.

Enterprise, using fast chiller equipment, organization of work is facilitated, prepare hot meals are chilled and can be stored up to 5 days in refrigerators. (Blast chillers ..., 2010). But good hygiene practice guidelines for closed-end catering companies determine if a company wants to set a longer shelf life, may be a microbiological testing laboratory where samples are removed from the dishes and found the microbiological parameters. Conversely, if the food is used for chilling the traditional method of chilling in a cold water bath or in specialized cells, for good hygiene practice guidelines for public catering enterprises, this must be done within 2 hours after cooking (Good hygiene practice guide..., 2006).
This means that each day is to prepare a particular dish, for example, in one day cooks goulash sauce not only for a certain day, but 2 or 3 days, it is cooled and placed in cold chambers. Cooking time will save about 30–50%. (Blast chillers..., 2010). By contrast, when preparing their own meals each day in small quantities, are consumed much more power and resources.

Materials and Methods

This study is based on two frequently used for meat dishes – minced meat souce and pork goulash cooked according to traditional technologies, professional pan Metos Futura. Technological research conducted Amica Ltd professional kitchen; microbiological analysis - Microbiology Laboratory of Faculty of Food Technology, Latvia University of Agriculture. Cooked foods quick blast chiller *Fast Friulinox* was used for chilling standard mode (hard), chilling the product of preparation (+82 – +84 °C) to a temperature +3 °C, +7 °C, and +11 °C. Product temperature inside the cabinet was detected by the built-in bimetallic thermometer (Irinox Blast chillers..., 2010).
For determination of the aerobic colony count (ACC) standard LVS EN ISO 4833:2003 "Microbiology of food and animal feeding stuffs. Horizontal method for the enumeration of microorganisms. Colony– count technique at 30 degrees C" was used. For isolation of the microorganism's cultures GPA medium was used. The standard method usage is required by Regulation of Eiropean Comission No. 2073/2005 on microbiological criteria for ready-to-eat foods (Regulation (EC) No.2073/2005).
Data processing is done with Microsoft Excel tools – average, standard error and graphics.

Results and Discussion

The study was conducted during the period from September 2010 to January 2011. In experiments using minced meat sauce and pork goulash, prepared according to a given technology. Ready meals placed in various GN containers of 1 kg at 6 and 2.5 cm thickness; fast chilling standard method (hard) with a chilling period of 90 minutes. The samples were chilled rapidly reaching the end temperature of +11 °C, +7 °C and +3 ºC and stored at 72 and 96 hours in a low constant temperature (+2 – +6 ºC).

Thickness of 2.5 cm

Chilling for 2.5 cm for is started, the food temperature is +7 ºC below normal (+70 ºC), which are chosen by the thickness of +63 ºC. Chilling process, the chamber temperature is -18º C, but after 15 minutes it rises to 0 ºC degrees. This temperature is maintained to 62nd minute, after that the cabinet temperature falls to -5 ºC, until the end of the cycle.
At the end of chilling process the food temperature has dropped to +9 ºC, that is not enough, therefore, is the reopening of the chilling cycle. The new chilling cycle is initiated by -5 ºC temperature in the cabinet. This means that the machine automatically sets the appropriate chilling temperature – the intensity depending on the temperature dishes (first chilling cycle was initiated with the -18 ºC). In the second chilling cycle, the cell temperature decreases from -5 to -19 ºC, until food temperature reaches +4 ºC. The total chilling time cycle is 106 min.

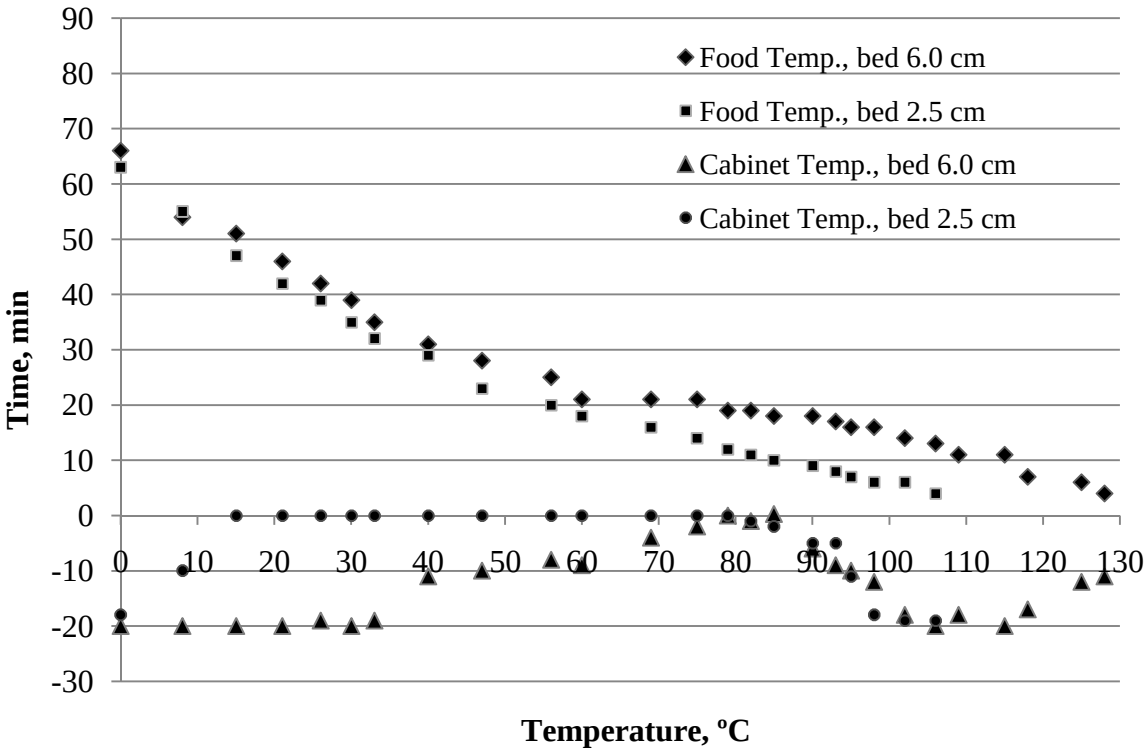


Figure 1. Changes of temperatures during food blast chilling process

Thickness of 6.0 cm

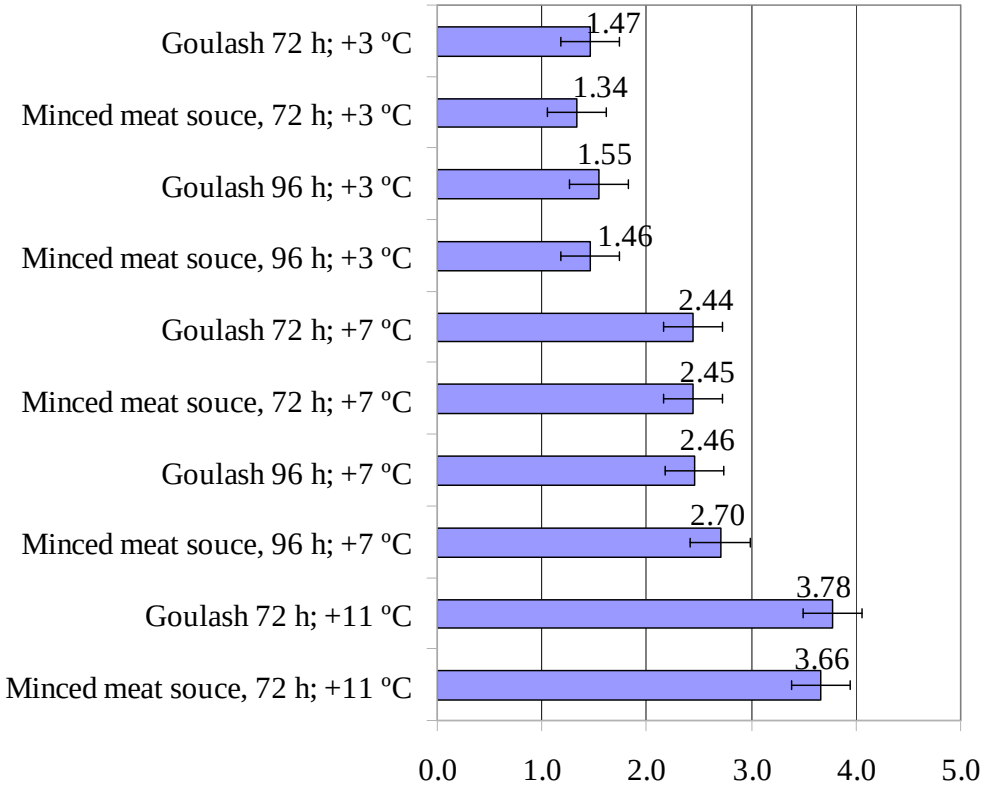
The temperature entering the chilling food is +81.8 ºC, what is 11.8 ºC higher than the recommended. Chilling process, the initial temperature of the chamber is -20 ºC, what persists to 25th minute, but installed by the end of the cycle method (90 minutes), the temperature in the chamber is gradually increased to 0 ºC, when installed on the expiry of 90 minutes, but after 90 minutes of chilling temperature of the food has to +18 ºC, which is not enough, therefore is repeated the cycle of chilling process. In the second chilling cycle in 11 minutes the cabinet temperature fall from -3 to -12 ºC, and then quickly goes down to -18 – -20 ºC. In this temperature the food is chilled 24 minutes, then it again rises to -11 ºC and chilling has been stopped because the food has reached +4 ºC temperature. The second chilling cycle lasts 39 minutes, but the total chilling time is 129 minutes.

A comparison of layers

Comparing the collected data, it can be concluded that the chilling influence of food start chilling temperature, and depth of food chilling container. At layer thickness 6 cm food beginning temperature is +80.3 ºC (the most by such temperature starts chilling, because the food in a blast chiller immediately after preparation), and the food is chilled in the temperature -20 ºC 35 minutes, but when the layer thickness of 2.5 cm and the food beginning temperature is +63 ºC, the food was chilled -18 ºC for only 15 minutes; after the chilling temperature is 0 ºC and only 90 minutes before the end of the cycle it will again fall to -5 ºC. Comparing the food temperature after 90 minutes chilling can be concluded that the layer thickness of 6 cm, whereas the +18 ºC, the layer thickness of 2.5 cm – +9 ºC, that is, two times lower.

The chilling intensity is different between the two studies – a layer of thickness 6 cm intensity is higher and the initial temperature is higher than the layer thickness of 2.5 cm. Continuing the chilling cycle after 90 min in both trials, the cabinet temperature falls to -20 ºC, but the chilling time at this temperature is different. At layer thickness 6 cm dish reaching +4 ºC,

temperature in the chamber once again rise to -11 ºC, but the layer thickness of 2.5 cm it is -20 ºC.
Chilling expectancy gap for both studies is 31 min. At layer thickness 6 cm dish was cooled in 129 minutes, but the layer thickness of 2.5 cm 106 minutes, both studies reach the same end temperature.
If the food to chill only to +11 ºC (as confirmed by microbiological studies), then a layer of thickness 6 cm requires 109 minutes, but at 2.5 cm requires only 82 minutes.
Storage and microbiology
Ready meals at the end of the chilling process (+11 ºC, +7 ºC, +3 ºC) were stored in refrigerators at +2 – +6 ºC degrees 72 and 96 hours.



Figigure 2. ACC average number of log CFU g^{-1} in minced meat sauce and pork goulash

The results (n = 15) shows ACC count, the total sample results are less than 10^4 CFU g^{-1}, but the disappointing results of the tests found two samples ($\geq 10^3$ CFU g^{-1}).
When stored samples are cooled to a final temperature +30°C, 72 hours, the average number ACC not exceed the limit – 1.34 log CFU g^{-1} minced meat and 1,47 log CFU g^{-1} pork goulash, which confirms the blast chilling equipment manufacturer's recommendations. Samples chilled to +7 °C ACC average number is about the same, within acceptable standards – pork goulash 2.44 and 2.45 log CFU g^{-1} of minced meat sauce. Analysis shows that the food may be chilled by the chosen technology.
Most microorganisms evolved in samples cooled to a final temperature +11 °C - minced meat sauce ACC is 3.66, but the pork goulash 3.78 log CFU g^{-1}. This is related to sensitive margin temperature (+10 – +60 °C) achievement of the development of microorganisms is to create a favourable environment. ACC average number of meals exceeds the limit, so after such a technology chilled foods considered to be microbiologically unsafe.
When stored samples 96 hours after chilling to +3 °C, ACC average number of appropriate (not exceeding 10^3 CFU g^{-1}) - figures are roughly similar to minced meat sauce and pork

goulash. Samples chilled to +7 °C over ACC is minced meat in a cream sauce – 2.7 log CFU g^{-1}. Minced meat sauce organisms evolved more, as this can be explained by different food pH environment. Minced meat sauce environment is neutral, as for food technologies sauce add cream, but the pork goulash environment is more acidic.
Survey data show that the prepared meat dishes (pork goulash and minced meat sauce), which are prepared by the process, rapidly chilled and stored in a low 72 and 96 hours, the test meets the criteria used for the study, if the chilling end temperature does not exceed +7 °C. Dishes, which are chilled to the final temperature of +11 °C, it is recommended to realize a shorter period of time, up to 48 hours.

Conclusions

1. The study confirms that the company may be stored for goulash, minced meat sauce up to 96 hours in refrigerators and those ready-to-eat meals are microbiologically safe, if the preparation is rapidly chilled end temperature of +7 °C and +3 ºC.
2. Investigated food is microbiologically safe for the consumer, where it is chilled only to +11ºC current notional location (+3 ºC). Dishes, which are chilled to +11 °C is recommended to realize a maximum of 48 hours.
3. Blast chilling process, and finished dishes chilled +11 ºC, the chilling time is reduced by an average of 24 minutes (22%) to the finished dish a layer thickness of 2.5 cm and about 19 minutes (15%) at a layer thickness 6 cm, which allows blast chilling to optimize the overall process.
4. Storing ready-to-eat dishes until 4 days to provide the necessary storage conditions: constant temperature (+2 – +6 ºC) in a closed container in which the finished dish placed to prevent any contamination.

References

1. Blast chillers. Source: http://www.traulsen.com/Products/Blast-Chillers/Blast-Chillers/; resource used on 18.01.2011.
2. Effect of Bacterial Growth on the Shelf-Life of Meat and Meat Products. Source: http://www.fao.org/docrep/004/t0279e/T0279E03.html; resource used on 19.10.2011.
3. General legislation of Food Industry. Source: http://www.zm.gov.lv/index.php?id_=1496&sadala=553; resource used on 25.01.2011.
4. Good hygiene practice guide for public catering enterprises (2006) Zemkopības ministrija. Source: http://www.zm.gov.lv/doc_upl/vadlinijas2.pdf; resource used on 15.01.2011.
5. Irinox Blast chillers and shock freezers: Locking in taste, texture and flavour. Source: http://www.starchefs.com/product_education/irinox/blast_chiller_shock_freezer/html/index.shtml; resource used on 18.01.2011.
6. Marčenkova Tatjana. Microbiological Criteria for Ready-to-Eat Foods. Doctoral Thesis for aquiring the Doctor's degree of Engineering sciences in sector of Food Sciences. (2010). Jelgava: LUA, P 176.
7. Regulation (EC) No.2073/2005, on Microbiological Criteria for Foodstuffs (2005) European Union Law, L 338, 22.12.2005., P 1.–26.
8. Ruciņš Mārtiņš. Sabiedriskās ēdināšanas uzņēmumu iekārtas: No idejas līdz tās realizēšanai [Foodservice Equipment: From an Idea to It's Realization]. (2001) Jelgava: LUA, P 918.