

## Chilled chicken, very cool!

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*Poultry meat is very healthy and nutritious food but it can also be an extremely good medium to grow micro-organisms. Therefore, in Indonesian circumstances warm poultry meat should be cooked within a few hours after slaughter to prevent consumers from getting food poisoning. With the high temperatures and humidity in Indonesia, poultry meat can become unsafe for human consumption after 4 to 5 hours. Adequate chilling after hygienic slaughter can considerably extend the shelf life of raw poultry meat to up to several days after slaughter. Adequate chilling means that the temperature of poultry carcasses (on the outside and deep inside) should be below 4 °C within 4 hours after slaughter. To chill poultry carcasses three methods can be used: immersion in iced water, spraying with cold water, and cooling with cold air. In hot climates and for small to medium sized poultry slaughter plants, chilling by immersion in iced water is the most effective and cheapest solution. Poultry meat of which the temperature has not been below -2 °C can be sold as 'fresh' chicken meat and does not have to be labelled as "deep-frozen".*

*In this leaflet we would like to inform you on the current and desired chilling practices of poultry carcasses in Indonesia.*

**DIFS-Live** is a cooperation between the Indonesian Ministry of Agriculture and the Embassy of the Netherlands in Jakarta. Together they promote food security and private sector development in the Indonesian livestock sectors. The project focusses on the poultry and dairy sectors in West Java. Both sectors face challenges in terms of meeting the growing demand of urban consumers in an efficient and sustainable way.

DIFS Live is implemented by Wageningen University & Research together with public and private stakeholders in the supply chain. Together they build viable models for the production and supply of affordable, nutritious and safe chicken and dairy products. DIFS Live has 4 major areas of intervention: (a) promoting consumer acceptance of cooled chicken meat; (b) improving poultry slaughter practices and cool chain management; (c) raising productivity and income of broiler farms; (d) improving the dairy feeding practices.

### Current situation in poultry slaughter

About 75% of the total Indonesian poultry production is slaughtered manually in small scale slaughter locations. Generally, these slaughter locations do not have chilling facilities. They slaughter during the night to be able to sell the warm carcasses at the traditional market in the early morning next day. Due to traffic problems, there is a serious risk that the time between slaughter and cooking of the poultry meat is too long (exceeding 4 to 5 hours) to guarantee safety of the poultry meat.

About 10% of the production is slaughtered in medium sized slaughter plants or at governmental slaughter locations. On most of these locations, chilling of slaughtered poultry is possible. However, this is in general only done with carcasses that are destined to be deep-frozen. Only a few slaughter locations produce chilled, fresh poultry meat.

About 15% of the production is slaughtered in modern, fully certified slaughter plants. In these

plants, chilling is standard procedure and according to HACCP standards.

### Current chilling practices

Students of IPB, under supervision of Professor Denny Lukman, examined the chilling process at three locations (X, Y, and Z) in Jakarta and Depok in November and December 2016. They visited the locations every week for 8-10 weeks and measured the temperature of carcasses, slaughter rooms and chilling water. At these locations, chilling was done in a water tank cooled with lumps of ice.

Their findings were quite disconcerting; in the hundreds of carcasses they measured at the three locations, an adequate temperature was never found. None of the carcasses had an interior temperature below 4 °C. In most carcasses, the temperature after cooling was far above the temperature required to be considered as safe poultry meat. Please refer to the following website for the full report: <http://www.difslive.com/wp-content/uploads/2017/03/DIFS-REPORT-on-cool-chain-monitoring-in-jakarta-march2017-def.pdf>

Table 1 provides an overview of their findings averaged across weeks.

	Average temperature (°C)		
Location	X	Y	Z
Water chilling tank	11.9	11.0	13.5
Carcass, deep inside	18.8	12.6	15.8
Carcass, skin	16.2	19.3	19.1

	Minimum temperature (°C)		
Location	X	Y	Z
Water chilling tank	6.5	5.9	13.5
Carcass, deep inside	10.0	7.4	13.9
Carcass, skin	10.3	7.6	15.4

Table 1. Average and Minimum temperature in chilling water and carcass in three slaughterhouses.

### Impact of storage temperatures and contamination level at the start of the chilling process on the safety of poultry meat

Figure 1 shows the importance of correct, low storage temperatures for the shelf life of poultry meat. The data in Figure 1 are based on poultry slaughtered with a high level of hygiene resulting in clean carcasses with low contamination levels.

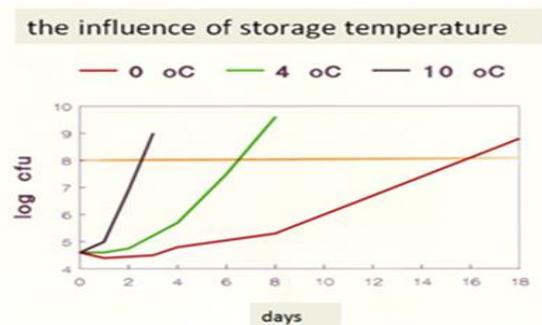


Figure 1: Relation between temperature of the carcass (0, 4 or 10 °C) and shelf life in poultry. At 10<sup>8</sup> CFU the meat is unfit for human consumption due to spoilage bacteria (Bolder, personal communication).

As can be seen from Figure 1, with clean carcasses and carcass temperatures continuously below 4 °C, meat can be safe for human consumption up to 6 days after slaughter. However, keeping clean carcasses at 10 °C will result in chicken meat that becomes unsafe for human consumption within 48 hours.

Based on the observations of the project team, it is very likely that broilers slaughtered in small scale and medium sized slaughter plants in Indonesia start at a much higher level of contamination. This higher level of contamination prior to chilling, combined with the high observed temperatures in the Indonesian situation, implies a much shorter shelf life than 48 hours for most carcasses. It is therefore important to work hygienically to get clean carcasses and to chill them rapidly.

### How to chill poultry meat properly?

A practical way to chill poultry meat and increase hygiene is a two-step washing and chilling procedure. Immediately after evisceration, carcasses should be washed and pre-chilled by spray-washing. After being spray-washed they can be placed into a tank filled with a mixture of water and slush ice. The water temperature in this tank should always be around 0 °C. In this tank the carcasses are chilled to a temperature below 4 °C. A rule of thumb is that around 1.5 l/carcass is required for spray-washing and at least 1 l/carcass for chilling. Chilling is fastest in a mixture of about 70% slush ice and 30% water. For effective chilling, the ice should be processed into shivers. Lumps of ice are far less effective.

The time to chill carcasses properly in the tank depends on the agitation of the ice/water mixture. Agitation can be provided by inserting compressed air at the bottom of the chilling tank. Without agitation it takes more than 60 minutes to chill a carcass properly; with agitation the chilling time can be reduced to 30-40 minutes.

A very effective way for chilling is to have a counter current in the chilling tank resulting in the movement of carcasses in one direction and of the chilling water in the opposite direction. The advantage of this method is that the water is coldest and cleanest where the carcasses leave the tank. Such a system requires a kind of spin chiller and is more suitable for medium sized slaughter plants (see Figure 2).

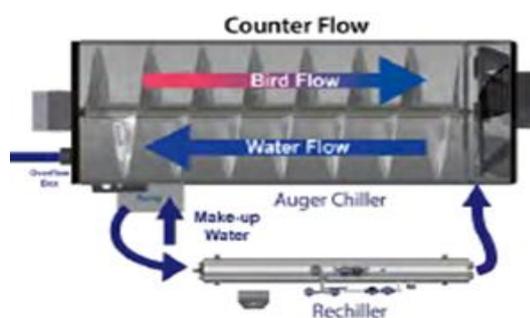


Figure 2: Principle of counter flow two step chilling of poultry in a spin chiller system (from Barbut, 2015).

A blast freezer to chill poultry is not a good idea if the meat has to be sold as “fresh”; although the desired temperature of below 4 °C of the inside of the carcass can be achieved by storing in a blast freezer, the outside of the carcass will be frozen. This will reduce the quality of the poultry meat.

### What after chilling?

After letting the carcasses drip for a short period, they can be packed in plastic bags, preferably in a cooled room, and be stored in a cold storage that has temperatures of between 0 and 4 °C.

If the carcasses have to be cut up and marinated, a cooled room becomes a must. The temperature of the carcasses should stay below 4 °C when they are cut up and marinated. Chilled carcasses are also suitable for deep-freezing. To do so, they have to be placed in a blast freezer and kept deep frozen at temperatures below –18 °C.

### How to check if chilling is done properly?

With rather complicated formulas it is possible to calculate chilling time dependent on the type of tank, the weight of the carcasses, and the amount of ice and water used. However, it is preferred to continuously evaluate the chilling process in the slaughter plant and adjust according to the findings. The quality manager can be made responsible for the evaluation of temperature of the carcasses.

Evaluation of the chilling process can be done with a standard digital food thermometer which can be purchased for 300-500.000 IDR (see Figure 3).



Figure 3: examples of thermometers, to check the temperature of carcasses.

With this device, the temperature of a number of carcasses can be measured by placing the device under the breast meat against the breast bone. The temperature of the ice/water mixture can also be measured with the thermometer. If the temperature deep inside the carcasses is measured at below 4 °C, than the chilling process is considered as satisfactory. If the temperature is measured at above 4 °C while the temperature of the ice/water mixture is between 0 and 2 °C, then it can be concluded that the carcasses have been chilled for a too short period. Either the chilling time needs to be increased and/or the agitation in the chilling tank needs to be increased. If the ice/water mixture is too warm, i.e. above 2 °C, it should be checked whether ice shivers were used (no lumps) and whether sufficient ice was added. Of course, all temperature measurements should be logged to be able to show customers the reliability of the chilling process. This can be done in writing in a logbook or electronically in a computer file (e.g. Excel). The logging and filing of temperature data has to be done continuously, even if the quality manager is experienced and is able to adjust the chilling process just by looking and feeling.

### Hygienic slaughter is crucial

For good quality chilled poultry meat slaughter should be hygienic. This implies that clean water (drinking water quality) for spray-washing and chilling should be used, good quality of ice that is stored and chopped in a clean spot, carcasses should not be laying on the floor but instead only on ceramic or stainless steel tables. In addition, workers should: wear protective and clean cloths dedicated for poultry slaughter, wash their hands before and regularly during works, not smoke during work, clean knives, eviscerate in a correct manner to prevent contamination of the carcasses with manure.

In a next leaflet we will provide more information on hygienic slaughter.

### Further reading

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