

Research Shows Better Way of Storing & Displaying Meat, Poultry and Seafood

A recent research work, fully accepted and published in the journal *Food Control*, has shed some new light on the matter of which display case technology is best.

Today's world of food retailing (grocery stores, supermarkets, etc.) is proving more competitive and complex to operate than ever. Fresh food product categories—fruits and vegetables, meat, fish, dairy, and baked goods—amount to 40% or more of the retailer's sales¹. These items typically stand at the forefront of creating and maintaining store traffic, and inevitably, return customers (customer loyalty). Fresh food, however, has always been exceedingly complex for food retailers to manage with the perishable nature of the products serving as a major factor. Driving this deeper is the rising consumer demand for retailers to carry an ever-expanding range of fresh products. Considering these challenges, many food retailers struggle to achieve satisfactory margin levels in their fresh departments. Adding further to this is the ever-increasing scrutiny on food safety in an effort to avoid any incidence of foodborne illness. Such problems can have devastating monetary business and legal consequences for a food retailer.

With these challenges in mind, food retailers are taking steps to protect and increase their margins and competitive position. Generally speaking, perishables departments (e.g., meat) represent much higher gross margins for the retailer than most other departments. Perishable foods are stored and merchandised in refrigerated display cases. So, it comes as no surprise that food retailers are turning their attention to these display cases to see what opportunities exist that would yield incremental improvement, such as increased product shelf life, improved product quality and appearance, and decreased product shrinkage (loss of weight over time).

¹ Why Retailers Are Keeping It Fresh, Nielsen, 2013

A recent research work², fully accepted and published in the journal *Food Control*, has shed some new light on the matter of which display case technology is best for achieving these improvement goals when the product involves beefsteaks and chicken breasts.

Shelf life³ is defined as the time a food product retains its desired sensory, chemical, and physical characteristics while also remaining safe for consumption. Bacteria associated with meat spoilage produce off-odors and flavors, tissue discoloration, gas, and slime. This can cause a variety of adverse issues for a food retailer, not the least of which is a loss of sales revenue. The objectives of the *Food Control* study were:

1. Determine the effect of refrigerated display case type on the shelf life and microbial load of beefsteak and chicken breasts, and;
2. Evaluate the effect of a gravity coil conductive cooling case vs. complete conductive cooling case on the growth of *Escherichia coli* K12 artificially-inoculated onto beef steak.

Beefsteaks and chicken breasts were placed for 5 and 8 days, respectively, in four types of commercially-available refrigerated display cases utilizing either convective, conductive, or a combination of the two cooling technologies.

Specifically, the four refrigerated display case technologies studied by ISU were:

² Food Control: Evaluation of Shelf Life and Quality of Beef Steaks and Chicken Breasts in Refrigerated Display Cases Using Four Unique Cooling Technologies; completed by the Polymer and Food Protection Consortium at Iowa State University, 2018

³ Sun and Holley, 2012; Delmore, 2009

1. Conduction Cooling Gravity Assist Service Case (CCGA)
2. Gravity Coil Service Case with Partial Conduction Coil Base Deck (PCC)
3. Gravity Coil Service Case with Serpentine Assist (GSA)
4. Blower Coil Service Case with an Additional Fogging System (BCF)

Bacterial counts on meat surfaces, meat color, internal meat temperature, case temperature, case relative humidity and product weight loss were assessed daily for all four types of the refrigerated display cases. Among the notable differences between the four case technologies studied in areas that would most directly impact product integrity and meat quality were:

1. Internal beefsteak meat (product tissue) temperature varied between 36.95 °F and 39.90 °F (2.75 °C and 4.39 °C) with the lowest temperature reading belonging to the conductive cooling CCGA case while the warmest tissue temperatures tended to occur when the cuts were placed in the PCC (Gravity Coil Service Case with Partial Conduction Coil Base Deck) case. The chicken breasts mirrored these results.
2. Product weight loss (shrinkage) was notably lower in the CCGA conductive cooling case than in the other three display case technologies evaluated.

The Conduction Cooling Gravity Assist Service Case (CCGA) technology did maintain the lowest internal product tissue temperature of the beefsteaks and chicken breasts compared to the other cooling systems even during compromised cooling conditions such as doors left open during peak summer months. This is driven in large part by the fact that the CCGA's conductively-cooled design creates a "microclimate"⁴ at the product's surface which keeps temperature at the proper level while elevating the

⁴ The Free Dictionary, 2018

relative humidity to minimize any moisture losses in the product tissue. A “microclimate” is defined as the climate in a small, specific place in an area as contrasted with the climate of the entire area. This is key since meat product temperature has perhaps the most profound impact on restraining bacterial growth and preventing the growth of food-borne pathogens. The approximately 3 °F differential measured in the beefsteak product temperature between the CCGA and PCC cases may not seem like a big number at first sight, but it is very significant when it comes to the pathogen modeling and growth potential of harmful microorganisms (bacteria). Shelf life can be lengthened by properly controlling the temperature of the meat.

Besides the notable advantage of lower product tissue temperature, the CCGA conduction cooling case realized benefits from its ability to keep relative humidity at properly elevated levels and minimize decreased product weight due to moisture losses. The steaks lost more weight when held in the PCC case (the closest competitor to the CCGA case) and therefore exhibited a higher product shrinkage. By day 8, steaks held in the PCC case had lost 10.8% of their weight compared to 9.7% for steaks held in the CCGA case. Steaks lost more weight each day they were held in the PCC case than the CCGA case except on day 8, where steaks in both cases lost the same amount of weight. Weight loss from meat is an important economic factor because meat is sold on a basis of unit weight.

The *Food Control* study concluded that the Conduction Cooling Gravity Assist Service Case (CCGA) utilizing pulse-flow coolant control, through its creation of a microclimate controlling temperature and relative humidity at the product surface, was superior to the other three technologies studied in its ability to create a favorable climate for the product integrity and safety of meat products.

This should be of great interest to food retailers since it represents a most tangible means of both operational and cost improvement for their stores.