

## Processed Meat Products for Asia

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## Introduction

One way for the New Zealand meat industry to increase export earnings is to develop innovative products or products that meet an existing demand but are not currently produced in New Zealand. Asia is undergoing strong economic and population growth and as a result eating habits are changing, including increased consumption of red meat. In 1988, Korea began liberalizing meat imports; in 1991 some beef by-products were liberalized and since then imports of intestine, tongue and stomach have increased dramatically. This liberalization has created market opportunities for New Zealand meat products. Two market surveys were done: one in Korea to identify the market opportunities for meat by-products, and one in Japan, Taiwan, Singapore and the Philippines to identify possibilities for meat-based snacks for Asia. Seven products were then developed, in consultation with New Zealand companies interested in marketing products in Asia.

## Methods

**Surveys:** To identify the various animal offals consumed in South Korea, personnel from the Korean meat industry, restaurants, and wholesale and retail outlets in both Seoul and Busan were interviewed. Beef offals were mainly discussed because beef is the main New Zealand meat export to Korea. Koreans do not like the strong flavours likely to be present in sheep offals. Based on the findings, beef bone broths, cleaned stomach products and dried beef granules were developed. In the second survey, information on meat-based snack foods was obtained by visiting various retail outlets in the four survey countries. Samples of the various snack foods were brought back to New Zealand for assessment, and literature searches were done to identify trends in eating habits, possible products and their recipes, and trade barriers (Swan and Nicholls, 1995; McBeth, 1996).

**Product development:** Product types were identified from the surveys that had good market potential. Specific products were then developed using New Zealand materials. The product development plan involved developing product specifications, developing a range of prototype products on a bench-scale basis, product evaluation, and appropriate product modification. The resulting prototype products were then considered ready for market testing. The following products, except stomachs, were manufactured in the MIRINZ export licensed packhouse using fresh and frozen lean beef, hearts, livers and tongues obtained from an export meat plant.

**Beef bone broth:** Bone broth recipes were developed in collaboration with local Korean immigrants to develop a thick, white broth suitable for the Korean market. In the final process developed (Mikkelsen, 1996), frozen leg bones from grain-fed steers were cut into 20-mm to 40-mm thick pieces and then soaked in iced water overnight. The leach water was discarded and the bones were rinsed three more times with cold water to remove any extra blood. The cleaned bones were simmered in water (ten times the weight of bones) for 1 h, then the liquid was discarded. The bones were re-rinsed with cold water and simmered in fresh water (ten times the weight of bones) for 10-12 h until the liquid was reduced to approximately 20% of the original volume. The concentrated broth was strained, canned and re-ported at 1 bar for 15 min.

**Stomachs:** Six methods were tested to clean four different parts of the stomach: the conventional New Zealand process, in which rinsed tripe is washed in an abrasive agitator with 65°C water, followed by a hot alkaline wash with bleaching agents, then a cold water rinse; the same method using 20°C water; soaking in water; soaking in 0.1% (v/v) Multifect® P-3000 enzyme solution (Genencor® protease, Enzyme Services, Auckland); soaking in 2% w/v sodium percarbonate bleach solution; and soaking in 2% (w/v) salt solution. The last four treatments were done at 50°C, a temperature that did not cook the stomachs. The cleaned products were then rinsed in cold water before sensory assessment for colour, texture and odour. The colour of both sides of the washed tissue was then reassessed using a Hunterlab Miniscan.

**Dried granules:** Trials were done to determine the proportion of raw materials needed to produce free-flow dried beef offal granules of the desired consistency, appearance and taste. The effect of pre-cooking the offals in vacuum bags before mincing was also investigated. The effect of type of packaging and storage temperature/time on the ability of the granules to remain free-flow was also investigated. Samples were sent to a meat export company for assessment and market testing. The process was then scaled up and larger quantities of product were manufactured.

**Snack foods:** Four meat-based snack foods were developed from beef insides, although knuckle, eye round or other large, lean muscle cuts could have been used. Boneless trim from both grass- and grain-fed beef was used, with the latter being included in the formulation to mask the grassy flavour that Japanese consumers find undesirable. The four foods were as follows:

**High sugar dried beef (sweet beef):** This product mimicked "sweet pork", a snack very popular in Singapore. Lean beef was cut into cubes, cooked in a small amount of water, then simmered in the leftover meat juice and high sugar marinades (to reduce the water activity and make it soft and sweet) until most of the liquid had evaporated. The marinated beef was placed onto trays and dried.

**Soft beef jerky:** Several traditional jerky recipes were modified and a two-step drying process used to produce a sweeter, softer jerky than the traditional product.

**Mini snack sausages:** The composition of samples of Japanese mini sausages was determined. Information from both the literature and previous developments at MIRINZ was used to produce a mini snack sausage formulation that replicated the imported sausages. The sausages were either smoked (using liquid or natural smoke) and cooked or just cooked. They were then chilled, vacuum packed and frozen. When sold at retail, the mini sausages would be thawed and then placed in vertical refrigerator displays common in Japanese convenience stores and supermarkets.

**Meat-based snack cracker:** The recipe for a basic Kerepok, a fish cracker popular in the Philippines, was used to develop a meat cracker. Trials were done to determine the effect of different ratios of finely minced beef, gelatinized starch and water on product quality. The mixture was dried and then cooked in hot oil to form an extruded cracker.

Informal sensory trials on all snack products were done in the test kitchen at MIRINZ. After making modifications, sensory evaluations were done using ethnic panels from the local community or by sending samples to the specific countries. Accelerated storage trials were done to investigate product shelf life. Samples of the final products were then sent to New Zealand companies interested in marketing products in Asia.

## Results and Discussion

**Korean products:** Background information on the work developing meat by-products for South Korea, including traditional recipes and commercial preparations, is presented in Swan and Nicholls (1995). Traditionally, Koreans eat almost all the by-products from cattle because they believe these products have medicinal effects and are very nutritious. Favourite beef by-products include bones for soup (tail, knee bone and leg bone) and offals such as varieties of stomach (tripe, mountain chain or rumen pillar, honeycomb), intestine, and tongue. Koreans believe that chilled by-products from domestic beef have better sensory qualities than frozen or imported by-products, and Korean by-product importers believe that domestic by-products are the most tender, followed by those from grain-fed beef (usually from the USA). By-products from grass-fed beef are considered thick and tough. However, restaurants and large by-product end users prefer imported by-products because of their lower cost and convenience. There is a potential market in Korea for the following products that could be made from New Zealand beef by-products: cleaned stomachs (tripe, mountain chain and other stomach parts), tongue, intestine, prepared soup stocks, dried soup bases, and marinated and/or pre-cooked offals for domestic and restaurant use. Once imports have been liberalized there will be a potential market for large and small bones suitable for making soup (Swan and Nicholls, 1995).

In this study, beef bone broth, cleaned stomachs and dried granules were investigated as potential products to be exported to Korea. With bone broth, whiteness is a major factor in Korean consumer acceptance. Both the number of extractions and the cooking time influence broth colour. Preliminary trials showed that using a single extraction resulted in a green/grey, which became darker and more viscous with further concentration. It is important to maximize extraction without letting the product get too dark, and so soaking the bones prior to cooking and the double extraction process used in this study ensured that the broth had the creamy white colour the consumer wants. Adding spices also affects broth colour. Currently, most of the broth sold in Korea is bone broth with no added spices. The consumer usually adds the spices after buying the broth. The challenge is to develop a product with added flavour ingredients desirable to the consumer without imparting too much colour to the broth.

When cleaning stomachs for the Korean market, the wash water temperature must be low enough to maintain raw characteristics, as Koreans often prefer to eat stomach raw. Green film from the internal walls of cattle tripe could not be removed with a cool water/short time wash. However, much of the film could be removed using 50°C water and longer wash times. About half the film was removed using enzyme at 50°C. A sodium percarbonate wash removed the film but made the stomach texture mushy. Washing with a 2% salt brine fixed the green film to the stomach walls. More work needs to be done to produce an acceptable product for export to Korea.

To produce free-flow dried granules, a specialized holeplate, spacer bar and sweeper arm were designed, to produce even-size granules of the size and appearance required by the market. Moisture content is a critical factor when producing free-flow particles. The best product was obtained when strips of cooked offals or lean meat were pre-dried in a hot air smoker/dryer for 1 h, then chilled before being minced for the final drying. Because the different types of offals (liver, heart, tongue) have different drying characteristics, they had to be pre-cooked and pre-dried separately, although they could be mixed together for the final mincing and drying. The resultant dried granules were 2-3 mm in diameter, and only a small amount of fines was produced. Even though the drying process had several stages, the colour of the resultant granules was similar to that of the sample provided.

**Asian snack foods:** The high sugar dried beef had a higher water activity than expected and the process used was time consuming and would not be commercially viable for producing a snack product. Therefore, product development was abandoned.

Three varieties of soft beef jerky were developed: smoky, honey and spice, and Mexican. All three recipes had high sugar levels with various levels of sweetness. Because the sugar levels differed, the three varieties had different drying times. The jerky was dried to a water activity of 0.78 or less. Results from initial accelerated storage trials indicate that the jerky products should have a shelf life of at least one year if they are packed to 90% vacuum and there is an oxygen scavenger in the pack.

Including grain-fed beef in the mini sausage formulation made the product more acceptable, as did using sheep casings. To obtain a suitable storage life that allowed for shipping to Asia, the finished sausages were cooked, vacuum packed and frozen. Once on display in the supermarket, convenience stores or other retail outlets, the thawed product would have a shelf life of 1-3 weeks in chilled storage.

With the meat cracker, it was important to maximize meat content; the optimum product developed contained 30% meat. The product developed can be sold either in an expanded form (in packaging similar to that for potato chips or biscuits) or unexpanded. The buyer would need to cook the unexpanded product before it could be eaten, and cooking instructions would be on the back of the pack. The unexpanded version of the product had a very low water activity, with an estimated shelf life of at least 1-2 years. However, the expanded product would have a much shorter shelf life, even if stored in modified atmospheres in impermeable film, because rancid flavours (due to fat oxidation) are likely to develop.

## Conclusions

Producing edible meat by-products for the Korean market and meat-based snack foods for Asian countries is one way of increasing export returns for New Zealand meat. Tremendous interest from various meat companies and the media was generated when reports of these studies were released to the general public. As a result, two companies interested in marketing offals and offal-based products to Korea liaised with MIRINZ to pursue their interest, and three snack products are undergoing further development and testing by three other companies interested in their export.

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