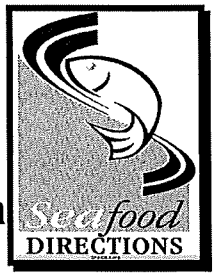
Development of Tuna and Swordfish Kebabs

By *Seafood Directions Pty Ltd*
For *DeBrett Seafood Pty Ltd*

SEAFOOD SERVICES
AUSTRALIA
Product & process development

Seafood Services Australia
Project 1998/484



CONTENTS

EXECUTIVE SUMMARY 1
INTRODUCTION 2
OBJECTIVES 2
METHODS 2
RESULTS AND DISCUSSION 3
CONCLUSION 5

APPENDIX I: KEBAB MANUFACTURING EQUIPMENT 6
APPENDIX II: KEBAB PRODUCTION 7
APPENDIX III: PACKAGING STYLES EVALUATED 9
APPENDIX IV: CRYOGENIC FREEZING PROFILE OF A 100G KEBAB 10

EXECUTIVE SUMMARY

Tuna, swordfish and marlin kebabs were launched onto the Australian Domestic market at the wholesale level in December 1999. Two types of kebabs, Frozen and Chilled, are packaged in 50 x 100g portions. The chilled kebabs are sold interleaved in a polystyrene esky with a specially designed sleeve and insert. Packaging for frozen kebabs is yet to be finalised but will be similar to the chilled product.

Kebab manufacturing equipment was sourced and evaluated. A fully-automated system such as the Koppens VMS Former was considered an overcapitalisation for anticipated production volumes. A manual system, the 18134 stainless steel kebab maker, imported from the UK by Lesnie's Pty Ltd appeared more appropriate for the anticipated volumes. Market reaction to the kebabs produced through this system was mixed. Some customers preferred a more 'natural appearance' over the 18134 Kebab Maker's uniform appearance.

Three methods of kebab manufacture are presently used including:
1. Cubes hand cut and placed onto skewers.
2. Cubes produced in the 18134 Kebab Maker then hand placed onto skewers. and
3. Kebabs produced through the 18134 Kebab Maker.

Methods 1 and 2 produce a 'natural appearance'.

The development of frozen tuna kebabs was unsuccessful as was the vacuum and skin packaging trials. In all instances the tuna flesh degraded to a brown colour which was deemed unsuitable for the market. The skin packaging also proved unsuccessful due to the difficulty in removing the kebabs from the laminate skin. Shrink wrapping was deemed unnecessary and costly for the wholesale market, but will be re-evaluated if kebabs are launched onto the retail market.

Due to logistical difficulties, the cryogenic tunnel freezer was replaced by a duel cryogenic batch freezer and optimal freezing times re-evaluated. A freezing time of 11 minutes at -50°C produced optimal equilibrium temperatures of -20°C.

INTRODUCTION

Funds were allocated by the National Seafood Centre (NSC) for an investigation into the processing and development of tuna and swordfish kebabs. Seafood Directions Pty Ltd, a food consultancy company, was employed to conduct this investigation.

OBJECTIVES

1. To source a processing method to produce kebabs.
2. To develop kebabs suitable for the domestic market.
3. To investigate / design packaging suitable for the market.
4. To determine optimum freezing times for the kebabs through cryogenic freezing.

METHODS

1. Food manufacturing equipment companies were contacted to evaluate types of equipment available for the manufacture of kebabs. This equipment was evaluated for suitability of purpose by management at De Brett Seafood Pty Ltd.

2. Kebabs were developed using off cut from the loining operation. Development involved investigating skewers types, kebab sizes (weight and length) and fish cube dimensions.

3. Packaging samples were developed using several typical packaging forms; polystyrene packs, specialised cartons, vacuum packaging, skin packaging and shrink packaging. Samples were evaluated for suitability of purpose by management at De Brett Seafood Pty Ltd.

4. The freezing time temperature profile was determined using a *Tinytalk* temperature data logger from Hastings Industries and a computer generated cascade program supplied by BOC Gases. The temperature probe was inserted into several cubes simulating a kebab. The tip of the probe was inserted into the centre of a cube of fish 2 x 3cm.

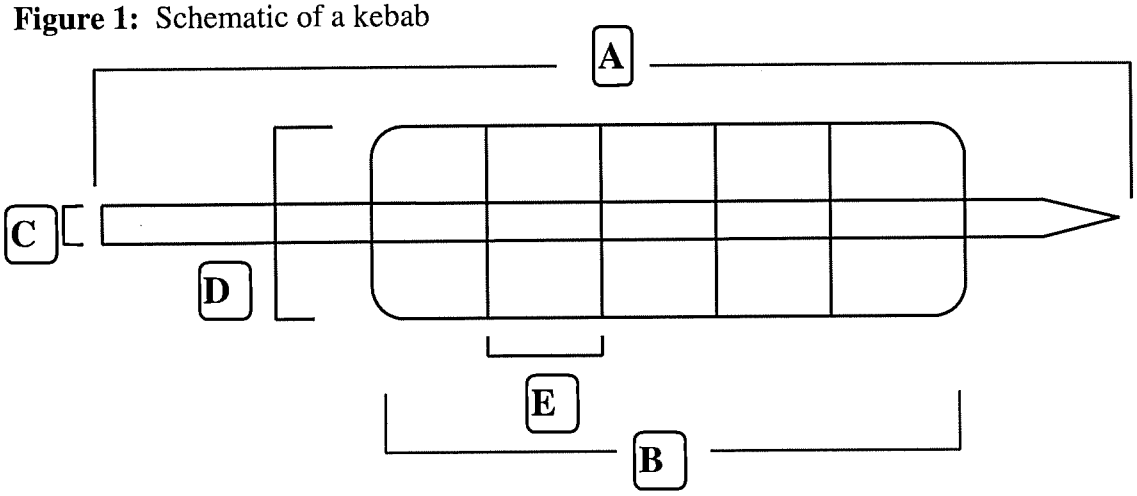
RESULTS AND DISCUSSION

1. Appendix 1 contains a list of food manufacturing equipment companies surveyed and their available equipment. Given the cost parameters, production rates and estimated quantities of raw material, management at De Brett Seafood believed that a fully-automated system was unwarranted and decided to purchase a 18134 Kebab Maker imported from the United Kingdom by Lisnie's Pty Ltd. The 18134 Kebab Maker has the ability to produce 3 sizes of kebabs (approximately 80, 90 and 100g) in 2 quantities, 48 or 96 kebabs at one time.

2. Appendix 2 contains pictures of the production of kebabs using the 18134 Kebab Maker. Off Cuts are layered into the camber of the 18134 Kebab Maker. When the chamber is full, a lid is press locked onto the flesh and skewers are inserted. A long-bladed knife is inserted into gaps in the chamber walls cutting the flesh into 2 x 3cm cubes. The chamber is then removed and the kebabs separated. Trials indicated that if the 18134 Kebab Maker was placed into a freezer for approximately 1 hour, the kebabs separated more easily thus reducing loss.

   Natural cut kebabs and kebabs produced through the 18134 Kebab Maker were presented to the market. Customer reaction was mixed, with many stating that the natural cut kebab was superior in appearance despite inconsistent dimensions. A combination of cutting cubes in the 18134 Kebab Maker and inserting these cubes onto skewers by hand was considered appropriate. The dimensions of the kebab are represented in Figure 1.

Figure 1: Schematic of a kebab



A	Length of skewer	240mm	**D**	Thickness of meat component	2.5 - 3.0cm
B	Length of meat component	130 - 150mm	**E**	Length of cubes	2.0 - 2.5cm
C	Thickness of skewer	4mm			

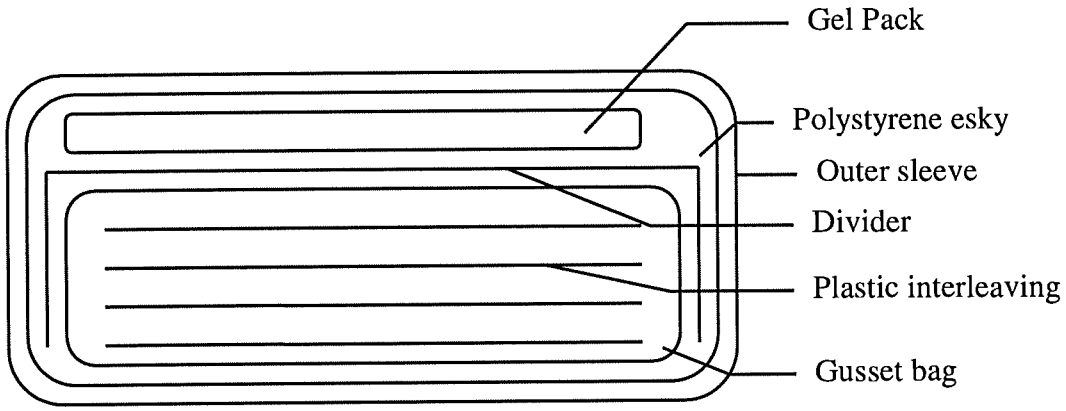
Weight of kebab - 100 - 110g

3. Trials were conducted on several forms of packaging both for bulk packs and for smaller retail packs. Appendix 3 outlines the styles evaluated and conclusions.

The use of vacuum or skin packaging technologies was considered undesirable due to the browning of the tuna flesh and, to a lesser extent, the browning of the red meat of the sword fish. No change in the appearance of the flesh of marlin was noted. The trialed skin packaging system had the negative effect of tightly wrapping the laminate around the skewers, making it difficult to extract the kebabs from the pack. Tray packaging using heat shrink laminates proved most successful but were deemed unnecessary and costly for a bulk pack. Tray packaging using heat shrink laminates will be re-evaluated if the kebabs are launched onto the retail market.

Final packaging selected for the bulk-chilled kebabs consisted of a polystyrene esky containing an inner gusseted bag, plastic interleaving sheets between the layers of kebabs, a cardboard insert separating a gel-pack from the product and an outer sleeve over the polystyrene esky depicting De Brett Seafood's logo. Figure 1 represents a cross section of the bulk-chilled kebab pack. The pack contains 5 layers of 10 x 100g kebabs.

Figure 2: Schematic representation of the cross section of the bulk chilled kebab packaging



Packaging for the frozen bulk kebab is yet to be finalised, but will be similar in dimension and design to the chilled product, ie an outer carton containing an inner gusset bag and plastic interleaving between 5 layers of 10 x 100g kebabs. See Appendix 3 for photographs of a sample carton, chilled and frozen packaging.

4. Trials were conducted in the cryogenic batch freezer to determine freezing times for the kebabs. Each batch consisted of a rack containing 16 trays, each holding 45 kebabs, with sufficient space between the kebabs not to hinder freezing. A cascade temperature differential of -50°C was recommended by BOC gas, since lower temperatures could result in cracking of the flesh through surface crusting, and higher temperatures could extend the dwell time thus reducing efficiencies.

Appendix 4 shows the freezing profile of a 100g swordfish kebab. To achieve a final internal temperature of -20°C, a dwell time of 11 minutes is required. When freezing product in cryogenic batch freezers, it should be noted that time must be considered for the batch to reach its given temperature. This will take longer if the freezer has been idle for some time, eg up to

10 minutes if the freezer has been idle compared with 2 to 3 minutes when the freezer is constantly in use. As part of the quality assurance program each batch contains a temperature probe that is inserted into the product to monitor temperatures. This is predominantly used during the initial cycle of the batch. Equilibrium temperatures are also taken prior to removing the product from the batch.

CONCLUSION

De Brett Seafood launched a range of chilled tuna, swordfish and marlin bulk packaged kebabs onto the wholesale market in December 1999. The kebab range, which is currently supplied to several wholesalers in the South East Queensland region will soon be launched onto the New South Whales market.

The Frozen Kebab range was delayed while a new cryogenic batch freezer was designed and built. Samples of a bulk (50 x 100g) frozen kebab carton have been distributed for evaluation. The frozen kebabs have been well received although the addition of the Tuna kebab to the range is still being debated. Management at De Brett Seafood believes this range will be launched onto QLD and NSW markets in the coming months.

Export markets for both the frozen and chilled kebabs are under investigation. An FPA allowing De Brett Seafood to export-value added products has been audited and approved by AQIS.

Management at De Brett Seafood is considering future developments in the kebab range including retail packs, the addition of a mako shark kebab, a cocktail kebab (approx 50g) and a change to bamboo skewers with handles.

APPENDIX I: KEBAB MANUFACTURING EQUIPMENT

Suppliers	Equipment	Conclusions
Lesnie's Pty Ltd	16843 Stainless Steel Kebab Maker	Suited purpose, produces 3 sizes of kebabs (80, 90 and 100g) in 2 quantities of 48 or 96. Cuts cubes 2 x 3cm. Produces best product if left in the freezer for 1 to a maximum of 11/2 hours before cutting, especially with the soft texture of tuna.
Kabab King	BM2000 Kebab Maker	Too small , producing only 24 kebabs; equipment not robust enough for a processing environment.
Convenience Foods	Koppens VMS Former with kebab attachment	Considered an overcapitalisation. Expected quantities of raw material not sufficient to warrant this machine. Product is also unnatural in appearance with some destruction of texture occurring.
FMC	Former with Kebab attachment	As above, considered an over capitalisation. Additionally, appearance of final product different from customer's requirements
Heat and Control	no equipment available	
TNA	Scanvaegt	As above, considered an over capitalisation. Additionally, appearance of final product different from customer's requirements
Scan American Coorporation	Emsen traditional kebab maker	This industrial-scale machine makes a traditional kebab with automatic skewering and custom design conveyor and assures consistency and variety at the same time. Machine has potential. Not available in Australia. Would require importing from USA. If product sales are strong, may consider.
Scan American coorporation	EAB25 automatic kebab machine	Automatic skewering and cutting, pneumatic non electrical system. Kebabs per container range from 49 to 100, with size of kebabs in inches ranging from ¾ x ¾ to 1 ¼ x 1 ¼ (mm ranging from 20 x 20 to 31 x 31). Maximum weight of pure meat ranging from 1.5 to 6 oz (40 to 180 g). Excellent product. May be second system considered.

APPENDIX II: KEBAB PRODUCTION

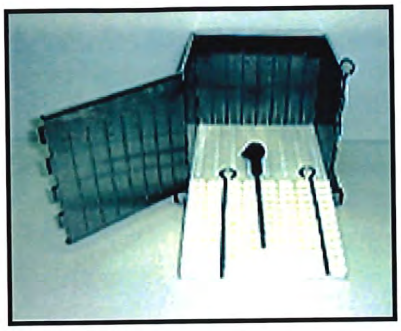


Figure 1:
Lesnie's 18134 Kebab Maker

Figure 2:
Swordfish Offcuts and Neck Meat

Figure 3:
Inserting Skewers

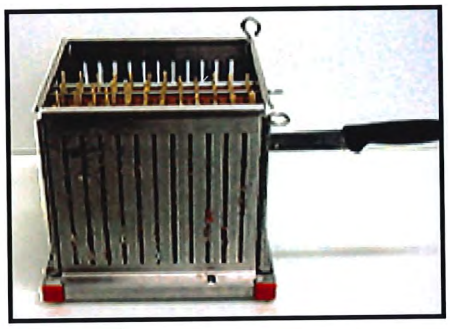


Figure 4:
Cutting Cubes

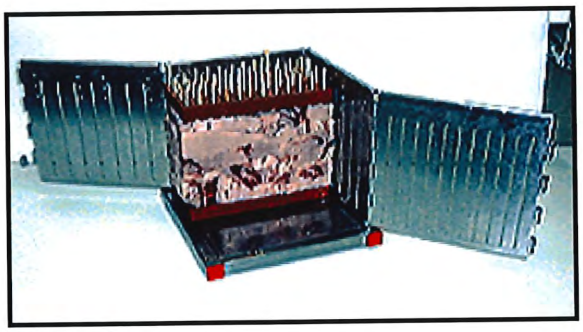


Figure 5:
Removing Kebabs

Figure 6:
Kebabs on Rack in Batch Freezer

Figure 7:
Chilled Kebabs

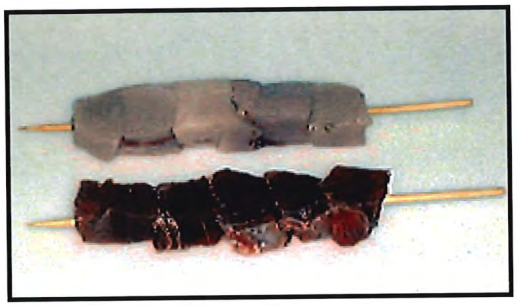


Figure 8:
Tuna and Swordfish Kebabs

Figure 9:
Frozen Kebabs

APPENDIX III: PACKAGING STYLES EVALUATED

Equipment Suppliers	Packaging	System	Conclusions
Ezyvac	Vacuum packaging	Kebabs vacuumed packed in bags on and not on trays.	The flesh of tuna and to a lesser extent the red meat in sword fish held in vacuum packs tended to change colour from red to an unpleasant brown.
Cryovac	Skin wrap	Kebabs placed on trays then vacuum skin packed.	The flesh of tuna and red meat of the swordfish again browned using this packaging. Additional difficulty in removing kebabs from the packaging occurred with the laminate skin wrapping around the skewers.
Dextron	Heat Shrink	Kebabs packed on trays then shrink wrapped.	Acceptable product, to cumbersome and expensive as a bulk pack. Will re-evaluate for retail purposes
R-Max, Long Plastics	Polystyrene esky	Chilled kebabs layered and interleaved in an esky, a 1.25kg frozen gel-pack.	Suited purpose for bulk chilled pack. Good insulation, with the addition of sleeve, inner divider, gel-pack, gusset bag and plastic interleaving proving successful.
Amcor Fibre Packaging	Poly-laminated cartons	Frozen kebabs layered and interleaved in laminated solid fibre carton.	Suited purpose for bulk frozen pack. Addition of gusset bag and plastic interleaving proved successful.

Chilled Kebab Packaging

APPENDIX IV: CRYOGENIC FREEZING PROFILE OF A 100G KEBAB