Ready-meals with

Ready-meals, both chilled and frozen, are well established in the international market report **Marina Braida** and **Ronan Gormley** of Ashtown Food Research Centre in Dublin

Mintel data shows that the value of the frozen ready-meals market in the UK has been reduced by the effect of price promotion, while chilled ready-meals continue to be a big rival in the market place. This has caused the main players to diversify into premium and luxury range prepared meals. The developing market for food in central and Eastern Europe may also represent an opportunity for increased sales of these products.

Most ready-meals are made up of a combination of carbohydrate (eg rice, potato or pasta), protein (fish or meat), vegetables and sauce. Despite increasing awareness of the health benefits from eating fish, ready-meals containing fish are less common than those containing chicken or beef and the appearance of such fish meals on the market are a relatively recent occurrence.

Pluses of *sous vide* and freeze-chilling

R&D on ready-meals has been a major focus at Ashtown Food Research Centre (AFRC) for a number of years. Much of the activity has been focused on freeze-chilling, which is a combination of freezing and chilling as the name suggests. This gives major logistical benefits for the processor as large amounts of a particular ready-meal can be produced, held in deep freeze, and then lots can be tempered and released into the chill chain as required, ie the consumer buys the meal as a chilled product.

R&D shows that freeze-chilling is a safe and suitable technology for most types of ready-meal and also for other products such as fresh fish fillets held in modified atmosphere packs (MAP).

Trials have also been conducted on fish processed by *sous vide* technology which ensures a gentle and low temperature process that causes minimal damage to the product in terms of nutritive value and sensory properties. A number of fish species in gourmet sauces have been processed at AFRC by sous vide technology with good outcomes.

Going beyond 'low fat'

WE are in the era of 'healthy choices' and ready-meal companies are responding to this with meals containing reduced salt and calories. However, companies are only just beginning to realise the potential of ready-meals as carriers of functional (healthy) ingredients and nutraceuticals. Such meals have applications in all sectors of the community but especially to the elderly who may find meal preparation difficult and who may also be lacking in trace minerals and other nutritives and non-nutritives (eg dietary fibre).

The production of such enriched meals is likely to be a major growth area in the near future especially when the inherent health benefits of fish are superimposed, ie these items become 'doubly' attractive.

These drivers led to the current study at AFRC on the formulation, preparation and freeze-chilling of a gluten-free salmon lasagne containing nutraceuticals and also a sous vide processed ready-meal of the same formulation but with Rigati pasta instead of sheets (still gluten-free).

The gluten-free aspect was introduced as intolerance to gluten and to flour-containing products is becoming more widespread in Europe. For example, one in 60 people in Ireland is a diagnosed coeliac and it is suspected that a much higher number are undiagnosed, ie latent coeliacs.

The research was conducted in association with Irish ready-meal producer, Dawn Fresh Foods as part of the EU-funded Seafoodplus project.

● **For further information contact Ronan Gormley at ronan.gormley@teagasc.ie**

THE TRIAL - LASAGNE FORMULATION

THE LASAGNE contained salmon sauce (50% of which was salmon pieces), Béchamel sauce, gluten-free pasta sheets and mozzarella cheese. Visual trials were conducted with 20 panellists who were asked to view a commercial sample of conventional salmon lasagne and to indicate what slice size they would consider adequate for their evening meal. Based on these responses an average portion size was calculated as being 400g.

The nutraceutical targets were based on 400g of lasagne (or per 146g of Béchamel sauce). These were: apple pectin (7g), Beneo HP (5g), taurine (1.5g) and Aquamin Soluble (120mg). Apple pectin *(Obipektin-ulv, Switzerland)* reduces serum cholesterol, is a soluble dietary fibre, and as such is desirable in the diet. Beneo HP (ORAFTI, Belgium) is an oligosaccharide and has dietary fibre and prebiotic properties, ie it encourages growth and proliferation of beneficial gut bacteria. Daily intake should not exceed 5g. Taurine (fish is a good source) is beneficial for cardiovascular health and a 1.5g daily supplement has been seen to largely restore endothelial (lining of the arteries) function in young smokers, hence the inclusion of 1.5g in the current study. Aquamin Soluble *(Marigot, Cork)* is derived from algae and is a highly available form of calcium as proven in clinical trials relating to bone health. An inclusion level of 120mg per 400g portion is equivalent to 15% of the recommended daily allowance for calcium.

Béchamel sauce

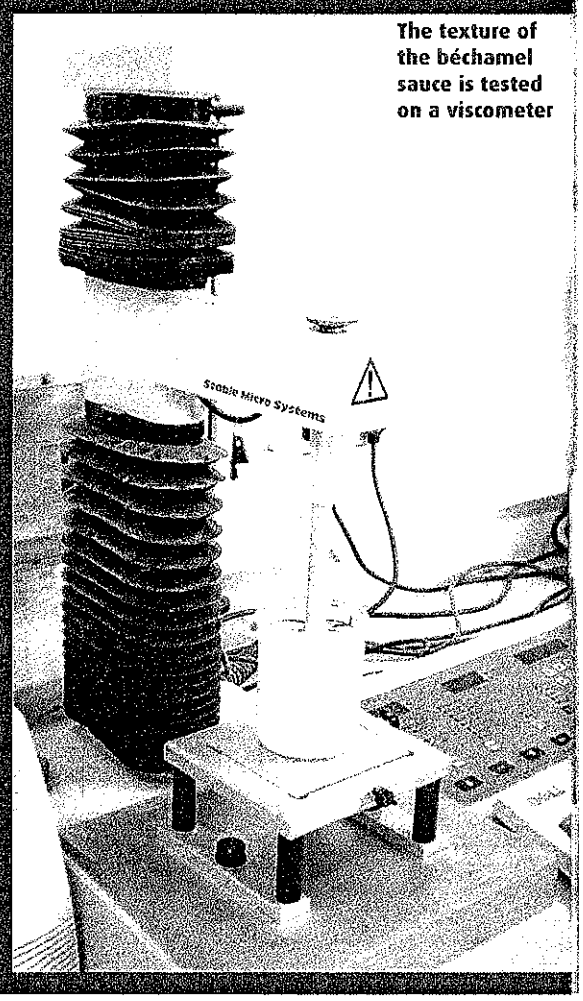
INITIALLY, the focus was on the Béchamel sauce component of the lasagne as it was used as the carrier for the nutraceuticals. Physicochemical and taste panel tests were conducted to study how the sauce properties were influenced by the gluten-free ingredients and by the nutraceutical inclusions. The gluten-free sauce was prepared by simmering over a constant heat source for a specified period and contained skimmed milk powder (SMP), corn starch, corn flour, sunflower oil and water. (The conventional sauce contained SMP, wheat flour, sunflower oil and water.)

The gluten-free Béchamel sauce was less viscous than its wheat-containing counterpart as indicated by Brookfield viscometer readings *(speed 5)* of 35 vs 45Pa's respectively at 5 deg C, and 27 vs 36Pa's at 20 deg C. The effect was more pronounced using the TAXT2i texture testing system *(Stable Micro Systems, Surrey, UK)* in back extrusion mode (firmness (g)), ie 54 vs 108g (5 deg C) and 41 vs 62g (20 deg C). The gluten-free sauce was slightly whiter than the wheat-containing sauce and had a higher whiteness/yellowness (L/b) ratio *(Hunter colour meter: L 89.8 vs 86.5; L/b of 12.1 vs 9.3)*.

A triangle taste panel indicated a difference between the sauces with 18 out of 21 tasters correctly identifying the odd sample out. The extent of the difference was considered large by nine tasters, moderate by six, slight by three, and no comment by three. However, the difference was not significant in a preference test, with eight tasters preferring the gluten-free sauce and 13 the wheat-containing sauce. Both sauces exhibited shear thinning, ie they thinned on stirring.

Effect of inclusions

A RANGE of inclusions were added to the sauce, both individually and together (Table 1). All of the inclusions (individually) lightened sauce colour except the pectin



The texture of the béchamel sauce is tested on a viscometer

a difference

place and competition is strong both in terms of choice and price. But in this special show that there is more than one way to add value to these products

inclusion which had a yellowing effect. Beneo HP had a thinning effect on the sauce while Aquamin Soluble caused a slight thickening. Pectin also thickened the sauce, especially at the higher inclusion level (Table 1). The data for all the inclusions together were similar to that for the 2.5% pectin inclusion level except that the moisture content was lower in the former.

Each of the inclusions reduced sauce acceptability score (Table 1) and all the inclusions combined (the 2.5% level of pectin was used) gave the lowest score. However, the data for this treatment had the highest coefficient of variation indicating that some of the panellists liked this sauce while others did not. The acceptability scores were remarkably good considering that Béchamel sauce is very bland and that it was being tasted on its own and not as a constituent in a product. It was decided, therefore, to use the 'all inclusions' sauce in the lasagne.

Salmon sauce

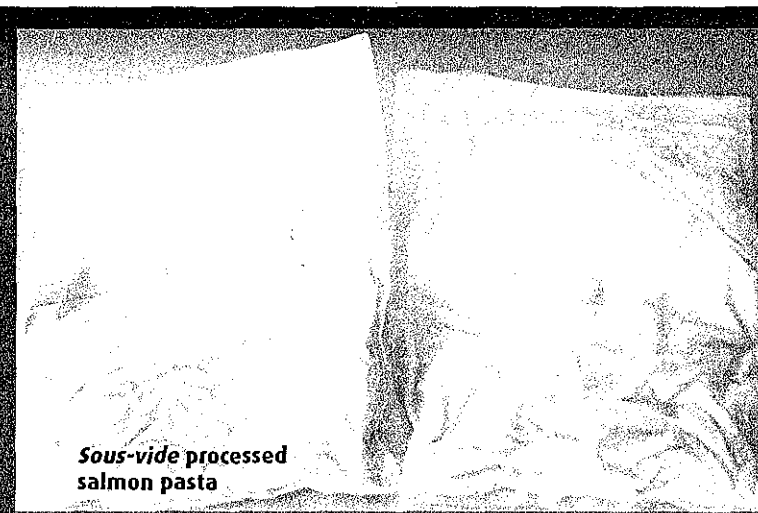
SALMON sauce (50% salmon content) was prepared using diced salmon pieces in boiling water incorporating fish boullion, tomato purée, modified starch, stabiliser, cream, vegetable oil and a range of spices. The salmon sauce was tasted as a single sample by a panel of 25 members who were asked to score for acceptability by marking a 6cm line with end-points of 0 (unacceptable) and 6 (very acceptable). The mean score was 3.5 with a coefficient of variation of 37.6%. This was a good acceptability score considering that the sauce was tasted in isolation and not as part of a product.

Salmon lasagne with nutraceuticals

GLUTEN-free pasta sheets were cooked in boiling water containing a small amount of salt for 90 seconds. The lasagne was formulated as outlined above and the cooked gluten-free pasta sheets were layered with salmon sauce in between. This was then topped with Béchamel sauce containing the nutraceuticals, which in turn was sprinkled with mozzarella cheese. The lasagne was blast frozen (-35°C) and stored overnight at -20°C for one day. It was then tempered at 4°C overnight and stored at 2-4°C in a chill room for eight days.

Microbiological tests were conducted on days 1, 5 and 8 and showed a total absence of pathogens. Paired comparison and acceptability taste tests (6cm scale with end-points of 0 (unacceptable) and 6 (very acceptable); 20 tasters) between the all-inclusions gluten-free salmon lasagne and a commercial wheat containing salmon lasagne showed a preference ratio of 5/15 and a score of 2.59 versus 3.59 in favour of the latter.

This difference was attributed to variations in spice content rather than to the Béchamel sauce with the inclusions. The gluten-free sample was also tested by personnel in Dawn Fresh Foods who produced the wheat-containing lasagne and they attributed the difference to the salmon sauce (less spice/flavour) rather than to the Béchamel sauce (which contained the nutraceuticals). The company is now carrying out in-house trials on the gluten-free product.



Sous-vide processed salmon pasta

Sous vide salmon ready-meal with nutraceuticals

THE sous vide processed gluten-free pasta product with salmon and nutraceuticals was identical in composition to the lasagne above except it contained gluten-free pasta pieces (Rigati) *(Dr Schär, Italy)* rather than gluten-free pasta sheets. The product was formulated, vacuum-packed (275g unit size) in plastic bags and processed in a Barriquand Steriflow cooker to a process value of P90 = 10 min.

The sous vide product was blast frozen and stored at -20°C for four weeks. It was then tempered at 4°C overnight and stored at 2-4°C in a chill room for 30 days.

Microbiological tests were conducted on days 1, 15 and 30 and showed a complete absence of pathogens. Small scale sensory tests (4 judges) indicated that the product had a high level of acceptability. However, they did comment that the gluten-free pasta component had a slightly slimier mouth feel than conventional pasta.

The finished product: salmon lasagne