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# Added Value Herring Products

A. Ross, T. R. Gormley and J. Somers

Traditional marinated herring products in Ireland are usually 'Rollmops' or 'Bismark'. They have an acid/salt flavour. However, in continental Europe, the trend is towards milder and sweeter marinated products.

A joint project between The National Food Centre and An Bord Iascaigh Mhara has investigated the development of a selection of German-style products, i.e., mild herring marinades in gourmet sauces, aimed at local and European markets. The marinated herrings were also evaluated as components of salads. A range of products (free from preservatives) has now been prepared and the technology and formulations for their production are currently being introduced to interested Irish food companies.

## Curing and Preservation

Primary-cure fish marinades are semi-preserves and have a shelf life of up to six months at minus 4°C. Secondary products from these usually have a shelf life of up to 13 weeks at 0-4°C, or three weeks less in the absence of preservatives. Fresh, frozen or salted fish may be used and are cured with spirit vinegar (or in combination with another acid) and salt. Spices may also be added. The acetic acid and salt penetrate the fish tissue by diffusion. Acetic acid binds loosely to fish proteins and tenderises fish (by hydrolytic action), while salt increases flesh firmness. Because of these opposite effects on texture it is important to ensure the correct ratio of acid to salt in the cure.

Preservation is effected by a reduced water activity and pH. During curing the fish flesh loses its grey-red colour and 'transparency' because of protein denaturation, and takes on the typical white colour of a herring marinade.

Weight loss during the preparation process of fresh herring to the marinated product is about 65%. Half of the whole fish weight is lost in filleting, and up to one-third of the fillet weight is lost in skinning and curing. Ideally, the herring should have a fat content of 12-16%.

## Preparing Marinades

A number of batches of fresh herring (butterfly fillets) were marinated using the solutions shown in Table 1. In all cases the ratio of fish to solution was 1.5 to 1. For solutions 1 and 2, the small drums containing the fillets were rolled frequently

during the first six hours. The curing/ripening temperature regime was 4 days at 12°C (+ 2°), followed by 5 days at 2-3°C. Cured samples were then stored in the cure in drums at minus 4°C until required for use. The results (Table 2) show that the salt and acid contents of the fish from solutions 1 and 2 were rather high. As a consequence, desalination in a solution of 1% salt and 0.5% acetic acid for 1-2 days was required before using the fish in order to reduce the salt content to about 3.5% and the acetic acid level to 2.3%.

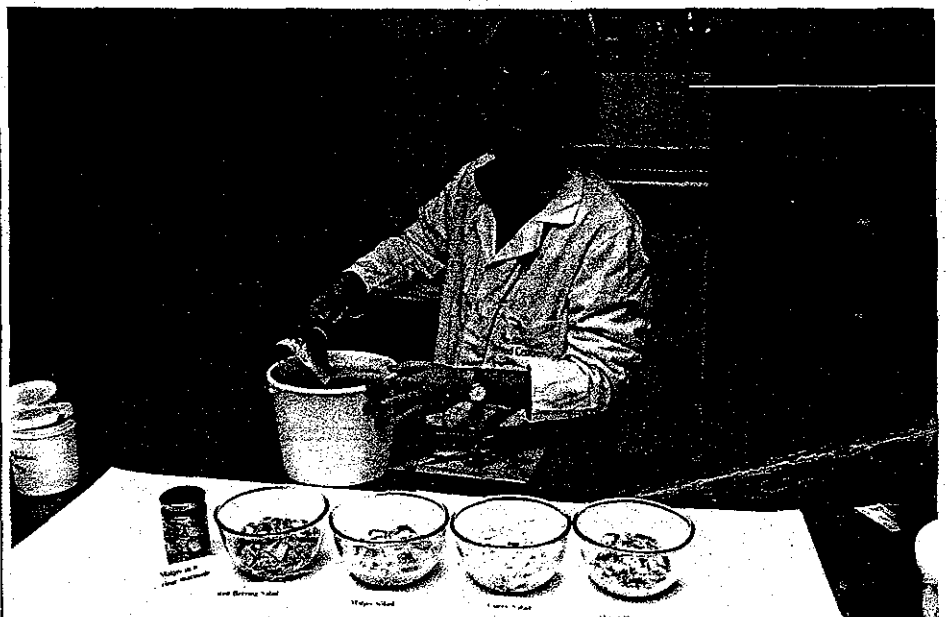
Solution 3 produced the so-called 'Matjes' low acid cure, with characteristic flavour and texture. It incorporates an enzyme 'cocktail' called 'Matjes Reif' which is supplied by the Reinert Gruppe in Germany. The word 'Matjes' signifies young herrings which are fished in early summer. The curing/ripening regime is 12-15°C for day 1, followed by days 2-10 at 5-8°C with thorough mixing each day. This primary product is stored at minus 4°C until required and has a shelf life of 3 months.

There are some notable features

TABLE 1: Composition of marinating solutions

Solution	%			
	Salt	Acetic Acid	Water	'Matjes Reif' (*)
1	14	7.0	79.0	0.0
2	11	5.5	83.5	0.0
3	12	0	85.5	2.5

\*'Matjes Reif' solution supplied by the Reinert Gruppe, Germany.



Ms. Alexandra Ross preparing salads with herring marinades.

TABLE 2: Tests on marinated herring — typical values

Marinating solution	Shear value (kN)	% Salt	% Acetic Acid	pH	Colour (Hunter white/yellow ratio)
1	2.59	6.6	3.0	3.9	7.7
2	1.96	5.1	2.8	4.1	7.6
3 ('Matjes')	0.45	7.2	<0.5	5.1	6.2

in the typical values for tests on the marinated herrings as shown in Table 2. The 'Matjes' herring has a much softer texture than the other cures (shear value in kilo Newtons on 100 g samples using a standard test cell and a shear press) and, as expected, has a low acetic acid content. The 'Matjes' texture is particularly succulent. The data for salt, acetic acid and pH reflect the varying composition of the three marinating solutions. It is also to be noted that the Matjes product is less white than the other two.

### Gourmet Sauces

Four mayonnaise-based (special formulation) gourmet sauces were prepared, viz., mustard, curry, horseradish and yoghurt. The mayonnaise contents were 87, 94, 64 and 42%, with the next major ingredient being 9% mustard cream, 2% curry paste, 16% horseradish powder or 41% natural yoghurt, respectively. Each sauce contained a quantity of additional ingredients, all being preservative free. Details of the precise formulations will be provided by the authors, on request. The colour and viscosity of three of the sauces (yoghurt excepted) were characterised, and their values are given in Table 3. The curry sauce was the most yellow, the least white, and had a much higher consistency value.

### Testing the Products

The marinated herring (half finger-sized strips) and gourmet sauces were packed in glass jars and had a high-quality shelf life of at least six

weeks at 5°C, as evaluated by sensory, microbiological and rancidity data (peroxide values and free fatty acids). The ratio of herring to sauce in the jars was typically 60:40.

A sensory test was carried out using 15 tasters (who liked fish) on the herrings in three of the sauces. Each taster was asked to rate five factors (sauce flavour, fish texture, product acidity, complementarity of fish and sauce, and overall acceptability) as being good, moderate or poor. All samples received good ratings with the order of preference being herring in mustard sauce, followed by curry, followed by horseradish. The herring in yoghurt sauce was not tested at this time due to separation problems which were later resolved.

The 'Matjes' cured herring was not packed in a sauce but in a clear pickle solution with carrot slices, onion rings, yellow mustard seeds and bay leaves. This product also has a shelf life of at least 6 weeks at 5°C and had an excellent appearance in the glass jar.

### Herring Salads

Strips of marinated herring were also used in four salad products. These had a high-quality shelf life of at least 6 days at 5°C. A 1400 g batch contained 400-500 g of marinated herring (depending on the salad), 500-600 g of salad and 400 g of sauce. Typical salads contained beetroot/onion/gherkin/apple ('red herring' salad), paprika/mixed pickles/pickled onions/cucumber (mixed herring salad), peach

halves/pineapple rings/curry paste (curry salad), or chopped onions/gherkins/apple/potato with 'Matjes' fillet pieces (Matjes salad). Sauces for the salads were based on sour cream or mayonnaise and with a range of other ingredients; no preservatives were used.

Sensory tests were carried out on the four salads by 14 tasters (who liked fish). The samples were scored for overall quality/acceptability on a 7-point scale from excellent (1), very good (2), good (3), fair (4), poor (5), very poor (6) to 'terrible' (7). The mean panel scores were in the range 2.07 (curry salad) to 2.57 (mixed herring salad), indicating that all four salads were classed between 'very good' and 'good'.

### Summary

A range of preservative-free, added-value, chilled herring products has been developed with excellent sensory properties and with a commercial, high-quality shelf life. Details of formulations are available from the authors.

The development of a special mayonnaise which was milder, more creamy and less acidic than conventional mayonnaise was a key factor in the development of the products.

The products with gourmet sauces and packed in glass jars are aimed at the continental European market, and especially the German market, while the shorter-shelf-life salad products are aimed at the Irish and UK markets.

The results of the study are being transmitted to interested food companies and especially to those that have chilled distribution systems in place.

*Ms. Alexandra Ross from Hochschule, Bremerhaven, Germany, was a visiting researcher (COMETT programme) in the Department of Plant and Marine Foods at The National Food Centre. Dr. Ronan Gormley is Head of that Department. Mr. Joe Somers is on the staff of An Bord Iascaigh Mhara.*

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TABLE 3: Colour and viscosity values for gourmet sauces

Sauce	Hunter colour values		Viscosity (20°C) (kPoises)
	Whiteness ('L')	Yellowness ('b')	
Mustard	80	19	0.45
Curry	72	29	1.26
Horseradish	82	15	0.37