MINISTERIE VAN LANDBOUW

Bestuur voor Landbouwkundig Onderzoek

Kommissie voor Toegepast Wetenschappelijk Onderzoek
in de Zeevisserij (T.W.O.Z.)

FISH FINGERS MADE FROM MINCED WHITING MEAT MIXED WITH FROZEN COD SAWDUST WASTE.

D. DECLERCK (*).

Werkgroep "Visverwerkende Bedrijven - Voorverpakking Vis" (I.W.O.N.L.).

Mededelingen van het Rijksstation voor Zeevisserij (C.L.O. Gent).

Publikatie nr 177 - VB/VV (I.W.O.N.L.) 28, 1981.

(*) Onderzoek gesubsidieerd door het Instituut tot Aanmoediging van het Wetenschappelijk Onderzoek in Nijverheid en Landbouw (I.W.O.N.L.).

Paper presented at the 10th Meeting of the West-European Fish Technologists Association, Göteborg, September 1980.

MINISTERIE VAN LANDBOUW

Bestuur voor Landbouwkundig Onderzoek

Kommissie voor Toegepast Wetenschappelijk Onderzoek
in de Zeevisserij (T.W.O.Z.)

FISH FINGERS MADE FROM MINCED WHITING MEAT MIXED WITH FROZEN COD SAWDUST WASTE.

D. DECLERCK (*).

CORRIGENDUM.

Page 1 - The last four lines should be deleted.

Werkgroep "Visverwerkende Bedrijven - Voorverpakking Vis" (I.W.O.N.L.).

Mededelingen van het Rijksstation voor Zeevisserij (C.L.O. Gent).

Publikatie nr 177 - VB/VV (I.W.O.N.L.) 28, 1981.

(*) Onderzoek gesubsidieerd door het Instituut tot Aanmoediging van het Wetenschappelijk Onderzoek in Nijverheid en Landbouw (I.W.O.N.L.).

Paper presented at the 10th Meeting of the West-European Fish Technologists Association, Göteborg, September 1980.

D/1981/0889/5

SUMMARY

Production of fish fingers from cod sawdust waste and minced whiting was studied under industrial conditions. During the production of minced whiting, bone separation was very contaminating. Before cutting, cooling of the raw material was necessary.

The raw material and the unfried fish fingers were of excellent chemical quality.

From the bacteriological point of vue the addition of batter and bread-crumbs was the most important source of contamination.

Fish fingers produced with 100 % minced whiting and those with a 75/25 (whiting/cod) composition were rejected by the taste panel for their rubbery dry texture.
From a 50/50, 25/75 (whiting/cod) and 100 % cod sawdust composition an acceptable product could be developped.

INTRODUCTION

In Belgium whiting is traditionally distributed in fresh conditions to the consumer. Specimens of large size are taken for the production of salted and dried fish and 30 % is used by the fish-meal industry.

For this reason we looked out for the transformation of whiting to convenient fish products.
The production of minced whiting was already described by DECLERCK (1). MENDELSON (2) studied the production of fish cakes and salt cured fish from minced whiting. The same author (3) also described the stability of canned minced whiting and TURGUT (4) used mutton tallow fat in whiting sausages.

This paper discusses the production of fish fingers based on minced whiting and cod sawdust waste. Cod sawdust waste was the other raw material that was used in our experiments. This is an important loss due to the fish finger production from frozen cod blocks. The quality of cod sawdust was already studied by DECLERCK (5).

1. MATERIALS AND METHODS

1.1. Technological process.

The production of fish fingers has been realized by means of two different raw materials, viz. separated whiting (Merlangus merlangus) and sawdust waste of cod (Gadus morhua L.). The separation was carried out with a "Baader 694" bone separator and a drum with holes of 5 mm diameter was used. The sawdust was recuperated during the portioning process of frozen cod blocks (5). To the prepared mixtures, additives as manucol DM (0,5 %), calcium chloride (0,125 %), monosodiumglutamate, salt and pepper were added. After one day's conservation at 0 °C the mixtures were extended and portioned automatically. The fish fingers were immersed in batter and covered with bread-crumbs. After freezing the fish fingers were packed and stored at -40 °C (figure 1).

1.2. Methods.

- Dry matter : by the methods of the AOAC (6).
- Total volatile bases (TVN) : by the method of LUCKE and GEIDEL (7) as modified by Antonacopoulos (8).
- Protein content : according the methods of AOAC (6).
- Microbiological assessments : - total bacterial counts at 20 °C and 37 °C
  - the total numbers of Enterobacteriaceae, Staphylococci, Coli, faecal Streptococci, Yeasts and moulds by the methods described by MOSSEL and TAMMINGA (9).
- Hypoxanthine : according to the method of JONES et al. (10).
- Bone content in minced fish : by the method of DINGLE, J.R. et al. (11).
- Organoleptical assessment : - frozen fish fingers were deep fried in commercial vegetable oil for 5 min. at 180 ° C

Figure 1 _ SCHEME OF THE INVESTIGATIONS

GUTTED WHITING

↓

HEADED AND WASHED

↓

DEBONED MINCED WHITING

+ 15°C

↓

+ 1°C

FROZEN COD SAWDUST WASTE

− 10°C

↓

− 3°C

ONE DAY CONSERVATION

AT 0°C

↓

CUTTING

↓

COMPOSITION		CUTTING-TIME In min.	ALGINATE $CACL_2$ SALT PEPPER	INITIAL TEMPERATURE	TEMPERATURE AFTER CUTTING
MINCED WHITING %	COD SAWDUST %				
100		2	+	1°C	8°C
75	25	2	+	0°C	2°C
50	50	2	+	− 1°C	2°C
25	75	2	+	− 2°C	1°C
	100	2	+	− 3°C	− 1°C

↓

ONE DAY CONSERVATION (0°C)

↓

EXTRUDING

↓

FROZEN FISHFINGERS (_28°C)

- panelists rated each constituent for colour, flavour, taste and texture on standard nine point hedonic scales. (9 = like extremely, 1 = dislike extremely)(12).

2. RESULTS AND DISCUSSION

2.1. Technological results.

From the gutted, headed and washed whiting 83,5 % minced fish was recuperated. The bone content was 0,22 % (table 1). After separating, washing was not necessary. The temperature after the separation process increased until 15,5 °C. The minced whiting reached 1 °C after a 24 hours' refrigeration. In order to obtain an acceptable homogeneous mass, cutting process time must be at least 2 minutes. During the cutting process the temperature of the mixture increased ca 3 °C.

Table 1 - Determination of the recuperation capacity and bone content of gutted and headed whiting by means of a bone separator.

Form	Initial weight in kg	Recuperation after separation in kg	Recuperation in %	Bone content in %
Gutted and headed whiting	29,6	24,7	83,5	0,22

The losses occurring during the portioning process of frozen cod blocks are included in table 2. Sawdust waste is the most important loss (3 %). On the other hand rest pieces (0,7 %) and losses along the moving band (1,4 %) were noted.

Table 2 - Average loss in weight by portioning of frozen cod blocks in fish sticks of 100 g.

Weight of the codblocks	Sawdust	Rest pieces	Losses along moving band	Total portioning losses
In kg 10 x 11,6	3,5	0,8	1,6	5,9
In % 100	3	0,68	1,37	5,05

2.2. Organoleptic assessment.

After frying the bread-crumbs layer adhered to the fish flesh and no water formation under the layer was observed. The fish fingers produced with 100 % recuperated cod sawdust waste were more acceptable than the fish fingers made with 100 % minced whiting.

The texture of the fish fingers with 100 % cod sawdust was excellent and no deformations or shrinking after frying was ascertained. The taste, flavour and colour were typical for cod.

On the other hand the texture of fish fingers based on 100 % separated minced whiting was tough and very elastic. An other important negative aspect was the irregular form and shrinking after frying. This deformation disappeared for fish fingers with a 50/50 composition (cod/whiting). Probably a decrease of the alginate and calciumchloride content should give a better result. This possibility however was not examined. The colour of the fish fingers was grey and the mixing with the white cod sawdust could not mask the grey colour.

In order to eliminate the mentioned negative properties the mixing of separated whiting with cod sawdust was a necessity. The fish fingers produce with a 50/50 composition seemed to give an acceptable product (table 3). The texture was acceptable and the taste, colour and flavour were in between those whiting and cod.

Table 3 - Results of the organoleptic assessment on fish fingers after frying

Fried fish fingers composition	Toughness and moisture	Deformation	Taste	Flavour	Colour
100 % whiting	- tough - very elastic - very dry	- fish finger become smaller after frying - irregular form	5,2	6	- grey (6)
75 % whiting 25 % cod	- slightly tough - elastic - dry	- slight deformations	5,5	6,5	- grey (6)
50 % whiting	- acceptable texture - normal moisture	- regular form - no deformations	7,3	7	- light grey (7)
25 % whiting	- preferred texture and moisture	- regular form - no deformations	7,5	7,5	- grey whiting (8) colour not definitely masked
100 % cod	- preferred texture and moisture	- regular form no deformations	8	8	- white (9)

2.3. Chemical results.

Table 4 shows the chemical results obtained from the raw material and the fish fingers. The unfried fish fingers (mince, batter, bread-crumbs) were totally homogenised for the chemical analyses.

The raw material and the fish fingers were of exellent chemical quality. The increase of dry material content was due to the addition of batter, bread-crumbs, and additives to the raw material. This addition means an increase of the food value of the product. However the increase of the dry matter did not result in a equivalent increase of the total protein content.

2.4. Microbiological results.

The raw material used was of good bacteriological quality (table 5). A strong reduction of the initial bacterial load was noted after washing, although the bacteria of hygienic significance did not disappear.

The separation process was one of the weakest links in the production. An increase of all microorganisms determined was noted. Total bacterial counts at 20 °C increased with a factor 10. After the separation process the bacteriological quality was still sufficient for further processing. The total bacterial counts of cod sawdust waste were always lower than the minced whiting counts, only a higher number of yeasts and moulds were found.

Contamination due to the two minutes cutting process was very small. The presence of Faecal Streptococci must be seen as an accidental infection. An important increase of the bacterial counts at 20 °C, the yeasts and moulds and the feacal Streptococci was observed after the production of fish fingers (table 6). This increse is due to some manuel manipulations during the production, contacts with extrusion machine, moving band, environment and especially the treatment with batter and bread-crumbs.

Table 4 - Result of the chemical quality assessment of the raw material and unfried fish fingers from separated whiting and recuperated cod sawdust waste.

Composition	Dry matter %	Total protein %	TVN mgN%	HX mgN%	Ash %	Fat %
Raw material						
Separated whiting	19,6	16,4	22,8	14,1	1,4	0,2
Cod sawdust	20,3	14,4	15,3	2,2	-	0,45
Fish fingers						
100 % whiting	32,1	13,7	21,2	-	2,4	-
75 % whiting 25 % cod	32,4	13,7	20,4	-	2,6	-
50 % whiting 50 % cod	32,6	13,4	18,6	-	2,8	-
25 % whiting 75 % cod	32,8	13,4	17,3	-	2,9	-
100 % cod	32,8	13,2	14,8	-	2,6	-

Table 5 - Total bacterial counts on the raw material and the mixtures.

Raw material		Total bacterial counts p/g at 20 °C	Total bacterial counts p/g at 37 °C	Yeasts and moulds	Coliforms	E. Coli	Staphylo-coccus aureus	Faecal Streptococci
Gutted whiting		2×10^4	3×10^3	0	5	0	10	0
Headed and washed whiting		3×10^3	2×10^2	0	10	1	0	0
Separated whiting		5×10^4	7×10^3	10	25	5	15	0
Cod sawdust waste		8×10^3	2×10^3	50	50	5	5	0
Composition of mixtures in %								
Separated whiting	Sawdust							
100 %	-	$7{,}1 \times 10^4$	8×10^3	40	30	0	10	0
75 %	25 %	$6{,}4 \times 10^4$	$7{,}5 \times 10^3$	75	40	2	10	10
50 %	50 %	$4{,}4 \times 10^4$	$4{,}5 \times 10^3$	35	45	0	10	0
25 %	75 %	$2{,}6 \times 10^4$	$3{,}5 \times 10^3$	100	15	0	0	0
-	100 %	$1{,}2 \times 10^4$	3×10^3	75	60	5	5	10

Table 6 - Total bacterial counts on unfried fish fingers.

Composition of unfried fish fingers		Total bacterial counts p/g		Yeasts and moulds	Coliforms	E.Coli	Staphyl. Aureus	Faecal streptococci
separated whiting	cod sawdust	at 20 °C	at 37°C					
100 %	-	$7,0x10^5$	$7x10^4$	750	10	0	10	15
75 %	25 %	$7,6x10^5$	$7x10^4$	650	10	0	15	30
50 %	50 %	$7,0x10^5$	$5,4x10^4$	350	45	10	10	20
25 %	75 %	$7,0x10^5$	$5,8x10^4$	1000	15	0	5	15
-	100 %	$8x10^4$	$2,1x10^4$	750	60	5	15	35
Batter		$2,3x10^5$	$1,5x10^5$	250	40	0	5	120
Bread-crumbs		$4x10^4$	$3,5x10^4$	280	10	0	0	18

LITERATURE

1. DECLERCK, D. - Technologische en hygiënische aspecten bij de verwerking van wijting tot gemalen visvlees.
C.L.O. Gent - 127-VB/VV, (I.W.O.N.L.), 21 (1977).

2. MENDELSOHN, J.M., CONNORS, T.J. - Pilot plant production of fish cakes and salt cured fish from minced fish flesh.
Atlantic Fisheries Technology Conf., Quebec, Canada, sept. 22-25 (1974)

3. MENDELSOHN, J.M. - Stability of canned minced whiting.
Food Product Development 11 (9), 26, 30 (1977).

4. TURGUT, H. et al. - The use of muttong tallow fat in fish sausages.
Journal of the Science of Food and Agriculture 30(5), 499-502 (1979).

5. DECLERCK, D. - Examen de la qualité des pertes survenant au cours de la mise en portions du cabillaud.
Revue de l'Agriculture no. 5 vol. 32 septembre-octobre (1979).

6. METHODS OF THE AOAC (1970) - AOAC, Washington, 11th Ed.

7. LUCKE, W. & GEIDEL (1935) - Zeitschr. Lebensm. - Unters. 70, 441.

8. ANTONACOPOULOS, N. (1968) - Lehrbuch der Lebensmittelchemie, vol. III/2, Springer Verlag, Berlin.

9. MOSSEL, A.A. & TAMMINGA, S.K. (1973) - Methoden voor het microbiologisch onderzoek van levensmiddelen - P.C. Noordevliet, Zeist.

10. JONES, N. et al. - Journal of the Science of Food and Agriculture 15, 763 (1964).

11. DINGLE, J.R. et al. - The measurement of the bone content in minced fish flesh.
New Series Curcular no. 44 - Fisheries and Marine Service, Environment Canada, Halifax Laboratory (1974).

12. BRIDE, B.L. & RICHARDSON, K.C. - The time-temperature tolerance of frozen foods : sensory methods of assessment.
J. Fd Technol. 14, 57-67 (1979).