Liquid Holding Capacity and Liquid Leakage of Raw Salmon and Trout Fillets

Liquid loss (i.e., loss of water and liquid fat) is an important property for salmonids when evaluating fish quality in production and as final product. It can be measured by several means, for example by liquid leakage or by liquid holding capacity. The present study examines how liquid leakage and liquid holding capacity of salmon and trout are influenced by fat content. Liquid leakage did not depend on fat content whereas the liquid holding capacity was lower for fish with high fat content. Thus the methods provide supplementary rather than equal information. Furthermore, the water loss part was linear depending on liquid loss. The results indicate that fat is more loosely bound in trout than in salmon. These findings may be of immediate relevance to quality control of high-value fat fish products, to assessment of raw material properties, to an efficient treatment in the production and to process control.

General information
State: Published
Organisations: National Food Institute, Research Group for Bioactives – Analysis and Application
Authors: Løje, H. (Intern), Nielsen, H. H. (Intern), Hyldig, G. (Intern), Jørgensen, B. M. (Intern)
Pages: 11-15
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Food Science and Quality Management
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Liquid loss, Salmon, Trout, Fat content
Electronic versions:
Food_Sci_Qual_Man_68_2017_11_15.pdf
Publication: Research - peer-review › Journal article – Annual report year: 2017
Antioxidant activity of cod (Gadus morhua) protein hydrolysates: Fractionation and characterisation of peptide fractions

This study aimed to characterise peptide fractions (>5 kDa, 3–5 kDa and <3 kDa) with antioxidative activity obtained from a cod protein hydrolysate. The free amino acids in all fractions were dominated by Ala, Gly, Glu and Ser. The total amino acid composition had high proportions of Lys, Ala and Glu. The 3–5 kDa and <3 kDa fractions were further fractionated by size exclusion chromatography. All sub-fractions showed high Fe²⁺ chelating activity. The DPPH radical-scavenging activity of the 3–5 kDa fraction was exerted mainly by one sub-fraction dominated by peptides with masses below 600 Da. The DPPH radical-scavenging activity of the <3 kDa fraction was exerted by sub-fractions with low molecular weight. The highest reducing power was found in a sub-fraction containing peptides rich in Arg, Tyr and Phe. Both free amino acids and low molecular weight peptides thus seemed to contribute to the antioxidative activity of the peptide fractions, and Tyr seemed to play a major role in the antioxidant activity.

General information
State: Published
Organisations: National Food Institute, Research Group for Food Production Engineering, Research Group for Bioactives – Analysis and Application, University of Copenhagen
Number of pages: 11
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Publication date: 2016
Main Research Area: Technical/natural sciences

Publication Information
Journal: Food Chemistry
Volume: 204
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BFI (2018): BFI-level 2
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.85 SJR 1.706 SNIP 2.091
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.597 SNIP 1.962 CiteScore 4.31
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.595 SNIP 2.027 CiteScore 3.92
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.548 SNIP 2.069 CiteScore 3.87
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.805 SNIP 2.357 CiteScore 3.98
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.909 SNIP 2.395 CiteScore 4.17
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.965 SNIP 2.261
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.776 SNIP 2.024
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.488 SNIP 1.703
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.467 SNIP 2.095
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.383 SNIP 1.848
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.017 SNIP 1.543
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.057 SNIP 1.449
Scopus rating (2003): SJR 0.893 SNIP 1.258
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.957 SNIP 1.238
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.805 SNIP 0.99
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.728 SNIP 0.979
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.661 SNIP 0.937

Original language: English
Amino acids, Antioxidant, Cod protein hydrolysates, LC–MS/MS characterisation, Peptides, Food Science, Analytical Chemistry, LC-MS/MS characterisation, Free radicals, Hydrolysis, Molecular weight, Proteins, Size exclusion chromatography, Anti oxidative activity, Anti-oxidant activities, Chelating activity, DPPH radical scavenging activities, LC-MS/MS, Low molecular weight, Low-molecular-weight peptides, Protein hydrolysate, Antioxidants

DOIs:
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Publication: Research - peer-review › Journal article – Annual report year: 2016

Separation and characterisation of biomolecules in effluent from the herring industry

General information
State: Published
Organisations: National Food Institute, Research Group for Food Production Engineering
Authors: Gringer, N. (Intern), Baron, C. P. (Intern), Nielsen, H. H. (Intern)
Number of pages: 169
Publication date: 2015

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Place of publication: Søborg
Publisher: National Food Institute, Technical University of Denmark
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
Printed_udganve_af_afhandling.pdf
Publication: Research › Ph.D. thesis – Annual report year: 2015

Stock structure of Atlantic herring Clupea harengus in the Norwegian Sea and adjacent waters
The genetic structure of Atlantic herring Clupea harengus L. was investigated in its north-easterly distribution in the Norwegian Sea and adjacent waters, using 23 neutral and one non-neutral (Cpa111) microsatellite loci. Fish from the suspected 2 main populations—the Norwegian spring-spawning herring (NSSH) and the Icelandic summer-spawning herring (ISSH)—were collected at spawning locations in their respective spawning seasons from 2009 to 2012. Samples were also collected from Norwegian autumn spawning locations, from different local Norwegian fjords such as the inner part of Trondheimsfjorden, Lindas pollene, Landvikvannet and Lusterfjorden, as well as from suspected Faroese spawning components. The observed level of genetic differentiation was significant but low (F-ST = 0.007) and mostly attributable to the differentiation of the local Norwegian fjord populations. The locus Cpa111, which was detected to putatively be under positive selection, exhibited the highest F-ST value (0.044). The observed genetic patterns were robust to exclusion of this locus. Landvikvannet herring was also genetically distinguishable from the 3 other fjord populations. In addition, the present study does not support genetic structuring among the ISSH and the NSSH.
Antioxidant activity of Cod (Gadus morhua) protein hydrolysates: In vitro assays and evaluation in 5% fish oil-in-water emulsion

Cod protein hydrolysates were fractionated according to the molecular mass into three fractions of >5kDa, 3–5kDa and
Characterization of process induced changes in matjes herring, using 2D gel electrophoresis

General information
State: Published
Organisations: National Food Institute, Division of Industrial Food Research, Norwegian Institute of Food, Fisheries and Aquaculture Research
Authors: Skåra, T. (Ekstern), Jessen, F. (Intern), Nielsen, H. H. (Intern), Rotabakk, B. T. (Ekstern)
Number of pages: 1
Publication date: 2014
Event: Poster session presented at 44th WEFTA meeting, Bilbao, Spain.
Main Research Area: Technical/natural sciences
Electronic versions: WEFTA2014Poster_2_.pdf
Source: PublicationPreSubmission
Source-ID: 93362465
Publication: Research - peer-review › Poster – Annual report year: 2014

Chemical Characterization, Antioxidant and Enzymatic Activity of Brines from Scandinavian Marinated Herring Products

Brines generated during the last marination step in the production of marinated herring (Clupea harengus) were chemically characterized and analyzed for antioxidant and enzyme activities. The end-products were vinegar cured, spice cured and traditional barrel-salted herring with either salt or spices. The chemical characterization encompassed pH, dry matter, ash, salt, fatty acids, protein, polypeptide pattern, iron and nitrogen. The antioxidant activity was tested with three assays measuring: iron chelation, reducing power and radical scavenging activity. The enzymatic activity for peroxidase and protease were also tested. Results revealed that the brine can contain up to 56.7 mg protein/mL, up to 20.1 mg fatty acid/mL, good antioxidant activity, high amounts of the antioxidative amino acids lysine, alanine, and glycine, and high enzymatic activity. The potential of using the protein-rich fraction with biological activity from brines from the marinated herring production was demonstrated in this work.

General information
State: Published
Organisations: Department of Systems Biology, National Food Institute, Division of Industrial Food Research, Chalmers University of Technology
Discovery and characterization of novel bioactive peptides from marine secondary products

There is an increasing interest in bioactive peptides from marine secondary products, as they offer a great potential for incorporation into functional food and for medical purposes. Bioactive peptides from marine sources have been found to display a wide range of physiological functions including antioxidative, antihypertensive, antimicrobial, immunomodulatory, anticancer and diabetes 2 effects among others. However, majority of the research has been focusing on the peptides derived from hydrolysis with commercial industrial enzymes and the usefulness of these hydrolysates. It could be interesting whether digestion of fish secondary tissue with gastrointestinal proteases generates peptides, which also have these health promoting properties either in relation to gastrointestinal digestion or as an alternative to the use of industrial proteases. Furthermore, as a bioactive defense system against the bacterial load in the water, fish is expected to possess bio-components as small peptides. It could therefore be relevant whether these naturally occurring peptides exhibit other functional and health promoting bioactive properties. On this background the overall goal of the present PhD research was to discover and characterize novel bioactive peptides from marine secondary products. The research was divided into two more specific objectives in different parts. Part I was to investigate naturally occurring peptides for bioactivities as radical scavenging activity, Angiotensin I-converting enzyme (ACE) and intestinal dipeptidyl peptidase (DPP-IV) inhibiting properties and protease inhibiting activity in tissue of secondary products such as gills, belly flap muscle and skin from salmon (Salmo salar). This was conducted in extracts from untreated and heat treated tissue by using in vitro assays. Furthermore, if any detected, an aim was to characterize the corresponding candidate bioactive molecules. Part II was to investigate peptides in hydrolysates from salmon (Salmo salar) belly flap muscle and skin generated by gastrointestinal proteases for radical scavenging activity, DPP-IV and ACE inhibiting properties. Furthermore it was the aim to study the stability and mechanism of the muscle hydrolysates towards ACE and DPP-IV activity. Also, the corresponding candidate bioactive molecules, - if any, in selected hydrolysates should be characterized. For the naturally occurring peptides investigated in part I, radical scavenging activity was detected in <10 kDa extracts of gills, belly flap muscle and skin with EC$_{50}$ values of 39, 82 and 100 μg/mL, respectively. No ACE and DPP-IV inhibiting activity could be detected. Mass spectrometry analysis of dominating compounds in active fractions from size exclusion chromatography showed that families of related compounds were found in several fractions from different tissues but most pronounced in gills. One family was defined according to content of a specific amino acid sequence (PW). Three families were defined by the m/z value of the smallest compound reported in each family (219, 434 and 403). The three latter families did not contain standard unmodified amino acids, indicating peptides with modified amino acids or other kinds of molecules. For the peptides in the hydrolysates generated by gastrointestinal proteases investigated in part II, analysis of <10 kDa hydrolysates showed that gastrointestinal proteases generated peptides with clear radical scavenging activity and DPP-IV and ACE inhibiting activity as well. Hydrolysates from pepsin digestion exhibited the lowest EC$_{50}$ values for radical scavenging activity and ACE inhibition, whereas EC$_{50}$ values increased in hydrolysates after subsequent digestion with pancreatic and mucosal proteases. Interestingly, EC$_{50}$ values for the DPP-IV inhibition were hardly affected by sequential digestion. Inhibition modes for the muscle hydrolysates were both competitive and non-competitive, but prolonged incubation showed that the inhibitory properties unstable, and therefore properly digested as competitive substrates by gastrointestinal proteases. When fractionated by size exclusion chromatography, radical scavenging activity was found in all obtained hydrolysates, though hydrolysates from belly flap muscle showed a much stronger activity compared to skin hydrolysates. DPP-IV and ACE inhibiting activity was observed in nearly all fractionated hydrolysates, only in the pepsin generated hydrolysates no pronounced (or maybe none) DPP-IV inhibitory effect was observed. This is notable, as it was not in agreement with the obtained results from EC$_{50}$ values for the three-fold dilution curves. However, it is interesting, as
it might be due to a synergy effect only present in the main hydrolysates, which vanishes when the hydrolysates are separated into fractions. Finally, mass spectrometry analysis of dominating compounds in active fractions from size exclusion chromatography from belly flap muscle and skin hydrolysate generated from pancreatin/mucosa digestion, showed that many compounds were present in several fractions. Currently it has not been possible to identify candidate bioactive compounds responsible for a certain bioactivity, as a more thorough analysis and characterization is required as a more thorough analysis and characterization is required. Overall, this PhD research clearly showed a potential for bioactive peptides with health promoting properties from fish secondary tissues, especially when generated with gastrointestinal proteases, both in relation to gastrointestinal digestion and as an alternative to the use of industrial proteases.

General information
State: Published
Organisations: National Food Institute
Authors: Falkenberg, S. S. (Intern), Nielsen, H. H. (Intern), Jessen, F. (Intern), Stagsted, J. (Ekstern), Joensen, H. (Ekstern)
Number of pages: 181
Publication date: 2014

Effect of Gastrointestinal Protease Digestion on Bioactivity of Marine Peptides
Focus in nutritional science has turned towards components in, or added to, foods that may possess health beneficial activities beyond the classical nutritional value, namely functional food. Bioactive peptides are examples of such components. In vitro studies on bioactivities have mainly been executed without concerning subsequent digestion after intake and the aim of this work was hence to investigate how the in vitro antioxidative, antihypertensive and caspase activating activities of peptides are affected by digestion with gastrointestinal (GI) proteases. Five different fish protein hydrolysates were chosen to study the effect of in vitro digestion on bioactivity. The protein concentration decreased in all samples during digestion and the molecular weight distribution of the peptides shifted towards lower values. Thus, in vitro digestion with GI proteases resulted in a further degradation of the peptides obtained by hydrolysis. The antihypertensive effect increased in all samples after digestion with GI proteases whereas the antioxidative capacity decreased. The effect on the caspase activity depended on the proteases used in the preparation of hydrolysates. In conclusion, the caspase activity and antihypertensive activity are maintained during digestion with GI proteases, while the antioxidative capacity seems to be reduced.

General information
State: Published
Organisations: National Food Institute, Division of Industrial Food Research, University of Tromsø, Marinova A/S, University of Copenhagen
Pages: 74-84
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Agricultural Science and Technology, B
Volume: 4
ISSN (Print): 2161-6264
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
Original language: English
Source: PublicationPreSubmission
Source-ID: 91513920
Publication: Research - peer-review › Journal article – Annual report year: 2014
Extraction and characterization of candidate bioactive compounds in different tissues from salmon (Salmo salar)

There is an interest in bioprospecting organisms from the aquatic environment to find novel bioactive compounds with health promoting or other functional properties. The aim of this study was to evaluate extracts from untreated and heat-treated salmon tissues for their radical scavenging activities and for their ability to inhibit activity of the proteases angiotensin I-converting enzyme (ACE) and dipeptidyl peptidase 4 (DPP-4). In vitro assays were used to detect these activities and the corresponding candidate bioactive compounds were characterized by LC-MS/MS. Radical scavenging activity was detected in <10kDa extracts of gills, belly flap muscle and skin with EC50 values of 39, 82 and 100 µg/mL, respectively. No ACE or DPP-4 inhibiting activity could be detected. LC-MS/MS analysis of dominating compounds in active fractions from size exclusion chromatography showed that families of related compounds were found in several fractions from different tissues but most pronounced in gills. One family was defined according to content of a specific amino acid sequence (PW). Three families were defined by the m/z value of the smallest compound reported in each family (219, 434 and 403). The three latter families did not contain standard unmodified amino acids, indicating peptides with modified amino acids or other kinds of molecules. Industrial relevance. Bioprospecting in fish tissue traditionally regarded as waste can lead to detection of novel natural bioactive compounds including peptides, which could have nutritional, pharmaceutical or other functional value and be used in health and functional foods, thus increasing the value adding of secondary marine products. A number of naturally occurring antimicrobial peptides have been characterized from fish skin and gills, such as piscidins, but these and other fish tissues may contain numerous other compounds with bioactive properties. Such compounds could be extracted by the subsection of the fish industry that processes marine secondary products and further developed to commercial products. Thus, the identification of novel bioactive compounds could be utilized by the pharmaceutical and biotech industry to develop new products.

General information

State: Published
Organisations: National Food Institute, Division of Industrial Food Research, University of the Faroe Islands, Aarhus University
Authors: Falkenberg, S. S. (Intern), Mikalsen, S. O. (Ekstern), Joensen, H. (Ekstern), Stagsted, J. (Ekstern), Nielsen, H. H. (Intern)
Number of pages: 15
Pages: 11-25
Publication date: 2014
Main Research Area: Technical/natural sciences

Publication information

Journal: International Journal of Applied Research in Natural Products
Volume: 7
Issue number: 4
ISSN (Print): 1940-6223
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Scopus rating (2016): SJR 0.217 SNIP 0.557
Scopus rating (2015): SJR 0.179 SNIP 0.248 CiteScore 0.45
Scopus rating (2014): SJR 0.245 SNIP 0.682 CiteScore 0.8
Scopus rating (2013): SJR 0.368 SNIP 1.16 CiteScore 1.18
ISI indexed (2013): ISI indexed no
Scopus rating (2012): SJR 0.372 SNIP 1.001 CiteScore 1.68
ISI indexed (2012): ISI indexed no
Scopus rating (2011): SJR 0.458 SNIP 0.929 CiteScore 0.94
ISI indexed (2011): ISI indexed no
Scopus rating (2010): SJR 0.255 SNIP 0.471
Scopus rating (2009): SJR 0.142 SNIP 0.124
Original language: English
Marine by-products, Natural compounds, Radical scavenging, Salmon tissue
Electronic versions:
250_938_1_PB.pdf
Links:
http://www.ijarnp.org/index.php/ijarnp/article/view/250
Source: FindIt
Source-ID: 2263886240
Publication: Research - peer-review › Journal article – Annual report year: 2015

Influence of dietary lipid and protein sources on the sensory quality of organic rainbow trout (Oncorhynchus mykiss) after ice storage

The influence of dietary protein and lipid sources on the quality of organic rainbow trout (Oncorhynchus mykiss) was studied. The protein and oil sources were fishmeal, fish oil, and organic vegetable protein and oils. Sensory profiling was
performed during 3 to 14 days of ice storage along with lipid analyses of the fillet. Overall, the results showed that the sensory characteristics of the trout were affected in different ways during ice storage. The source of lipid seemed to affect the sensory quality at the beginning of the storage period, while the protein source seemed to have a more pronounced impact at the end of the storage period

**General information**

State: Published
Organisations: National Food Institute, Division of Industrial Food Research, National Institute of Aquatic Resources, Section for Aquaculture
Pages: 333-346
Publication date: 2014
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Journal of Aquatic Food Product Technology
Volume: 23
Issue number: 4
ISSN (Print): 1049-8850
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.59 SJR 0.268 SNIP 0.582
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.298 SNIP 0.623 CiteScore 0.65
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.275 SNIP 0.632 CiteScore 0.62
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.281 SNIP 0.558 CiteScore 0.59
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.429 SNIP 0.545 CiteScore 0.64
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.385 SNIP 0.621 CiteScore 0.68
ISI indexed (2011): ISI indexed no
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.282 SNIP 0.34
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.197 SNIP 0
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.2
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.28
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.216
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.205
Web of Science (2005): Indexed yes
Protein markers for the salting and ripening process in Herring production

General information
State: Published
Organisations: National Food Institute, Division of Industrial Food Research, Norwegian Institute of Food, Fisheries and Aquaculture Research
Authors: Jessen, F. (Intern), Skåra, T. (Ekstern), Nielsen, H. H. (Intern)
Number of pages: 1
Publication date: 2014
Event: Poster session presented at 10th Siena Meeting From Genome to Proteome, Siena, Italy.
Main Research Area: Technical/natural sciences
Electronic versions:
FLJ_Siena_2014_poster_final.pdf
Source: PublicationPreSubmission
Source-ID: 103565000
Publication: Research - peer-review › Poster – Annual report year: 2014

Organic plant ingredients in the diet of Rainbow trout (Oncorhynchus mykiss): Impact on fish muscle composition and oxidative stability

Rainbow trout were fed diets containing either fish meal and fish oil (FM-FO) (control) or diets in which 40% of the fishmeal was substituted with a mixture of ingredients grown organically including plant protein concentrate (PP) in combination with either fish oil (FO) as lipid source, or one of the following organic plant oils; rapeseed (RO), linseed/flaxseed (LO), grape seed (GO), or sunflower (SO). The impact of these substitutions was investigated by measuring fish muscle fatty acid profile as well as oxidative and color stability of the fillet during 14 days ice storage. The inclusion of plant protein concentrate did not affect the fatty acid profile significantly but resulted in a slightly improved oxidative stability of the fish fillets as compared to the control diet. The fatty acid profile of the oil used was in general well reflected in the fish muscle fatty acid profile. Fish fed PP-RO were the most oxidatively stable during ice storage but the omega-3 fatty acid content was reduced by 40% compared to fish fed the FM-FO control diet. Replacing FO by LO was not suitable as it induced oxidation and the fillet contained 40–50% less of long chain omega-3 fatty acids.

General information
State: Published
Organisations: National Food Institute, Division of Industrial Food Research, National Institute of Aquatic Resources, Section for Aquaculture
Pages: 1367-1377
Publication date: 2013
Main Research Area: Technical/natural sciences
Publication information
Journal: European Journal of Lipid Science and Technology
Volume: 115
Issue number: 12
ISSN (Print): 1438-7697
Ratings:
BFI (2018): BFI-level 1
Oxidative changes during ice storage of rainbow trout (Oncorhynchus mykiss) fed different ratios of marine and vegetable feed ingredients

Recently fish meal and oil have increasingly been replaced with proteins and oils from vegetable sources in the diets of farmed salmonids, but the consequences for the oxidative stability of the resulting fish products have not been
investigated. The aim of the present study was to evaluate the influence of feeding regime on composition of rainbow trout fillets, as well as on lipid and protein oxidation during storage on ice. Rainbow trout were fed six different diets, which differed in their levels of marine oil and proteins vs. vegetable oil and protein. Fish fillets were characterised by measurement of fatty acid and amino acid composition, primary and secondary lipid oxidation products, astaxanthin and tocopherol content. Protein oxidation was assessed by measuring protein carbonyl content, oxidised amino acids, sulfhydryl groups and immuno-blotting against carbonyl groups. Feeding regimes significantly influenced fatty acid composition. Replacement of fish oil with vegetable oil reduced formation of primary oxidation products, but the effect on secondary oxidation products differed between different types of volatiles. The differences in protein and amino acid composition were not significant, and there were no clear effects of diets on protein oxidation, but data indicated that compounds present in the marine ingredients might have had an effect on protein oxidation.

**General information**
State: Published
Organisations: National Food Institute, Division of Industrial Food Research, Val-de-Marne Territorial Division
Authors: Timm Heinrich, M. (Intern), Eymard, S. (Ekstern), Baron, C. P. (Intern), Nielsen, H. H. (Intern), Jacobsen, C. (Intern)
Pages: 1220-1230
Publication date: 2013
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Food Chemistry
Volume: 136
Issue number: 3-4
ISSN (Print): 0308-8146
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BFI (2018): BFI-level 2
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.85 SJR 1.706 SNIP 2.091
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.597 SNIP 1.962 CiteScore 4.31
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.595 SNIP 2.027 CiteScore 3.92
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.548 SNIP 2.069 CiteScore 3.87
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.805 SNIP 2.357 CiteScore 3.98
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.909 SNIP 2.395 CiteScore 4.17
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.965 SNIP 2.261
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.776 SNIP 2.024
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.488 SNIP 1.703
Antioxidative, DPP-IV and ACE inhibiting peptides from fish protein hydrolysed with intestinal proteases

Proteins from fish tissue could be a promising source of peptides with a nutritional and pharmaceutical value, e.g. as treatment of type 2 diabetes with dipeptidyl peptidase IV (DPP-IV) inhibiting peptides, and could be used in health and functional foods and thereby increasing the value of secondary marine products.

The approach in this study is to hydrolyse skin and belly flap tissue from Salmon with the use of mammalian digestive proteases from pancreas and intestinal mucosa and test hydrolysates for antioxidative capacity, intestinal DPP-IV and angiotensin converting enzyme (ACE) inhibiting properties.

10kDa dialysis bags containing 10ml water were added to homogenized fish tissues, which were subsequently hydrolysed for 24 hours at 37°C and pH 8 with intestinal mucosa extract and/or pancreatin solution from pig. Dialysis bags were then removed and content were analyzed for free amino groups, antioxidative capacity by ABTS (2,2-azinobis(3-ethylbenzothiazoline-6-sulfonicacid)), DPP-IV and ACE inhibiting activity.

Degree of hydrolysis (DH) of hydrolysates was approximately 13% and 10% for belly flap and skin respectively. No clear difference was observed in DH between pancreatin and pancreatin + mucosa hydrolysates. No DH was obtained for tissues hydrolysed with only intestinal mucosa extract.

Preliminary results showed antioxidant activity and intestinal DPP-IV and ACE inhibiting activity in 10 kDa fraction from both belly flap and skin hydrolysates but with a higher antioxidative capacity in belly flap hydrolysates. No difference between hydrolysates with pancreatin and pancreatin+mucosa was observed.

Hydrolysates will be further fractionated by gelfiltration. Fractions will be analyzed for the three bioactivities and also presented.
Effect of Replacement of Marine Ingredients with Vegetable Oil and Protein on Oxidative Changes during Ice Storage of Rainbow Trout (Oncorhynchus mykiss)

Recently, fish meal and fish oil have increasingly been replaced with proteins and oils from vegetable sources in the diets of farmed salmonids, but the consequences for the oxidative stability of the resulting fish products have only been investigated to a limited extent. This presentation will discuss results from two recent studies from our laboratory on this topic. In the first study, rainbow trout were fed six different diets, which differed in the ratio between marine oil and proteins vs. vegetable oil and protein. Rapeseed oil was used as the oil source and the vegetable proteins were a mix based on pea, wheat, sunflower and beans. In the second study, one group of rainbow trout was fed a traditional diet based on fish meal and fish oil, whereas the other five groups were fed diets in which 40 % of the fish meal was replaced with plant proteins from peas, horse bean and rapeseed. The oil source was either fish oil, linseed oil, sunflower oil, rapeseed oil or grapeseed oil. Rainbow trout was stored on ice for up to 14 days. In both studies, the effect of the feeding regime on the fatty acid composition and lipid oxidation in the fish fillet was determined. In the first study, the effect of the diet on protein oxidation in fish fillets was also determined. In both studies, feeding regimes significantly influenced fatty acid composition. Moreover, concentration of primary oxidation products at the end of the storage period was highest in fish fed lipids with the highest unsaturation index and lowest in fish fed with lipids with low unsaturation index. The effect of the diet on secondary oxidation products differed between different types of volatiles. There were no clear effects of diets on protein oxidation, but data indicated that compounds present in the marine ingredients might have had an effect on protein oxidation.

General information
State: Published
Organisations: National Food Institute, Division of Industrial Food Research, Section for Aquatic Lipids and Oxidation
Publication date: 2012
Event: Abstract from Novel Sources for Omega-3 for Food and Feed Copenhagen, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Electronic versions:
14.pdf
Source: dtu
Source-ID: u::6326
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2012

Proteome Analysis of Pyloric Ceca: A Methodology for Fish Feed Development?

Changing the protein source of fish feed from fish meal to alternative sources of protein will affect traits such as fish growth, quality, and feed utilization. The present investigation was initiated to introduce a two-dimensional gel electrophoresis based proteomic workflow as a tool to investigate feed effects on fish by analyzing protein changes in the fish gut. The workflow was used to study the effect of substituting fish meal in fish feed by alternative sources of protein. Rainbow trout divided into five groups were fed for 72 days with feeds varying in protein composition. By two-dimensional gel electrophoresis proteins extracted from the pyloric ceca were separated, making it possible to measure the abundance of more than 440 protein spots. The expression of 41 protein spots was found to change due to differences in feed composition. By mass spectrometry 31 of these proteins were identified, including proteins involved in digestion (trypsinogen, carboxylic ester hydrolase, and aminopeptidase). The many expression changes indicated that the trout, when adapting to differences in feed formulation, alter the protein composition of the gut.

General information
State: Published
Organisations: Department of Systems Biology, Enzyme and Protein Chemistry, National Food Institute, Division of Industrial Food Research, University of Southern Denmark, Aller Aqua A/S
Authors: Wulff, T. (Intern), Petersen, J. (Ekstern), Nørrelykke, M. R. (Ekstern), Jessen, F. (Intern), Nielsen, H. H. (Intern)
Pages: 8457-8464
Publication date: 2012
Main Research Area: Technical/natural sciences
Publication information
Journal: Journal of Agricultural and Food Chemistry
Volume: 60
Issue number: 34
ISSN (Print): 0021-8561
Ratings:
BFI (2018): BFI-level 2
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.45 SJR 1.291 SNIP 1.344
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.236 SNIP 1.253 CiteScore 3.23
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.278 SNIP 1.421 CiteScore 3.25
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.423 SNIP 1.479 CiteScore 3.44
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.43 SNIP 1.471 CiteScore 3.2
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.384 SNIP 1.446 CiteScore 3.1
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.408 SNIP 1.392
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.317 SNIP 1.303
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.361 SNIP 1.324
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.249 SNIP 1.439
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.358 SNIP 1.418
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.286 SNIP 1.521
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.316 SNIP 1.496
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.158 SNIP 1.479
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.236 SNIP 1.537
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.066 SNIP 1.255
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 1.091 SNIP 1.312
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.859 SNIP 1.256
Original language: English
feed utilization, fish feed, Oncorhynchus mykiss, proteomic, pyloric ceca, two-dimensional gel electrophoresis
Electronic versions:
jf3016943.pdf
DOIs:
10.1021/jf3016943
Sensory and quality properties of fresh, frozen and packaged fish

General information
State: Published
Organisations: National Food Institute, Division of Industrial Food Research
Authors: Hyldig, G. (Intern), Nielsen, J. (Intern), Jacobsen, C. (Intern), Nielsen, H. H. (Intern)
Pages: 154-170
Publication date: 2012

Host publication information
Title of host publication: Advances in meat, poultry and seafood packaging
Publisher: Woodhead Publishing
Editor: Kerry, J. P.
ISBN (Print): 978-1845697518
Main Research Area: Technical/natural sciences
Source: dtu
Source-ID: u::5746
Publication: Research - peer-review › Book chapter – Annual report year: 2012

Sensory Properties of Frozen Herring (Clupea harengus) from Different Catch Seasons and Locations
Freezing of herring (Clupea harengus) for human consumption is increasing in the Nordic herring industry, either onboard the fishing vessels or right after landing. The quality of frozen herring as a raw material does not only depend on the frozen storage conditions applied, but also on compositional features, something which in turn can vary with season and catching ground. To unravel the link between biological variations, basic muscle composition, and sensory properties of frozen herring, a unique herring raw material was caught by commercial fishing vessels at three locations: around Iceland, outside the Norwegian coast, and in Kattegat/Skagerrak. The samplings were done according to a specific scheme and conducted over several seasons and 2 years. The herring was converted into butterfly fillets, packed in cardboard boxes, frozen, and then stored at –20 °C or –80 °C for up to 18 mo. The sensory quality was characterized by objective sensory profiling. It was shown that two generalized sensory variables could be defined from a principal component analysis of the sensory data. Except for the expected pronounced effect from storage time, the most distinct variation followed the lipid content, which in turn varied with season. An unexpected conclusion was that catching location only had a minor affect on the changes in sensory quality of herring during frozen storage. Knowledge about how season and catching location affect herring during frozen storage will be useful for optimizing the utilization of herring for frozen storage for human consumption.

General information
State: Published
Organisations: National Food Institute, Division of Industrial Food Research, Chalmers University of Technology, Institute of Marine Research, Icelandic Food Research
Authors: Hyldig, G. (Intern), Jørgensen, B. M. (Intern), Undeland, I. (Ekstern), Olsen, R. E. (Ekstern), Jónsson, Á. (Ekstern), Nielsen, H. H. (Intern)
Pages: S288-S293
Publication date: 2012
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Food Science
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Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.77 SNIP 1.013 CiteScore 1.92
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.83 SNIP 0.985 CiteScore 1.97
Web of Science (2015): Indexed yes
The effect of protein and lipid source in organic feed for (organic) rainbow trout on sensory quality

General information
State: Published
Organisations: National Food Institute, Division of Industrial Food Research, National Institute of Aquatic Resources, Section for Aquaculture
Number of pages: 1
Publication date: 2012
Event: Poster session presented at EuroSense 2012 Fifth European Conference on Sensory and Consumer research, Berne, Switzerland.
Vegetable based fish feed changes protein expression in muscle of rainbow trout (Oncorhynchus mykiss)

General information
State: Published
Organisations: National Food Institute, Division of Industrial Food Research, Department of Systems Biology, Enzyme and Protein Chemistry, Technical University of Denmark
Authors: Jessen, F. (Intern), Wulff, T. (Intern), Bach Mikkelsen, J. (Ekstern), Hyldig, G. (Intern), Nielsen, H. H. (Intern)
Pages: 134-137
Publication date: 2012

Host publication information
Title of host publication: Farm animal proteomics : Proceedings of the 3rd Managing Committee meeting and 2nd Meeting of Working Groups 1, 2 & 3 of COST Action FA 1002
Place of publication: The Netherlands
Publisher: Wageningen Academic Publishers
Editors: Rodrigues, P., Eckersall, D., de Almeida, A.
ISBN (Print): 978-90-8686-195-8
Main Research Area: Technical/natural sciences
Conference: 3rd Managing Committee Meeting and 2nd Meeting of Working Groups 1, 2 & 3 of COST Action FA1002, Algarve, Portugal, 12/04/2012 - 12/04/2012
Publication: Research › peer-review › Article in proceedings – Annual report year: 2012

Report from workshop on Bioactive peptides from aquatic raw materials: Copenhagen, 2 March 2010

General information
State: Published
Organisations: National Food Institute, Division of Industrial Food Research
Authors: Andersen, L. L. (Intern), Nielsen, H. H. (Intern), Jessen, F. (Intern)
Number of pages: 133
Publication date: Dec 2011

Publication information
Place of publication: Søborg
Publisher: The National Food Institute, Technical University of Denmark
Edition: 1
ISBN (Print): 978-87-92763-07-5
Original language: English
Main Research Area: Technical/natural sciences
Publication: Research › Report – Annual report year: 2011

Antioxidant Activity of Fish Protein Hydrolysates in in vitro Assays and in Oil-In-Water Emulsions.
The aim of this study was to screen different protein hydrolysates with respect to their antioxidative properties in order to select the most promising extracts for further evaluation in oil-in-water emulsions. Three fractions of protein hydrolysates (Crude, >5kDa and 5kDa, 3-5kDa and

General information
State: Published
Organisations: Division of Industrial Food Research, National Food Institute
Authors: Farvin, S. (Intern), Andersen, L. L. (Intern), Jacobsen, C. (Intern), Nielsen, H. H. (Intern), Jessen, F. (Intern)
Publication date: 2011
Event: Abstract from 102nd AOCS Annual Meeting & Expo, Cincinnati, Ohio, USA, .
Main Research Area: Technical/natural sciences
Electronic versions:
AOCS.pdf
Source: orbit
Source-ID: 312475
Differences in fish feed composition influence protein expression in the pyloric caeca in rainbow trout

General information
State: Published
Organisations: Division of Industrial Food Research, National Food Institute, Danish Technological Institute
Authors: Wulff, T. (Intern), Petersen, J. (Ekstern), Nørrelykke, M. R. (Ekstern), Jessen, F. (Intern), Nielsen, H. H. (Intern)
Publication date: 2011
Event: Poster session presented at Proteomic Forum, Berlin, Germany.
Main Research Area: Technical/natural sciences
Links:
http://www.proteomic-forum.de/index.php?option=com_content&view=category&id=3&layout=blog&Itemid=4
Source: orbit
Source-ID: 313958
Publication: Research - peer-review › Poster – Annual report year: 2011

Extraction and characterization of naturally occurring bioactive peptides from different tissues from Salmon (Salmo salar)
The aquatic ecosystem represents a large number of organisms adapted to living conditions remarkably different from the land-living ones. For instance fish generally possess an eminent bioactive defense to protect them from the high bacterial load in water, and must be expected to harbor a large number of bio-components such as bioactive peptides for this purpose. Tissue and proteins from e.g. fish gills, skin and viscera could be a new source of peptides that could have a nutritional and pharmaceutical value, and be used in health and functional foods and thereby increasing the value adding of secondary marine products. Only few naturally occurring bioactive peptides have been characterized such as the antimicrobial polypeptide piscidines from gills. It is therefore hypothesized, that fish tissue also contains numerous other peptides with other bioactive properties. The approach in this project is therefore to extract and identify naturally occurring bioactive peptides from different tissues from salmon. A number of aqueous extracts were made from gills, skin and belly flap. In order to preserve the bioactivity of the peptides mild extraction procedures as acidic, basic and aqueous solutions were used. Combination of different extraction conditions such as with/without boiling, with/without inhibitor and variation of pH resulted in a total of 36 extracts. The activity of the extracts was analyzed in vitro for ACE (angiotensin-converting enzyme) inhibiting activity, and anti-oxidative activity (Free Radical Scavenging assay). A number of extracts showed high ACE inhibiting and anti-oxidative activity. The extracts were then size fractionated by ultrafiltration using a 10 kDa filter, and relevant fractions below 10 kDa from gills, skin and belly flap were further fractionated by gel-filtration on a Superdex peptide HR 10/30 column. Peptide fractions were collected and freeze-dried and will be further characterized with LCMS and MS/MS.

General information
State: Published
Organisations: Division of Industrial Food Research, National Food Institute
Authors: Falkenberg, S. S. (Intern), Nielsen, H. H. (Intern)
Number of pages: 119
Publication date: 2011

Host publication information
Title of host publication: WEFTA 2011 - Seafood for the Modern Consumer : Abstracts
Place of publication: Gothenburg
Publisher: Chalmers tekniska högskola
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 287024
Publication: Research › Conference abstract in proceedings – Annual report year: 2011

Feed based on vegetable materials changes the muscle proteome of the carnivore rainbow trout
Feed production for aquaculture of carnivore fish species relies heavily on protein and lipid from the limited resources of wild fish and other sea living organisms. Thus the development of alternative feeds replacing fish meal and oil with components of vegetable origin is important for a sustainable production of fish from aquaculture. However, such a change in feed will have an effect on the fish composition and metabolism and may also affect eating quality as well as different health and nutritional properties. A proteomic approach was taken to compare the muscle protein profile of rainbow trout fed two different diets identical in protein and oil content, but with diet C based on fish meal and oil and diet V based on rapeseed oil and vegetable proteins. In addition to the proteomic investigation the textural properties of the fish were analysed by sensory profiling. Protein expression profiles were achieved by 2-dimensional gel electrophoresis.
The result showed that 40 spots were significantly (p

**General information**

State: Published
Organisations: National Food Institute, Division of Industrial Food Research, Technical University of Denmark
Authors: Jessen, F. (Intern), Wulff, T. (Intern), Bach Mikkelsen, J. (Ekstern), Nielsen, H. H. (Intern)
Number of pages: 119
Publication date: 2011

**Host publication information**

Title of host publication: WEFTA 2011 - Seafood for the Modern Consumer : Abstracts
Place of publication: Gothenburg
Publisher: Chalmers tekniska högskola
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 287000
Publication: Research › Conference abstract in proceedings – Annual report year: 2011

**The effect of protein and lipid source in organic feed for (organic) rainbow trout on sensory quality**

The aim of this work was to study which effects protein and lipid source in feed for organic rainbow trout (Oncohynchus mykiss) may have on the sensory quality of the final product after up to 14 days of storage in ice. The protein sources used in the experiment were fishmeal and a mixture of vegetable protein. While the lipid sources were fish, linseed, sunflower, rapeseed and grape seed oil. After slaughtering all fish were frozen (-40°C) until the sensory experiment was performed, for which the trout were thawed and stored for 3, 5, 7 and 14 days in ice respectively. The sensory experiment included objective sensory profiling, of samples which were heat treated in a convention oven at 100°C until the core temperature was 70°C. The sensory panel consisted of 11 assessors which all were tested and trained. The sensory analysis included descriptors related to the odour, appearance, flavour and texture. After 3 days of storage in ice an impact of lipid source is seen. Inclusion of linseed oil resulted in a sensory profile comparable to the use of fish oil in the feed. While some of the other vegetable oils, especially grape seed oil results in a sensory profile rather different from the trout that had fish oil. However, this difference observed after 3 days of storage did not appear after a longer storage time, and consequently no differences in the sensory characteristics is observed after the 5 days of storage in ice. Nevertheless after 7 days in ice some differences are appearing again. Here the trout which have had rapeseed and grape seed oil in the feed has a more neutral flavour and odour compared to the other ones. After 14 days of storage the protein source had an effect, and the trout which received fishmeal in the feed were more tainted. Therefore, it is seen that the shelf-life is increased by feeding the fish with vegetable protein compared to fish meal. The conclusion of the experiment therefore was that both dietary vegetable protein and lipid sources can influence on sensory characteristics of trout stored in ice.

**General information**

State: Published
Organisations: Division of Industrial Food Research, National Food Institute, Section for Aquaculture, National Institute of Aquatic Resources
Number of pages: 119
Publication date: 2011

**Host publication information**

Title of host publication: WEFTA 2011 - Seafood for the Modern Consumer : Abstracts
Place of publication: Gothenburg
Publisher: Chalmers tekniska högskola
Main Research Area: Technical/natural sciences
Electronic versions:
abstract.pdf
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Source-ID: 286999
Publication: Research › Conference abstract in proceedings – Annual report year: 2011

**Vækst og kvalitet af motioneret regnbueørred**

**General information**

State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources, Division of Industrial Food Research, National Food Institute

Vækst og kvalitet af motioneret regnbueørred
Fish health and fish quality: Effects of tissue regeneration from a molecular perspective

Aquaculture is an expanding worldwide industry producing an increasing amount of fish every year. The quality of the fish meat is dependent upon many biological and non-biological factors. Infectious diseases are known to cause bleedings and damage of the muscle tissue that may lead to scarring after recovery, which possibly will affect some quality parameters. However, until now it has not been examined if previous infections have an impact on the sensory characteristics of the meat after slaughter. Further, the underlying molecular mechanisms involved in regeneration of muscle tissue are poorly described in fish. The present work in this thesis focused on: 1) examination of potential changes in the quality regarding texture of the muscle tissue in rainbow trout (Oncorhynchus mykiss) after previous infection with the bacterial pathogens Yersinia ruckeri and Vibrio anguillarum; 2) characterisation of potential immune functions of fibroblasts and the importance of this in relation to tissue regeneration; 3) creation of a model to study local, sterile tissue damage in the muscle tissue of rainbow trout and comparison of this to infection of Atlantic salmon (Salmo salar) by the bacterium Moritella viscosa, the causative agent of ‘winter ulcer’ in Norway. In order to reach these objectives, sensory analysis and ELISA was used. Further, quantitative real-time RT-PCR was used in order to measure the expression of genes coding for immunological factors and tissue regeneration. The results of these studies showed that previous infections by Yersinia ruckeri and Vibrio anguillarum gave rise to subsequent changes regarding textural quality parameters in fresh fish meat, while no differences were seen for cold-smoked meat from the same fish. The texture in previous infected fish was less flaky and less oily, but had a higher toughness and fibrousness in comparison to control fish. These observations could be explained from the molecular studies. Herein, local inflammatory responses characterised by up-regulation of IL-1β and IL-8 was seen in mechanically damaged and M. viscosa infected fish. However, this response was much stronger in infected versus damaged fish, indicating that damaged cells initiate an immune response, but pathogenic triggering was much more potent. A further activation of the genes TGF-β, MMP-2, CTGF and myostatin-1αβ was then seen in both groups, indicating initiation of tissue regeneration. Likely as a consequence of heavier tissue damage in infected fish, the collagen-1α gene was induced in this group. Scarring or fibrosis is equal to deposition of collagen in repaired tissue. Hence, these data may explain the sensory observations from previously infected fish. Finally, the fibroblast cell-line RTHDF from rainbow trout was found to be an immune competent cell type. This was examined since a fast up-regulation of IL-1β and IL-8 shortly after tissue damage was observed in muscle tissue from rainbow trout. These observations led to the suggestion that local resident cells in the muscle tissue are the first to initiate an inflammatory response following tissue damage. The RTHDF cell-line was found to be responsive to LPS from the surface of gram-negative bacteria, but also from damaged RTHDF cells. Hence, the data supported that theory.
Effect of Protein Hydrolysates on Pancreatic Cancer Cells

Effect of Fish Protein Hydrolysates on Pancreatic Cancer Cells Carlo G. Ossum1, Lisa Lystbæk Andersen2, Henrik Hauch Nielsen2, Else K. Hoffmann1, and Flemming Jessen2 1University of Copenhagen, Department of Biology, Denmark, 2Technical University of Denmark (DTU), National Food Institute, Denmark Corresponding author: Carlo G. Ossum (cgossum@gmail.com) A large number of bioactive peptides have been identified in and isolated from various food sources. Milk seems to be a particularly rich source but also different fish species have been found to yield bioactive peptides. Bioactive peptides, usually consisting of 3 to 20 amino acids, can be released from proteins upon degradation by proteolytic enzymes, e.g. in the intestinal tract. The numerous described bioactivities include antihypertensive, anticancerous, antimicrobial, and immunomodulating effects. Here, we investigate the effect of fish protein hydrolysates obtained by enzymatic hydrolysis on cancer cell proliferation. Skin and belly flap muscle from trout were hydrolysed with the unspecific proteases Alcalase, Neutrase, or UE1 (all from Novozymes, Bagsværd, Denmark) to a hydrolysis degree of 1-15%. The hydrolysates were tested for biological activities affecting cell proliferation and ability to modulate caspase activity in pancreatic cancer cells COLO357 and BxPC-3 in vitro. A number of the hydrolysates showed caspase promoting activity; in particular products containing muscle tissue, i.e. belly flap, were able to stimulate caspase activity. Selected hydrolysis products were further fractionated by ultrafiltration into molecular sizes above and below 5 kDa and their activity and dose-dependence was tested.

General information
State: Published
Organisations: National Food Institute, Division of Industrial Food Research, University of Copenhagen
Authors: Ossum, C. G. (Ekstern), Andersen, L. L. (Intern), Nielsen, H. H. (Intern), Hoffmann, E. K. (Ekstern), Jessen, F. (Intern)
Publication date: 2010
Event: Poster session presented at Marine Ingredients Conference, Oslo, Norway.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 270602
Publication: Research - peer-review › Book chapter – Annual report year: 2010
feed production. Consequently, alternative feeding regimes are now considered e.g. use of components of vegetable origin such as soy oil or rapeseed oil combined with vegetable proteins. Such a change in feeding regime will result in a “green fish” and may affect flesh quality and eating quality. The objective was to study the effect of vegetable based feed on sensory of ice storage farmed rainbow trout. Experimental design and methods Feed trials Rainbow trout were farmed in tanks at Biomar A/S, Hirtshals and fed on six different diets covering only marine, only vegetables and mixture of marine and vegetable feeds. Trout for the quality study were slaughtered, vacuum-packed and stored at -80°C until analysis. Sensory Quality Changes in sensory quality were determined by objective descriptive sensory methods using profiling carried out by a trained panel. The fish samples were thawed and ice storage for 3, 5, 7 and 12 days. Results The sensory characterization of the trout feed with 100% marine and 100% vegetable feed showed after 3 days of ice storage that the trout feed with marine fed were more firm, juicy and the texture was more flaky that trout feed with vegetable feed. This sensory difference increased with increasing ice storage.

### General information
- **State:** Published
- **Organisations:** Division of Seafood Research, National Food Institute
- **Authors:** Hyldig, G. (Intern), Nielsen, H. H. (Intern), Holm, J. (Ekstern)
- **Publication date:** 2010
- **Event:** Abstract from 4th European Conference on Sensory and Consumer Research, Vitoria-Gasteiz, Spain.
- **Main Research Area:** Technical/natural sciences
- **Source-ID:** 272259
- **Publication:** Research › Conference abstract for conference – Annual report year: 2010

### Purification and Characterization of Bioactive Peptides from Fish Protein Hydrolysates
- **General information**
  - **State:** Published
  - **Organisations:** National Food Institute, Division of Industrial Food Research
  - **Authors:** Andersen, L. L. (Intern), Nielsen, H. H. (Intern), Jessen, F. (Intern)
  - **Publication date:** 2010
  - **Event:** Poster session presented at Protein.DTU Workshop, Kgs. Lyngby, Denmark.
  - **Main Research Area:** Technical/natural sciences
  - **Source-ID:** 264638
  - **Publication:** Research › Poster – Annual report year: 2010

### Testing New Protein Ingredients for Fish Feed: In Vitro method for estimating protein digestibility in rainbow trout (Oncorhynchus mykiss)
- **General information**
  - **State:** Published
  - **Organisations:** Division of Seafood Research, National Food Institute, Danish Technological Institute, Aller Aqua A/S, BioMar A/S
  - **Authors:** Nørrelykke, M. (Ekstern), Harlyck, V. (Ekstern), Zerrahn, J. E. (Ekstern), Holm, J. (Ekstern), Nielsen, H. H. (Intern)
  - **Publication date:** 2010
  - **Event:** Poster session presented at 2010 EFFoST Annual Meeting : Food and Health, Dublin.
  - **Main Research Area:** Technical/natural sciences
  - **Source-ID:** 272688
  - **Publication:** Research › Poster – Annual report year: 2010

### The effect of farmed trout on cardiovascular risk markers in healthy men
- Increased intake of marine long-chain n-3 PUFA (n-3 LCPUFA) may decrease the risk of CVD and reduce mortality by lowering serum TAG and blood pressure (BP). Furthermore, n-3 LCPUFA may affect novel CVD risk markers related to inflammation and vascular function. The objective of the present study was to examine the effect of farmed trout on novel and traditional CVD risk markers in healthy men, and to evaluate whether this was affected by the aquacultural feed regime. We performed a parallel, 8-week intervention study in which sixty-eight healthy male volunteers were randomised to consume either a daily meal with 150 g farmed trout raised on either marine or vegetable-based feed, or a reference meal containing 150 g chicken. Twenty-four hour BP, pulse wave velocity, augmentation index, fatty acid composition of erythrocyte (RBC), and concentrations of TAG, HDL-cholesterol, LDL-cholesterol, glucose, insulin, C-reactive protein (CRP) and other markers of inflammation were measured at weeks 0 and 8. RBC content of total n-3 LCPUFA, both EPA and DHA, was significantly higher among men consuming trout raised on marine feed compared with men consuming the
vegetable-fed trout or chicken. The three intervention groups did not differ significantly with respect to any of the other outcome variables, although there were trends towards associations between the changes in RBC n-3 LCPUFA and those in BP and CRP. In the present study, we conclude that we could not confirm the fish oil-induced reduction in CVD risk markers after daily consumption of trout with high or low n-3 LCPUFA content. However, trout raised on vegetable-based feed had less pronounced impact on RBC n-3 LCPUFA status.

**General information**

State: Published
Organisations: Division of Seafood Research, National Food Institute, Division of Food Chemistry, National Institute of Aquatic Resources, University of Copenhagen, Aalborg University Hospital, BioMar A/S
Authors: Hallund, J. (Ekstern), Madsen, B. O. (Ekstern), Bügel, S. H. (Ekstern), Jacobsen, C. (Intern), Jakobsen, J. (Intern), Krarup, H. (Ekstern), Holm, J. (Ekstern), Nielsen, H. H. (Intern), Lauritzen, L. (Ekstern)
Pages: 1528-1536
Publication date: 2010
Main Research Area: Technical/natural sciences

**Publication information**

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ISSN (Print): 0007-1145
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- BFI (2018): BFI-level 1
- BFI (2017): BFI-level 1
- Web of Science (2017): Indexed yes
- BFI (2016): BFI-level 1
- Scopus rating (2016): CiteScore 3.46 SJR 1.983 SNIP 1.533
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 1
- Scopus rating (2015): SJR 1.583 SNIP 1.446 CiteScore 3.52
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 1
- Scopus rating (2014): SJR 1.468 SNIP 1.278 CiteScore 3.18
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 1
- Scopus rating (2013): SJR 2.72 SNIP 2.521 CiteScore 3.61
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): SJR 2.263 SNIP 2.484 CiteScore 3.12
- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 1
- Scopus rating (2011): SJR 2.079 SNIP 1.661 CiteScore 3.13
- ISI indexed (2011): ISI indexed yes
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 1
- Scopus rating (2010): SJR 1.248 SNIP 1.277
- Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 1
- Scopus rating (2009): SJR 0.62 SNIP 0.581
- Web of Science (2009): Indexed yes
- BFI (2008): BFI-level 2
- Scopus rating (2008): SJR 0.956 SNIP 1.199
- Web of Science (2008): Indexed yes
- Scopus rating (2007): SJR 0.941 SNIP 1.192
- Web of Science (2007): Indexed yes
- Scopus rating (2006): SJR 0.71 SNIP 0.924
PEPFISH: Utilisation of Bioactive Peptides from Fish Processing – Upgrading the Value of Secondary Products

General information
State: Published
Organisations: National Food Institute, Novozymes A/S, University of Tromsø, Lund University, Marinova A/S, Biofac A/S, Copenhagen University Hospital, University of Copenhagen
Publication date: 2009
Event: Poster session presented at 3rd Joint Trans-Atlantic Fisheries Technology Conference, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences

Proteinafgrøder til økologiske regnbueørreder (Oncorhynchus mykiss)

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources, Section for Fish Diseases, Section for Aquatic Protein Biochemistry
Authors: Jokumsen, A. (Intern), Lund, I. (Intern), Dalsgaard, A. J. T. (Intern), Dalsgaard, I. (Intern), Nielsen, H. H. (Intern), Rasmussen, H. T. (Ekstern), Larsen, V. J. (Ekstern), Jessen, P. B. (Ekstern), Holm, J. (Ekstern)
Publication date: 2009
Event: Poster session presented at Økologi-kongres, Odense, Danmark.
Main Research Area: Technical/natural sciences

Purification and Characterization of Peptides from Fish Protein Hydrolysates

General information
State: Published
Organisations: Section for Aquatic Protein Biochemistry, National Food Institute
Authors: Andersen, L. L. (Intern), Nielsen, H. H. (Intern), Jessen, F. (Intern)
Publication date: 2009
Seafood and health: what is the full story

General information
State: Published
Organisations: Section for Aquatic Protein Biochemistry, National Institute of Aquatic Resources
Authors: Undeland, I. (Ekstern), Lindquist, H. (Ekstern), Chen-Yun, Y. (Ekstern), Falch, E. (Ekstern), Ramel, A. (Ekstern), Cooper, M. (Ekstern), Gildberg, A. (Ekstern), Luten, J. (Ekstern), Stenberg, E. (Ekstern), Nielsen, H. H. (Intern), Elvevoll, E. (Ekstern)
Number of pages: 176
Pages: 17-87
Publication date: 2009

Host publication information
Title of host publication: Marine functional food
Volume: 17
Place of publication: Wageningen
Publisher: Wageningen Academic Publishers
Editor: Luten, J.
ISBN (Print): 90-86-86078-8
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 238807
Publication: Research - peer-review › Book chapter – Annual report year: 2009

Acute single meal effects of trout and poultry on the human plasma proteome

General information
State: Published
Organisations: Section for Aquatic Protein Biochemistry, National Institute of Aquatic Resources
Authors: Rentsch, M. L. (Intern), Nielsen, H. H. (Intern), Lauritzen, L. (Ekstern), Lametsch, R. (Ekstern), Jessen, F. (Intern)
Publication date: 2008
Event: Poster session presented at 8th Siena Meeting From Genome to Proteome, Siena, Italy.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 229072
Publication: Research › Poster – Annual report year: 2008

A molecular approach to pre-harvest impact on post-harvest quality of trout

Fish meat quality is influenced by many biological and physical factors like e.g. rearing, feeding, slaughtering, processing and storage. Observations from the commercial aquaculture industry indicate that infections in e.g. salmon caused by Moritella viscosus or Pancreas Disease (PD) results in downgrading of fish quality and subsequent a reduction in prize. Despite this, the impact of infectious diseases on the meat quality and the mechanisms behind are poorly investigated. Wound repair is a dynamic, interactive response to tissue injury that involves a complex interaction and cross talk of various cell types, extracellular matrix molecules, soluble mediators and cytokines. In order to describe the molecular mechanisms and processes of wound repair, a panel of genes covering immunological factors and tissue regeneration were used to measure changes at the mRNA level following mechanical tissue damage in rainbow trout (Oncorhynchus mykiss). Needle disrupted muscle tissue was sampled at different time points and subject to real-time RT-PCR for measuring the expression of the genes IL-1ß, IL-8, IL-10, TGF-ß, Myostatin-1ab, MMP-2, CTGF, Collagen-1alfa, VEGF, iNOS, Arg-2 and FGF. The results showed an initial phase with up-regulation of immune-related genes followed by a regenerative phase with regulation of genes coding for muscle growth and synthesis of connective tissue.

General information
State: Published
Organisations: Section for Aquatic Protein Biochemistry, National Institute of Aquatic Resources, Section for Aquatic Process and Product Technology
Authors: Nielsen, M. E. (Intern), Hyldig, G. (Intern), Nielsen, H. H. (Intern), Jessen, F. (Intern), Ingerslev, H. (Intern)
Publication date: 2008
Event: Poster session presented at International Conference on Fish Diseases and Fish Immunology, Reykjavik, Iceland,
A molecular approach to pre-harvest impact on post-harvest quality of trout

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquatic Protein Biochemistry, Section for Aquatic Process and Product Technology
Publication date: 2008
Main Research Area: Technical/natural sciences

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Dambrugsørreder bliver vegetarer

**General information**

State: Published
Organisations: Division of Food Production Engineering, National Food Institute, National Institute of Aquatic Resources
Authors: Jørgensen, S. B. (ed.) (Intern), Nielsen, H. H. (Intern)
Publication date: 2008
Main Research Area: Technical/natural sciences

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Changes in liquid-holding capacity, water distribution and microstructure during chill storage of smoked salmon

**General information**

State: Published
Organisations: Division of Food Production Engineering, National Food Institute, Section for Aquatic Process and Product Technology, National Institute of Aquatic Resources, Section for Aquatic Protein Biochemistry
Authors: Løje, H. (Intern), Jensen, K. (Ekstern), Hyldig, G. (Intern), Nielsen, H. H. (Intern), Nielsen, J. (Intern)
Pages: 2684-2691
Publication date: 2007
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Journal of the Science of Food and Agriculture
Volume: 87
Issue number: 14
ISSN (Print): 0022-5142
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.48 SJR 0.87 SNIP 1.222
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.813 SNIP 1.088 CiteScore 2.11
Web of Science (2015): Indexed yes
Fatty acid composition of herring (Clupea harengus L.): influence of time and place of catch on n-3 PUFA content

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquatic Lipids and Oxidation, Section for Aquatic Protein Biochemistry
Authors: Jensen, K. N. (Intern), Jacobsen, C. (Intern), Nielsen, H. H. (Intern)
Pages: 710-718
Publication date: 2007
Main Research Area: Technical/natural sciences
Frozen storage of herring from different stocks and catching seasons. Changes in the sensory attributes

General information
State: Published
Organisations: Section for Aquatic Process and Product Technology, National Institute of Aquatic Resources, Section for Aquatic Protein Biochemistry
Authors: Hyldig, G. (Intern), Møller, J. U. (Intern), Sørensen, R. (Intern), Jørgensen, B. (Intern), Nielsen, H. H. (Intern)
Publication date: 2007
Event: Abstract from 37th WEFTA Conference Seafood, Lisbon, Portugal.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 225987
Publication: Research › Journal article – Annual report year: 2007

Healthy, nutritious and tasty fish for the future

General information
State: Published
Organisations: Section for Aquatic Protein Biochemistry, National Institute of Aquatic Resources, Section for Aquatic Process and Product Technology, National Institute of Aquatic Resources, Section for Aquatic Protein Biochemistry
Authors: Nielsen, H. H. (Intern), Rentsch, M. L. (Intern), Jessen, F. (Intern), Hyldig, G. (Intern), Jacobsen, C. (Intern), Eymard, S. (Intern), Hallund, J. (Ekstern), Lauritzen, L. (Ekstern), Bügel, S. (Ekstern), Lametsch, R. (Ekstern), Holm, J. (Ekstern)
Publication date: 2007
Event: Abstract from 37th WEFTA Conference Seafood, Lisbon, Portugal.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 229306
Publication: Research › Conference abstract for conference – Annual report year: 2007

New method to discriminate between cathepsin B and cathepsin L in crude extracts from fish muscle based on a simple acidification procedure

A new and simple method to distinguish between cathepsin B and cathepsin L in crude extracts of herring (Clupea harengus) muscle has been established. An acid treatment of crude extracts (exposed to pH 3 for 5 min) activated a latent form of cathepsin L and inactivated cathepsin B. Furthermore, in neutral crude extract, the hydrolysis of benzyloxycarbonyl-L-phenylalanyl-L-arginylnyl-4-methylcoumarine (Z-Phe-Arg-MCA) (cathepsin B and cathepsin L substrates) was between 0% and 15% of the hydrolysis of benzyloxycarbonyl-L-arginyl-L-arginyl-7-amino-4-methylcoumarine (Z-Arg-Arg-MCA; cathepsin B substrate). Cathepsin B activity is measured in neutral extract using the specific cathepsin B substrate Z-Arg-Arg-MCA and cathepsin L activity is measured in acid-treated extract with Z-Phe-Arg-MCA as substrate. The specific cathepsin B inhibitor, CA-074, did not inhibit the Z-Arg-Arg-MCA significantly without affecting the Z-Phe-Arg-MCA activity. An acid treatment of the crude extract is therefore a more advantageous approach to discriminate between cathepsin B and cathepsin L activities.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquatic Protein Biochemistry
Authors: Godiksen, H. (Intern), Nielsen, H. H. (Intern)
Pages: 102-106
Publication date: 2007
Main Research Area: Technical/natural sciences
Attachment of Pseudomonas fluorescens AH2 to stainless steel surfaces is reduced by conditioning with fractions of fish extract

General information
State: Published
Organisations: Section for Aquatic Microbiology and Seafood Hygiene, National Institute of Aquatic Resources, Section for Aquatic Protein Biochemistry
Authors: Bernbom, N. (Intern), Kingshott, P. (Ekstern), Barkholt, V. (Ekstern), Nielsen, H. H. (Intern), Gram, L. (Intern)
Publication date: 2006
Event: Poster session presented at 93rd Annual Meeting International Association for Food Protein , Calgary Alberta, Canada
Main Research Area: Technical/natural sciences

Bibliographical note
Poster at IAFP yearly meeting, August 2006, Canada
Økologisk fiskeopdræt: Rapport fra en vidensyntese om udviklingsmuligheder inden for økologisk fiskeopdræt i Danmark

General information
State: Published
Organisations: Section for Aquaculture, National Institute of Aquatic Resources, Section for Fish Diseases, Section for Aquatic Protein Biochemistry
Authors: Jokumsen, A. (Intern), Larsen, V. (Ekstern), Dalsgaard, I. (Intern), Nielsen, H. H. (Intern), Jessen, P. (Ekstern), Kold, J. (Ekstern), Jokumsen, A. (ed.) (Intern)
Number of pages: 110
Publication date: 2006

Publication information
Publisher: FØJO
Original language: Danish
Series: FØJO rapport
Number: 21
Main Research Area: Technical/natural sciences
Links:
Source: orbit
Source-ID: 226076
Publication: Research › Report – Annual report year: 2006

Effect of brining conditions on weight gain in herring (Clupea harengus) fillets

General information
State: Published
Organisations: Section for Aquatic Protein Biochemistry, National Institute of Aquatic Resources
Authors: Birkeland, S. (Ekstern), Sivertsvik, M. (Ekstern), Nielsen, H. H. (Intern), Skåra, T. (Ekstern)
Pages: E418-E424
Publication date: 2005
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Food Science
Volume: 70
Issue number: 7
ISSN (Print): 0022-1147
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.77 SNIP 1.013 CiteScore 1.92
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.83 SNIP 0.985 CiteScore 1.97
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.937 SNIP 1.11 CiteScore 2.07
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.011 SNIP 1.079 CiteScore 2.24
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.978 SNIP 1.086 CiteScore 1.98
ISI indexed (2012): ISI indexed yes
Gammeldags modnede sild og ny teknologi

General information
State: Published
Organisations: Section for Aquatic Protein Biochemistry, National Institute of Aquatic Resources
Authors: Nielsen, H. H. (Intern)
Pages: 2-3
Publication date: 2005
Main Research Area: Technical/natural sciences

Publication information
Journal: LMC nyt
Volume: 4
Original language: Danish
Source: orbit
Source-ID: 224961
Publication: Research - peer-review › Journal article – Annual report year: 2005

Lipid content in herring (Clupea harengus L.) - influence of biological factors and comparison of different methods of analyses: solvent extraction, Fatmometer, NIR and NMR
Lipolysis og different oils using crude enzyme isolate from the intestinal tract of rainbow trout, Oncorhynchus mykiss

Crude enzyme isolate was prepared from the intestine of rainbow trout. Positional specificity of the crude enzyme isolate was determined from both 1(3)- and 2-MAG products after in vitro lipolysis of radioactive-labeled triolein. The ratio of 2-MAG/1(3)-MAG was 2:1, suggesting that the overall lipase specificity of the enzyme isolate from rainbow trout tended to be 1,3-specific; however, activity against the sn-2 position also was shown. In vitro lipolysis of four different unlabeled oils
was performed with the crude enzyme isolate. The oils were: structured lipid (SL; containing the medium-chain FA (MCFA) 8:0 in the sn-1,3 positions and long-chain FA (LCFA) in the sn-2 position), DAG oil (mainly 1,3-DAG), fish oil (FO), and triolein (TO). MCFA were rapidly hydrolyzed from the SL oil. LCFA including n-3 PUFA were, however, preserved in the sn-2 position and therefore found in higher amounts in 2-MAG of SL compared with 2-MAG of FO, DAG, and TO. Lipolysis of the DAG oil produced higher amounts of MAG than the TAG oils, and 1(3)-MAG mainly was observed after lipolysis of the DAG oil. The positional specificity determined and the results from the hydrolysis of the different oils suggest that n-3 very long-chain PUFA from structured oils may be used better by aquacultured fish than that from fish oils.

**General information**

State: Published
Organisations: Section for Aquatic Lipids and Oxidation, National Institute of Aquatic Resources, Section for Aquatic Protein Biochemistry
Authors: Göttsche, J. (Ekstern), Nielsen, N. S. (Intern), Nielsen, H. H. (Intern), Mu, H. (Ekstern)
Pages: 1273-1279
Publication date: 2005
Main Research Area: Technical/natural sciences

**Publication Information**

Journal: Lipids
Volume: 40
Issue number: 12
ISSN (Print): 0024-4201
Ratings:

BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.693 SNIP 0.77 CiteScore 1.94
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.782 SNIP 0.744 CiteScore 1.96
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.792 SNIP 0.876 CiteScore 2.07
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.903 SNIP 0.976 CiteScore 2.59
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.888 SNIP 1.048 CiteScore 2.5
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.765 SNIP 0.931 CiteScore 2.3
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.798 SNIP 0.898
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.694 SNIP 0.892
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.707 SNIP 0.841
Scopus rating (2007): SJR 0.741 SNIP 0.904
Scopus rating (2006): SJR 0.83 SNIP 0.788
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.673 SNIP 0.801
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.75 SNIP 0.876
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.807 SNIP 0.957
Web of Science (2003): Indexed yes
*Liquid holding capacity and instrumental and sensory texture properties of herring (Clupea harengus L.) related to biological and chemical parameters*

**General information**
- **State:** Published
- **Organisations:** Department of Systems Biology, Section for Aquatic Process and Product Technology, National Institute of Aquatic Resources, Section for Aquatic Protein Biochemistry
- **Authors:** Nielsen, D. (Intern), Hyldig, G. (Intern), Nielsen, J. (Intern), Nielsen, H. H. (Intern)
- **Pages:** 119-138
- **Publication date:** 2005
- **Main Research Area:** Technical/natural sciences

**Publication information**
- **Journal:** Journal of Texture Studies
- **Volume:** 36
- **Issue number:** 2
- **ISSN (Print):** 0022-4901
- **Ratings:**
  - BFI (2018): BFI-level 1
  - BFI (2017): BFI-level 1
  - Web of Science (2017): Indexed Yes
  - BFI (2016): BFI-level 1
  - Scopus rating (2016): SJR 0.655 SNIP 0.963 CiteScore 1.75
  - BFI (2015): BFI-level 1
  - Scopus rating (2015): SJR 0.562 SNIP 0.896 CiteScore 1.43
  - Web of Science (2015): Indexed yes
  - BFI (2014): BFI-level 1
  - Scopus rating (2014): SJR 0.726 SNIP 0.904 CiteScore 1.82
  - BFI (2013): BFI-level 1
  - Scopus rating (2013): SJR 0.731 SNIP 1.014 CiteScore 1.56
  - ISI indexed (2013): ISI indexed yes
  - BFI (2012): BFI-level 1
  - Scopus rating (2012): SJR 0.661 SNIP 0.854 CiteScore 1.18
  - ISI indexed (2012): ISI indexed yes
  - Web of Science (2012): Indexed yes
  - BFI (2011): BFI-level 1
  - Scopus rating (2011): SJR 0.533 SNIP 0.85 CiteScore 1.01
  - ISI indexed (2011): ISI indexed yes
  - BFI (2010): BFI-level 1
  - Scopus rating (2010): SJR 0.518 SNIP 0.648
  - BFI (2009): BFI-level 1
  - Scopus rating (2009): SJR 0.733 SNIP 1.151
  - BFI (2008): BFI-level 1
  - Scopus rating (2008): SJR 0.769 SNIP 1.009
  - Scopus rating (2007): SJR 0.637 SNIP 0.955
NIR: optimerer produktionen af gammeldags modnede sild

General information
State: Published
Organisations: Department of Systems Biology, Section for Aquatic Protein Biochemistry, National Institute of Aquatic Resources
Authors: Svensson, T. (Ekstern), Bro, R. (Intern), Nielsen, H. H. (Intern), Volmer, S. (Ekstern)
Pages: 8-10
Publication date: 2005
Main Research Area: Technical/natural sciences

Publication information
Journal: Plus Proces
Volume: 19
Issue number: 9
ISSN (Print): 0902-5057
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
BFI (2016): BFI-level 1
BFI (2015): BFI-level 1
BFI (2014): BFI-level 1
BFI (2013): BFI-level 1
ISI indexed (2013): ISI indexed no
BFI (2012): BFI-level 1
ISI indexed (2012): ISI indexed no
BFI (2011): BFI-level 1
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
BFI (2009): BFI-level 1
BFI (2008): BFI-level 1
Original language: Danish
Source: orbit
Source-ID: 227612
Publication: Research › Journal article – Annual report year: 2005

Seafood Enzymes

General information
State: Published
Organisations: Department of Systems Biology, Section for Aquatic Protein Biochemistry, National Institute of Aquatic Resources
Sensory properties of marinated herring (Clupea harengus) processed from raw material from commercial landings

Sensory properties of marinated herring processed from raw material from Danish commercial catches were described and related to fishing season and biological, chemical and functional properties. Herring was caught on five cruises and stored on board in tanks or ice. The sensory profile of marinated herring from the North Sea was influenced by season, and changes coincided with the cycle of feeding and spawning. During the spawning period the texture was soft and the muscle more susceptible to lipid oxidation. The texture became firmer and the fatty mouth feel stronger during the feeding period, and the odour and flavour characteristics less rancid. These effects were explained by the chemical composition and biological parameters. The sensory profile was influenced by herring size and age, but not by sex or gonad maturity; the storage method also had an effect. Herring from the Kattegat stored in ice smelled and tasted more of fresh herring and were juicier than herring from the North Sea stored in tanks. (C) 2004 Society of Chemical Industry

General information
State: Published
Organisations: Department of Systems Biology, Section for Aquatic Process and Product Technology, National Institute of Aquatic Resources, Section for Aquatic Protein Biochemistry
Authors: Nielsen, D. (Intern), Hyldig, G. (Intern), Nielsen, J. (Intern), Nielsen, H. H. (Intern)
Pages: 127-134
Publication date: 2005
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of the Science of Food and Agriculture
Volume: 85
Issue number: 1
ISSN (Print): 0022-5142
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.48 SJR 0.87 SNIP 1.222
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.813 SNIP 1.088 CiteScore 2.11
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.819 SNIP 1.153 CiteScore 2.1
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.846 SNIP 1.224 CiteScore 2.22
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.891 SNIP 1.129 CiteScore 1.9
ISI indexed (2012): ISI indexed yes
Water distribution and mobility in herring muscle in relation to lipid content, season, fishing ground and biological parameters

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquatic Process and Product Technology, Section for Aquatic Protein Biochemistry
Authors: Jensen, K. N. (Intern), Jørgensen, B. (Intern), Nielsen, H. H. (Intern), Nielsen, J. (Intern)
Pages: 1259-1267
Publication date: 2005
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of the Science of Food and Agriculture
Volume: 85
Issue number: 8
ISSN (Print): 0022-5142
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes

DOI: 10.1002/jsfa.1962
Source: orbit
Source-ID: 226799
Publication: Research - peer-review › Journal article – Annual report year: 2005
Determination of the protein content in brine from salted herring using near-infrared spectroscopy

Near-infrared reflectance (NIR) spectroscopy in the spectral range of 1000-2500 nm, was measured directly on brine from barrel salted herring, to investigate the potential of NIR as a fast method to determine the protein content. A principal component analysis performed on the NIR spectra shows two groups, separating the first 100 days of storage from the storage time exceeding 100 days. A partial least-squares regression model between selected regions of the NIR spectra
and the protein content yields a correlation coefficient of 0.93 and a prediction error (RMSECV) of 0.25 g/100 g. The results clearly indicate that NIR spectroscopy has a potential as a fast and noninvasive method for assessing the protein content in brine from barrel salted herring, which again may be used as an indicator for the ripening quality of barrel salted herring.

**General information**

State: Published
Organisations: Section for Aquatic Protein Biochemistry, National Institute of Aquatic Resources, Department of Systems Biology
Authors: Svensson, V. (Ekstern), Nielsen, H. H. (Intern), Bro, R. (Intern)
Pages: 803-809
Publication date: 2004
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Lebensmittel - Wissenschaft und Technologie
Volume: 37
Issue number: 7
ISSN (Print): 0023-6438
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.31
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 3.11
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 3.12
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.11
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 3.12
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 3.18
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
BFI (2009): BFI-level 1
BFI (2008): BFI-level 2
Web of Science (2008): Indexed yes
Web of Science (2005): Indexed yes
Web of Science (2004): Indexed yes
Web of Science (2003): Indexed yes
Web of Science (2002): Indexed yes
Web of Science (2001): Indexed yes
Web of Science (2000): Indexed yes
Original language: English
DOIs:
10.1016/j.lwt.2004.03.004
Source: orbit
Source-ID: 227613
Er sild bare sild når de skal forarbejdes?

General information
State: Published
Organisations: Section for Aquatic Protein Biochemistry, National Institute of Aquatic Resources, Department of Systems Biology
Authors: Nielsen, H. H. (Intern), Nielsen, D. (Intern), Worsøe Clausen, L. (Intern)
Pages: 30-41
Publication date: 2004
Main Research Area: Technical/natural sciences

Publication information
Journal: Fisk og Hav
Issue number: 58
ISSN (Print): 0105-9211
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: Danish
Links:
Source: orbit
Source-ID: 226850
Publication: Research › Journal article – Annual report year: 2004

Sensory properties of marinated herring (Clupea harengus) - influence of fishing ground and season
The sensory properties of marinated herring produced immediately post mortem of raw material from different fishing ground and seasons were described and related to biological, biochemical and functional properties. Subtle variation was encountered in the appearance of whole marinated herring fillets. Fishing ground did not influence the odor, flavor or texture, but there was an apparent effect of season on the sensory profile. The sensory properties were influenced by body weight, but not by age, sex and gonad maturity. The influence of varying lipid content, water content and liquid holding capacity resulted in similar effects showing the high correlation between these properties. The results indicated that variation in sensory quality observed by the industry is not primarily due to the parameters fishing ground and season.

General information
State: Published
Organisations: Department of Systems Biology, Section for Aquatic Process and Product Technology, National Institute of Aquatic Resources, Section for Aquatic Protein Biochemistry
Authors: Nielsen, D. (Intern), Hyldig, G. (Intern), Nielsen, H. H. (Intern), Nielsen, J. (Intern)
Pages: 3-24
Publication date: 2004
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Aquatic Food Product Technology
Volume: 13
Issue number: 3
ISSN (Print): 1049-8850
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.59 SJR 0.268 SNIP 0.582
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.298 SNIP 0.623 CiteScore 0.65
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.275 SNIP 0.632 CiteScore 0.62
Cathepsin activity in herring (Clupea harengus L.) caught at different locations and different seasons

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquatic Protein Biochemistry
Authors: Godiksen, H. (Intern), Nielsen, H. H. (Intern)
Number of pages: 400
Publication date: 2003

Host publication information
Title of host publication: TAFT 2003: First joint trans Atlantic Fisheries Technology conference, 10-14 June 2003
Reykjavik, Iceland: 33rd WEFTA meeting
Place of publication: Reykjavik
Publisher: The Icelandic Fisheries Laboratory
Correlation between sensory analysis and dynamic headspace GC analysis in stored marinated herring

General information
State: Published
Organisations: Section for Aquatic Lipids and Oxidation, National Institute of Aquatic Resources, Department of Systems Biology, Section for Aquatic Process and Product Technology, Section for Aquatic Protein Biochemistry
Authors: Jacobsen, C. (Intern), Nielsen, D. (Intern), Hyldig, G. (Intern), Nielsen, H. H. (Intern)
Number of pages: 400
Publication date: 2003

Host publication information
Title of host publication: TAFT 2003 : First joint trans Atlantic fisheries technology conference, 10-14 June 2003 Reykjavik, Iceland : 33rd WEFTA meeting
Place of publication: Reykjavik
Publisher: The Icelandic Fisheries Laboratories
ISBN (Print): 9979-74-005-1
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 229256
Publication: Research › Article in proceedings – Annual report year: 2003

Protein content in brine from salted herring measured by near-infrared spectroscopy: A possible fast indicator of ripening

General information
State: Published
Organisations: Section for Aquatic Protein Biochemistry, National Institute of Aquatic Resources
Authors: Nielsen, H. H. (Intern), Povlsen, V. (Ekstern), Bro, R. (Ekstern)
Number of pages: 400
Pages: 160-162
Publication date: 2003

Host publication information
Title of host publication: TAFT 2003 : First joint trans Atlantic fisheries technology conference, 10-14 June 2003 Reykjavik, Iceland : 33rd WEFTA meeting
Place of publication: Reykjavik
Publisher: The Icelandic Fisheries Laboratories
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 229308
Publication: Research › Conference abstract in proceedings – Annual report year: 2003

Sensory properties of herring - influence of fishing ground and season

General information
State: Published
Organisations: Department of Systems Biology, Section for Aquatic Process and Product Technology, National Institute of Aquatic Resources, Section for Aquatic Protein Biochemistry
Authors: Nielsen, D. (Intern), Hyldig, G. (Intern), Nielsen, H. H. (Intern), Nielsen, J. (Intern)
Pages: 129-131
Publication date: 2003
A phenomenological study of ripening of salted herring. Assessing homogeneity of data from different countries and laboratories

Data from ripening experiments of herring carried out at three Nordic fishery research institutions in the period 1992-1995 were collected and analyzed by multivariate analysis. The experiments were carried out at different times, with different stocks as raw material, using different types of treatments and analyzed in different laboratories. The question considered here is whether these data can be assumed to be one homogeneous set of data pertaining to ripening of salted herring or whether data from different labs, stocks, etc. must be considered independently. This is of importance for further research into ripening processes with these and similar data. It is shown in this paper that all data can be considered as one homogeneous data set. This is verified using resampling where latent structures are compared between different sample sets. This is done indirectly by testing regression models, that have been developed on one sample set, on other sample sets. It is also done directly by monitoring the deviation in latent structure observed between different sample sets. No formal statistical test is developed for whether samples can be assumed to stem from the same population. Although this can easily be envisioned, it was exactly the need for a more intuitive and visual test that prompted this work, developing different exploration tools that visually make it clear how well the data can be assumed to derive from the same population. Subsequently analyzing the data as one homogeneous group provides new information about factors that govern the ripening of salted herring and can be used in new strategic research as well as in industrial practice. Copyright (C) 2002 John Wiley Sons, Ltd.
Proteolysis in salmon (Salmo salar) during cold storage: Effects of storage time and smoking process

Changes in free amino acids (FAAs), small peptides and myofibrillar proteins were investigated in salmon (Salmo salar) muscle stored at OC for up to 23 days and after the stored salmon was smoked. Storage time and smoking process did not increase the formation of FAAs and small peptides indicating low exopeptidase activity. During storage, SDS PAGE analysis of myofibrils showed an increase in density of bands at 16, 37, 60, 64, 67, 76 and 130 kDa, a decrease of a 32 kDa band and the appearance of four new bands of 30, 90, 95 and 113 kDa. These results indicate proteolytic degradation. A little change of myosin and no change of alpha-actinin and actin were observed. The smoking process itself enhances the intensity of bands, but does not change the pattern markedly except for the appearance of a 25 and 70 kDa band. Degradation pattern after smoking was not affected by storage time.

General information
State: Published
Organisations: Section for Aquatic Protein Biochemistry, National Institute of Aquatic Resources
Authors: Lund, K. (Ekstern), Nielsen, H. H. (Intern)
Pages: 379-395
Publication date: 2001
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Food Biochemistry
Volume: 25
Issue number: 5
ISSN (Print): 0145-8884
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Purification and characterization of cathepsin D from herring muscle (Clupea harengus)

Cathepsin D was purified and concentrated 469-fold from a homogenate of Clupea harengus muscle. The purified enzyme is a monomer with a molecular weight of 38 000-39 000. It is inhibited by pepstatin and has optimal activity at pH 2.5 with hemoglobin as the substrate. The isoelectric point is at pH 6.8. Glycosidase treatment and binding to Concanavalin A indicated that the enzyme contains one N-linked carbohydrate moiety of the high-mannose type per molecule. The first 21 amino acid residues of the N-terminal showed high similarity to cathepsin D from antarctic icefish liver (Chionodraco hamatus) and trout ovary (Oncorhynchus mykiss). Digestion of the P-chain of oxidized insulin resulted in preferential cleavage at Leu(15)-Tyr(16), (47%), Tyr(16)-Leu(17) (34%) and Ala(14)-Leu(15) (18%). Incubation with myofibrils from herring muscle at pH 4.23 showed that the enzyme mainly degraded myosin, actin and tropomyosin. (C) 2001 Elsevier Science Inc. All rights reserved.
Frozen herring as raw material for spice-salting

General information
State: Published
Organisations: Section for Aquatic Protein Biochemistry, National Institute of Aquatic Resources
Authors: Stefánsson, G. (Ekstern), Nielsen, H. H. (Intern), Skára, T. (Ekstern), Schubring, R. (Ekstern), Oehlenschläger, J. (Ekstern), Luten, J. (Ekstern), Derrick, S. (Ekstern), Gudmundsdóttir, G. (Ekstern)
In situ activity of chymotrypsin in sugar-salted herring during cold storage

In situ activity of intestinal chymotrypsin in sugar-salted whole herring during cold storage was evaluated by analysing changes in the low-molecular-weight nitrogen fraction when a specific inhibitor was added. Addition of chymostatin (0.01 mM) to sugar-salted herring gave 100% inhibition of chymotrypsin activity compared to sugar-salted herring without chymostatin. Inhibition of chymotrypsin did not affect the profile of low-molecular-weight peptides analysed by capillary zone electrophoresis, but resulted in 22% lower content after 26 weeks of storage. Inhibition of chymotrypsin resulted in 17% lower content of free amino acids. The relative amount of single free amino acids was unaffected by the presence of inhibitor, except for valine, leucine, isoleucine, methionine, phenylalanine and tyrosine, which were formed in lower relative amount. Removal of intestines (gutted herring) and thereby all intestinal proteolytic activity did not change the free amino acid profile, except for the concentration of histidine which decreased more when intestines were present. (C) 2000 Society of Chemical Industry.
IT-baseret netværk for pelagiske fisk

General information
State: Published
Organisations: Department of Biotechnology, Section for Aquatic Protein Biochemistry, National Institute of Aquatic Resources
Authors: Jonsdottir, S. (Intern), Nielsen, H. H. (Intern)
Pages: 14-15
Publication date: 1999
Main Research Area: Technical/natural sciences

Publication information
Journal: Plus proces
Volume: 13
ISSN (Print): 0902-5057
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
BFI (2016): BFI-level 1
BFI (2015): BFI-level 1
BFI (2014): BFI-level 1
BFI (2013): BFI-level 1
ISI indexed (2013): ISI indexed no
BFI (2012): BFI-level 1
ISI indexed (2012): ISI indexed no
BFI (2011): BFI-level 1
Occurrence of low molecular weight peptides and free amino acids in spice salted herring

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquatic Protein Biochemistry
Authors: Engvang, K. (Intern), Nielsen, H. H. (Intern)
Pages: 328-329
Publication date: 1999

Host publication information
Place of publication: Budapest
Publisher: Akadémiai Kiadó
Main Research Area: Technical/natural sciences
Conference: Peptides 1998, The Twentieth-Fifth European Peptide Symposium, Budapest, 01/01/1999
Source: orbit
Source-ID: 229205
Publication: Research › Article in proceedings – Annual report year: 1999

Salting and ripening of herring - collection and analysis of research results and industrial experience within the Nordic countries

General information
State: Published
Organisations: Section for Aquatic Protein Biochemistry, National Institute of Aquatic Resources
Authors: Nielsen, H. H. (Intern), Bro, R. (Ekstern), Stefánsson, G. (Ekstern), Skåra, T. (Ekstern)
Number of pages: 33
Publication date: 1999

Publication information
Place of publication: Copenhagen
Publisher: Nordisk Ministerråd
Original language: English
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 226856
Publication: Research › Report – Annual report year: 1999

The influence of intestinal proteinases on ripening of salted herring

General information
State: Published
Organisations: Section for Aquatic Protein Biochemistry, National Institute of Aquatic Resources, FF secretariat
Authors: Nielsen, H. H. (Intern), Børresen, T. (Intern)
Pages: 293-304
Publication date: 1997

Host publication information
Place of publication: Amsterdam
Publisher: Elsevier
Modning af kryddersild - udvikling og styring af en ny modningsproces, Forsøg 1 + Forsøg 2. Hirtshals

General information
State: Published
Organisations: Section for Aquatic Protein Biochemistry, National Institute of Aquatic Resources
Authors: Andersen, E. (Ekstern), Nielsen, H. H. (Intern), Jacobsen, L. (Ekstern)
Publication date: 1996

Publication information
Publisher: Aqua
Original language: Danish
Series: DIFTA
Main Research Area: Technical/natural sciences

Bibliographical note
2 bind
Source: orbit
Source-ID: 224696
Publication: Research › Report – Annual report year: 1996

Proteolytic enzyme activities in salted herring during cold storage

General information
State: Published
Organisations: Section for Aquatic Protein Biochemistry, National Institute of Aquatic Resources
Authors: Nielsen, H. H. (Intern)
Publication date: 1995

Publication information
Publisher: Department of Seafood Research
Original language: English
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 226855
Publication: Research › Ph.D. thesis – Annual report year: 1995

Ripening of spice-salted herring

General information
State: Published
Organisations: Section for Aquatic Protein Biochemistry, National Institute of Aquatic Resources
Authors: Stefánsson, G. (Ekstern), Nielsen, H. H. (Intern), Gudmundsdóttir, G. (Ekstern)
Number of pages: 45
Publication date: 1995

Publication information
Place of publication: København
Publisher: Nordisk Ministerråd
Original language: English
Series: TemaNord
Number: 613
ISSN: 0908-6692
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 227515
Publication: Research › Report – Annual report year: 1995
Purification and characterization of elastase from the pyloric caeca of rainbow trout (Oncorhynchus mykiss)

1. An elastase-like enzyme was purified from the pyloric caeca of rainbow trout by hydrophobic interaction, cation exchange and gel-filtration chromatography. The approximate molecular weight of the elastase was 27 kDa and the isoelectric point was remarkably basic. 3. The pH optimum of this enzyme was 8.0, when assayed with Succinyl-Ala-Ala-Ala-p-Nitroanilide. 4. When assayed with Succinyl-Ala-Ala-Ala-p-Nitroanilide, the enzyme activity had a temperature optimum of 45 degree C, and the enzyme was stable up to this temperature. 5. The trout elastase exhibited a higher specific activity than porcine elastase against Succinyl-Ala-Ala-Ala-p-Nitroanilide and elastin-orcein. 6. The trout elastase was inhibited by elastatinal, PMSF, TPCK, SBTI and Bowman-Birk inhibitor.

General information
State: Published
Organisations: Technical University of Denmark
Authors: Bassompierre, M. (Intern), Nielsen, H. H. (Intern), Børresen, T. (Intern)
Number of pages: 6
Pages: 331-336
Publication date: 1993
Main Research Area: Technical/natural sciences

Publication information
Journal: Comparative Biochemistry and Physiology. Part B: Biochemistry & Molecular Biology
Volume: 106
Issue number: 2
ISSN (Print): 1096-4959
Ratings:
  BFI (2018): BFI-level 1
  BFI (2017): BFI-level 1
  Web of Science (2017): Indexed Yes
  BFI (2016): BFI-level 1
  Scopus rating (2016): SJR 0.607 SNIP 0.787 CiteScore 1.7
  Web of Science (2016): Indexed yes
  BFI (2015): BFI-level 1
  Scopus rating (2015): SJR 0.736 SNIP 0.775 CiteScore 1.69
  Web of Science (2015): Indexed yes
  BFI (2014): BFI-level 1
  Scopus rating (2014): SJR 0.734 SNIP 0.745 CiteScore 1.87
  BFI (2013): BFI-level 1
  Scopus rating (2013): SJR 0.717 SNIP 0.979 CiteScore 2.11
  ISI indexed (2013): ISI indexed yes
  BFI (2012): BFI-level 1
  Scopus rating (2012): SJR 0.678 SNIP 0.948 CiteScore 2
  ISI indexed (2012): ISI indexed yes
  Web of Science (2012): Indexed yes
  BFI (2011): BFI-level 1
  Scopus rating (2011): SJR 0.74 SNIP 0.91 CiteScore 2.14
  ISI indexed (2011): ISI indexed yes
  BFI (2010): BFI-level 1
  Scopus rating (2010): SJR 0.631 SNIP 0.896
  BFI (2009): BFI-level 1
  Scopus rating (2009): SJR 0.591 SNIP 0.775
  BFI (2008): BFI-level 1
  Scopus rating (2008): SJR 0.577 SNIP 0.809
  Scopus rating (2007): SJR 0.674 SNIP 0.845
  Scopus rating (2006): SJR 0.632 SNIP 0.818
  Scopus rating (2005): SJR 0.674 SNIP 0.824
  Scopus rating (2004): SJR 0.71 SNIP 0.867
  Scopus rating (2003): SJR 0.605 SNIP 0.827
Purification and characterization of two chymotrypsin-like proteases from the pyloric caeca of rainbow trout oncorhynchus-mykiss

Two chymotrypsins, called chymotrypsin I and II, were purified from the pyloric caeca of rainbow trout, by (NH4)2SO4 fractionation, hydrophobic interaction chromatography (phenyl-Sepharose) and ion-exchange chromatography (DEAE-Sepharose). The approximate molecular weights of chymotrypsin I and II were 28,200 (+-1200) and 28,800 (+-900), respectively, as determined by SDS-PAGE and their isoelectric points were about 5. The pH optima of the enzymes were centered around nine, when assayed for succinyl-L-Ala-L-Ala-L-Pro-L-Phe-p-nitroanilide (Such-AAPF-NA) as substrate and both enzymes were unstable at pH values below 5. The amidase activity of both enzymes increased with temperature up to about 55.00C. Chymotrypsin I was found to be more heat stable than chymotrypsin II, an effect most likely explained by strong calcium binding of the former. The trout chymotrypsins were significantly more active than bovine .alpha. chymotrypsin when assayed against Suc-AAPF-NA at 25.00C. C and casein at low temperatures (10-20.00C). C, indicating an adaptation of the activities of the trout chymotrypsins to the habitation temperatures of the fish.
Amino Acid Sequence, Animals, Calcium, Caseins, Catalysis, Cattle, Chromatography, Gel, Chymotrypsin, Electrophoresis, Polyacrylamide Gel, Enzyme Stability, Hydrogen-Ion Concentration, Intestines, Molecular Sequence Data, Salmon, Serine Endopeptidases, Serine Proteinase Inhibitors, Temperature, EC 3.4.21.- Serine Endopeptidases, EC 3.4.21.1 Chymotrypsin, SY7Q814VUP Calcium, DIAMMONIUM SULFATE FRACTIONATION ION-EXCHANGE CHROMATOGRAPHY HYDROPHOBIC INTERACTION CHROMATOGRAPHY THERMOREGULATION, Pisces Vertebrata Chordata Animalia (Animals, Chordates, Fish, Nonhuman Vertebrates, Vertebrates) - Osteichthyes [85206], 9014-01-1D: PROTEASES7783-20-2: DIAMMONIUM SULFATE, 07508, Ecology: environmental biology - Animal, 10062, Biochemistry studies - Nucleic acids, purines and pyrimidines, 10802, Enzymes - General and comparative studies: coenzymes, 10804, Enzymes - Methods, 10806, Enzymes - Chemical and physical, 14004, Digestive system - Physiology and biochemistry, 23012, Temperature - Thermoregulation, Biochemistry and Molecular Biophysics, Environmental Sciences, Ingestion and Assimilation, Digestive System, Ecology, Enzymology, Physiology

Source: Findit
Source-ID: 63468147
Publication: Research - peer-review › Journal article – Annual report year: 1992

Projects:

Udvikling af bæredygtige innovative fødevareingredienser på basis af ørredrestprodukter

National Food Institute
Division of Industrial Food Research

Division of Food Chemistry
Period: 01/01/2014 → 31/12/2015
Number of participants: 11
Acronym: DANFomega
Project participant:
Nouard, Marie-Louise (Intern)
Nielsen, Henrik Hauch (Intern)
Sloth, Jens Jørgen (Intern)
Rasmussen, Rie Romme (Intern)
Separation and characterisation of biomolecules in effluents from the herring industry

National Food Institute
Period: 01/05/2012 → 02/09/2015
Number of participants: 6
Phd Student: Gringer, Nina (Intern)
Supervisor: Nielsen, Henrik Hauch (Intern)
Main Supervisor: Baron, Caroline P. (Intern)
Examiner: Hobley, Timothy John (Intern)
Otte, Jeannette (Ekstern)
Rustad, Turid (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Pelagic industry processing effluents innovative and sustainable solutions
Volumes of effluents from herring processing industries are important and their organic loads are high, which means that the cost imparted for their discharge is substantial. However, the processing effluents also contain molecules with good marked potential which are discarded.

Technological separation solutions available today do not fit the herring industries due to their poor flux and their poor chemical tolerance and also because they are not well suited for recovery of organic fractions. PIPE will test cutting edge technologies to address sustainability and water purification challenges.

The main goal for the PIPE project is to test cutting edge technologies to separate water and organic material from pelagic industries effluents and to characterise as well as valorise the organic material collected

The PIPE projet has 3 innovative values:
for the first time, technologies such as ceramic membranes and electrochemistry will be tested and their efficiency in separation organic matter from effluents will be investigated;
the functionality and bioactivity of components from pelagic industries effluents will be evaluated;
at the same time, the potential market value of the recovered fractions will be studied.
Aquatic Resources as a Source of Potential Natural Antioxidants for Food Industry

It is well documented that long-chain polyunsaturated omega-3 fatty acids (omega-3 PUFA) have a range of beneficial health effects such as reducing atherosclerosis, prevention and treatment of numerous disorders like cardiovascular disease, cancer, diabetics, mental illness etc.

At the same time they are very susceptible to lipid oxidation that not only causes deterioration of food sensory quality, but also contributes to carcinogenesis, atherosclerosis and aging processes in humans. Hence, the oxidative instability of omega-3 fatty acids often limits their use as nutritionally beneficial lipids in fish oil enriched foods. Addition of antioxidants that scavenge free radicals and control pro-oxidative metals is used to retard lipid oxidation.

Many of the most commonly used antioxidants are synthetic compounds, which have been reported to possess carcinogenic effect in humans and there is, therefore a need to find potent and safer natural antioxidants.

Many living organisms in the marine environment are rich in omega-3 PUFA. Our hypothesis is therefore that these marine organisms are rich in natural antioxidants that are able to protect them against lipid oxidation and that these antioxidants can be used to protect foods against oxidation.

Objectives

The overall goal of the project is to identify natural compounds with antioxidant activity from aquatic resources such as marine algae, bacteria, fungi, peptides isolated from fish waste and to evaluate potential applications of these novel compounds to enhance oxidative stability, flavor quality and nutritional value of foods enriched with omega-3 fatty acids and seafood based products.

This will be achieved by:

Screening extracts from aquatic resources like marine algae, bacteria, fungi and peptides isolated from fish waste for their
antioxidative mechanisms and properties and identifying the most promising sources of antioxidants.
Evaluating the antioxidant properties of the most promising antioxidant sources in different foods systems enriched with omega-3 fatty acids such as milk, dressing and seafood.

Project financing:
Danish research council for Technology and production (FTP)
National Food Institute
Division of Industrial Food Research
Department of Systems Biology
Bacterial Ecophysiology and Biotechnology
Metabolomics Platform
Period: 01/01/2009 → 31/12/2012
Number of participants: 6
Acronym: Potential natural antioxidants
Contact person:
Jacobsen, Charlotte (Intern)
Project participant:
Gram, Lone (Intern)
Jessen, Flemming (Intern)
Nielsen, Henrik Hauch (Intern)
Nielsen, Kristian Fog (Intern)
Project Manager, organisational:
Farvin Habeullah, Sabeena (Intern)

Mucosal Fish Immunology and Pathology - Host Pathogen Interactions
National Food Institute
Period: 01/12/2008 → 30/09/2012
Number of participants: 5
Phd Student:
Przybylska, Dominika Alicja (Intern)
Main Supervisor:
Nielsen, Michael Engelbrecht (Intern)
Examiner:
Nielsen, Henrik Hauch (Intern)
Hoole, David (Ekstern)
Raida, Martin (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Marie Curie (EU-stipendium)
Project: PhD

Utilisation of bioactive peptides from fish processing - Upgrading the value of secondary products.
Fish and seafood products contain bioactive peptides with different health promoting effects on e.g. blood pressure, immune system, cancer, diabetes, obesity and ulcer. Some bioactive peptides are present per se in the fish whereas most are only formed by degradation of the proteins. The aim of the project was to find bioactive peptides in enzymatic hydrolysed fish parts or whole fish not used for human consumption. We have found many peptide preparations with positive effects on the enzyme regulating blood tension (ACE) and with antioxidative effects, but also several that inhibit or kill pancreatic cancer cells in culture and some that strongly inhibit the adhesion of ulcer forming bacteria (Helicobacter pylori) to stomach cells in culture. Especially the effects on cancer cells and bacteria have interesting perspectives if the peptides show up to function in whole organisms, including human, because they would then have potential as future anticancer and antibacterial drugs.

National Food Institute
Division of Industrial Food Research
Division of Toxicology and Risk Assessment
Period: 01/04/2008 → 31/12/2012
Number of participants: 10
Acronym: PEPFISH
Project participant:
Nielsen, Henrik Hauch (Intern)
Andersen, Lisa Lystbæk (Intern)
Nielsen, Michael Engelbrecht (Intern)
Hoffmann, Else K. (Ekstern)
Andersen, Leif Percival (Ekstern)
Elvevol, Edel Oddny (Ekstern)
Jakobsen, Greta (Ekstern)
Rørvig, Peter (Ekstern)
Project Manager, academic:
Jessen, Flemming (Intern)
Working partner:
Lynglev, Gitte Budolfson (Ekstern)

Financing sources
Source: Public research council
Name of research programme: Programkomiteen for Sundhed, Fødevarer og Velfærd
Amount: 8,000,000.00 Danish Kroner

Project: Fiskekvalitet og fiskehelse- sygdoms indflydelse på kødkvalitet hos fisk
National Food Institute
Period: 01/10/2007 → 22/09/2010
Number of participants: 6
Phd Student:
Ingerslev, Hans-Christian (Intern)
Supervisor:
Nielsen, Henrik Hauch (Intern)
Main Supervisor:
Nielsen, Michael Engelbrecht (Intern)
Examiner:
Jessen, Flemming (Intern)
Andersen, Leif Percival (Ekstern)
Wiegertjes, Geert Frits (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Offentlig finansiering
Project: PhD

Integreter sporbar kvalitet af fisk
National Food Institute
Period: 01/08/2007 → 27/06/2012
Number of participants: 6
Phd Student:
Rasmussen, Maria-Louise Randrup (Intern)
Supervisor:
Frederiksen, Marco Thorup (Intern)
Main Supervisor:
Jørgensen, Bo Munk (Intern)
Examiner:
Nielsen, Henrik Hauch (Intern)
Brunsøe, Karen (Ekstern)
Organic Aquaculture - the linkage between sustainable production and superior products
This project will contribute to the successful establishment of organic trout farming in Denmark. It will develop and optimise new recipes for organic fish feeds with high levels of organic vegetable protein of Danish origin. These will be fed to trout to investigate feed quality as digestibility, effects on the environment, feed conversion, and growth. Effects of the feeds upon general health and welfare, and immunocompetence (vaccination efficacy), will be assessed. Objective sensory and biochemical analyses will provide an overall picture of the eating quality of trout raised with the new organic feeds at an organic farm. Consumer preference for trout with pale coloured meat will be explored, plus other market issues for organic trout (supply chain, traceability, export). Results will be disseminated to industry, consumers and regulatory authorities with open workshops. Guidelines will be prepared for optimal rearing and marketing of organic trout.

National Veterinary Institute
National Food Institute
Division of Seafood Research
Division of Industrial Food Research
Danish Institute for Fisheries and Marine Research
Royal Veterinary and Agricultural University
Danish Technological Institute
Dansk Akvakultur
Period: 01/01/2006 → 31/12/2010
Number of participants: 11
Acronym: ORAQUA
Project ID: 22451
Project participant:
Jokumsen, Alfred (Ekstern)
Pedersen, Lars-Flemming (Ekstern)
Dalsgaard, Inger (Intern)
Nielsen, Henrik Hauch (Intern)
Jacobsen, Charlotte Munch (Ekstern)
Jessen, Flemming (Intern)
Larsen, Erling P. (Ekstern)
Nielsen, Michael Engelbrecht (Ekstern)
Kold, John (Ekstern)
Larsen, Villy J. (Ekstern)
Project Manager, organisational:
McKenzie, David J. (Ekstern)

Financing sources
Source: Forskningsprojekter - Fødevareministeriet
Name of research programme: Forskningsprojekter - Fødevareministeriet
Amount: 548,554.00 Danish Kroner
Project

Forbruger orierteret sensorisk kvalitets model for fisk og fiskeprodukter
National Food Institute
Period: 01/11/2004 → 23/06/2010
Number of participants: 7
Phd Student:
Green-Petersen, Ditte (Intern)
Supervisor:
Structured lipids for fish feed for rainbow trouts

Intake of n-3 polyunsaturated fatty acids (PUFA) from fish is important for human health, due to the positive health effects of these PUFA. Feed for farmed fish has traditionally contained ingredients of marine origin high in n-3 fatty acids. However, marine resources might be in shortage for future feed production due to an increasing aquaculture production and stable or declining catches for fish-meal and -oil production.

Alternative sources of oil for fish feed have been investigated. Substitution of fish oil with vegetable oil may not affect the growth of fish, but will be reflected in the tissue of the fish by a reduced content of n-3 PUFA such as EPA and DHA. A major challenge is to influence fatty acid metabolism to save EPA and DHA for storage.

Medium chain fatty acids may preferably be oxidised to provide energy especially when positioned in the sn-1 and -3 positions as demonstrated in mammals. Due to the high fat content in the diets fat accumulation in trout is sometimes too high. In mammals, addition of diacylglycerols to the diet has been shown to reduce fat accumulation.

Objectives:

To determine the specificity of lipase in trout
To investigate whether it is possible to increase the relative incorporation of EPA in a low n-3 PUFA diet by feeding trout specific structured triacylglycerols with n-3 PUFA in the sn-2 position and medium chain fatty acids in the sn-1,3 positions
To investigate whether addition of diacylglycerols (DAG) in a fish diet could reduce fat accumulation in trout.

National Food Institute
Division of Industrial Food Research
Communications and Management Secretariat
Period: 01/01/2004 → …
Number of participants: 8
Acronym: Lipids for fish feed
Project participant:
Nielsen, Nina Skall (Intern)
Nielsen, Henrik Hauch (Intern)
Jørgensen, Jane (Ekstern)
Mu, Huiling, (Ekstern)
Göttsche, Jesper R. (Ekstern)
Xu, Xuebing (Ekstern)
Holm, Jørgen (Ekstern)
Project Manager, organisational:
Jacobsen, Charlotte (Intern)
Project
Supervisor:
Hyldig, Grethe (Intern)
Nielsen, Henrik Hauch (Intern)
Main Supervisor:
Nielsen, Jette (Intern)
Examiner:
Sendergaard, Ib (Intern)
Ofstad, Ragni (Ekstern)
Skåra, Torstein (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Kandidatstipendium ansat ekste
Project: PhD

Sild- denlevende ressource- Det gode produkt

Department of Systems Biology
Period: 01/04/2001 → 27/07/2004
Number of participants: 7
Phd Student:
Nielsen, Durita (Intern)
Supervisor:
Hyldig, Grethe (Intern)
Nielsen, Henrik Hauch (Intern)
Main Supervisor:
Nielsen, Jette (Intern)
Examiner:
Jørgensen, Bo Munk (Intern)
Martens, Magni (Ekstern)
Undeland, Ingrid (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Ansat eksternt
Project: PhD

Degradation of myofibrillar proteins from herring muscle by herring Cathepsin D

The aim of the project is to investigate the role of the lysosomale protease Cathepsin D in the ripening process of salted herring. The project is part of a larger project "Production of Cathepsin D from Herring" carried out at Biotechnological Institute, Denmark. The aim of the experimental work is to see whether Cathepsin D is active and able to degrade myofibrillar proteins under conditions corresponding to storage conditions of marinated and salted herring. Myofibrillar proteins extracted from herring muscle have been incubated with purified cathepsin D from herring muscle at pH (4.5 and 6), temperature (5 C) and salt concentration (10 and 20% NaCl) corresponding to what is found in marinated and salted herring during storage. Changes in the profile of myofibrillar proteins has been study by SDS-PAGE.

National Institute of Aquatic Resources
Bioteknologisk Institut
Period: 01/04/1997 → 30/04/1998
Number of participants: 3
Project participant:
Reimers, Karin (Intern)
Nielsen, Lars Bjarne (Ekstern)
Project Manager, organisational:
Nielsen, Henrik Hauch (Intern)

Peptides and free amino acids on the quality of salted fish products

Enzymatic degradation of proteins in salted fish products can influence the sensory quality of the products both in a positive and negative way. However, it is today only possible to detect the presence of active proteolytic enzymes but not how active the enzymes actually are under the conditions the products are stored. In order to estimate which proteolytic
enzymes that are active in the products during storage, it is necessary to identify the breakdown products, such as peptides and free amino acids, from the protein degradation and correlate this to the presence of active enzymes. Heavy salted and spice salted herring is characterised by a long ripening process where a degradation of proteins in the fillet is considered to be important in order to obtain the correct sensory profile of the product. The enzymatic degradation of the muscle proteins in the herring results in a more soft texture and in the formation of taste-active peptides and free amino acids. The aim of the present project is therefore to establish a well defined profile of peptides and free amino acids in brine and fillets of spice salted herring during storage. Changes in the profiles will be investigated when the different proteases present in fillet are influenced by inhibitors. Capillary zone electrophoresis (CZE) will be used to analyse changes in the peptide fraction of spice salted herring during storage. Dominating peptides will be collected and sequenced. Changes in the peptide and amino acid concentrations will be followed during storage.

National Institute of Aquatic Resources
Period: 01/01/1997 → 31/01/1999
Number of participants: 3
Project participant:
Engvang, Karen (Intern)
Reimers, Karin (Intern)
Project Manager, organisational:
Nielsen, Henrik Hauch (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 1,500,000.00 Danish Kroner

Collection and Analysis of Research Results and Industrial Experience on the salting and ripening of herring
Salted and marinated herring products are of great importance for the fish industry in the Nordic countries. The background for this production is herring caught in the right season and ripened by salting in barrels for several months according to old experience. Little scientific knowledge is however yet available for understanding the process. The aim of the project is to retrieve and process existing data from three Nordic laboratories by means of multivariate statistical analysis in order to obtain a better understanding of the main factors (quality criteria) that govern the salting and ripening of herring, with the purpose of improving the economy in the industry and making the industry able to market products with consistently high quality. In the project an overview will first be obtained of the results that the three laboratories have already obtained in numerous salting experiments on different herring stocks. Secondly, the scientific results will be pooled together. Thirdly, information will be collectively gathered by interviewing experienced people from the industry on the factors that are important for the salting and ripening of herring. The results obtained by the scientific studies and the experience from industry will be combined using sophisticated statistical methods (multivariate analysis). The final step will be to present the results in a workshop to the industry.

National Institute of Aquatic Resources
The Icelandic Fisheries Laboratories
Norconserv
University of Copenhagen
Period: 01/12/1996 → 31/03/1999
Number of participants: 4
Project participant:
Stefansson, Gudmundur (Ekstern)
Skåra, Torstein (Ekstern)
Bro, Rasmus (Ekstern)
Project Manager, organisational:
Nielsen, Henrik Hauch (Intern)

Undersøgelse af de enzymatiske modningsprocessser i saltsild
Department of Systems Biology
Period: 01/06/1992 → 23/04/1996
Number of participants: 3
Phd Student:
Nielsen, Henrik Hauch (Intern)
Supervisor:
Børresen, Torger (Intern)
Main Supervisor:
Adler-Nissen, Jens (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Centerfinansieret
Project: PhD

Press clippings:

Bioaktive marine peptider
Henrik Hauch Nielsen
14/05/2012
National Food Institute, Division of Industrial Food Research

Bioaktive marine peptider
14/05/2012
Fiskeritidende, Print
Eva Beyer Westergaard
Henrik Hauch Nielsen
National Food Institute, Division of Industrial Food Research

Modning af gammeldagsmodnede sild
Henrik Hauch Nielsen
01/01/2010
National Food Institute, Division of Seafood Research

Modning af gammeldagsmodnede sild
01/01/2010
Print
Henrik Hauch Nielsen
National Food Institute, Division of Seafood Research

Nu3Health
Henrik Hauch Nielsen
01/01/2010
National Food Institute, Division of Seafood Research

Anvendelse af vegetabilsk baseret foder til opdrætsfisk
Henrik Hauch Nielsen
01/01/2010
National Food Institute, Division of Seafood Research