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Sensory quality of herring milt powder tested at accelerated storage conditions

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Rest raw material from the pelagic fish sector is predominantly used for fish meal, protein concentrate and oil production. Herring roe is to some extent processed for human consumption, while the utilization of herring milt is still limited. Herring milt is a complex marine raw material with high content of protein, DNA, trimethylamine N-oxide, and polyunsaturated fatty acids. Herring milt protein has especially high content of the semi-essential amino acid arginin, which has both nutritional (1) and medical (2) potential. The goal of the present project was to further optimize a novel manufacturing process and evaluate the oxidative stability of a dried herring milt product.

Materials and methods

Frozen milt from Norwegian spring spawning herring was partly thawed overnight at 5 °C and heat treated in a tube cooker. Antioxidant was added and the product dried in a Jäckering hot air mill dryer (Figure 1).

Figure 1: Mill dryer with ultra-rotor for simultaneous milling and drying

Storage stability of the milt powder was tested at 35 °C with access to air. Effect of the addition of 3 antioxidants (rosemary extract, natural tocopherols, and propyl gallate) after drying were assessed based on a 3-factorial experimental design (Table 1). Sensory quality was assessed after suspension in hot water based on an intensity scale with 0 representing no difference and 4 strong difference relative to a reference sample stored at -80 °C without addition of antioxidant and by descriptive comments. Quality of samples without the addition of antioxidant and with propyl gallate, respectively, were initially followed weekly to decide the storage time needed to obtain noticeable differences. The storage test was interrupted after 12 weeks, and all samples assessed based on sensory, dynamic headspace GC-MS, and TBARS analysis.

Results and discussion

The newly processed milt powder had an appealing flavor characterized as freshly cooked cod and seafood. Sensory evaluation after 12 weeks storage at 35 °C indicated a still acceptable quality but with a less fresh and more stored fishy profile.

Table 1: Experimental design and sensory evaluation after 12 weeks at 35°C . Sensory marks from 0 (no difference, equal to reference) to 4 (large difference, not palatable)

Experimental design			Sensory evaluation	
Rosemary	**Tocopherol**	**Propyl gallate**	**Smell**	**Taste**
1	1	-1	2,8	2,7
1	-1	1	1,3	2,0
-1	-1	-1	2,2	2,7
-1	-1	1	2,0	2,7
1	1	1	1,7	2,0
-1	1	-1	1,5	1,8
1	-1	-1	2,3	2,3
-1	1	1	1,7	2,0

The sensory results revealed no significant effect of antioxidant addition on the storage stability of herring milt powder. However the addition of antioxidant before drying may have a positive influence on oxidation stability.

Compared to the other samples (Figure 2), powder without antioxidant seems to have a higher decomposition of trimethylamine-N-oxide (TMAO) to trimethylamine (TMA) and dimethylamine (DMA). TMA has a strong fishy smell and DMA a fishy, ammonia like smell. An increased concentration of 1-penten-3-ol and 2-penten-1-ol (green, fruity smell) and acetic acid indicates oxidation of fatty acids.

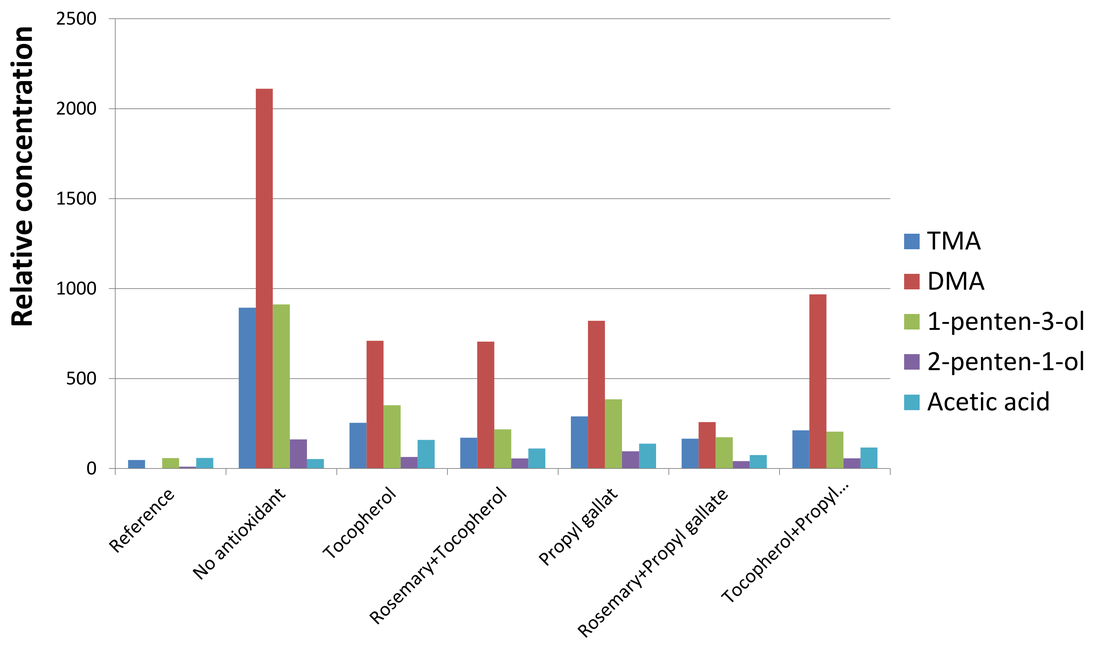

Figure 2: Effect of antioxidants on the development of headspace volatiles during storage of herring milt powder in 12 weeks at 35 °C.

Headspace GC-MS analyses of samples after 12 weeks of storage indicates that rosemary extract + propyl gallate give the lowest value of indicator volatiles (Figure 2). This is also in agreement with the sensory analysis (Table 1). However, there is a need for further optimization studies to improve the shelf-life of the herring milt product.

Following lipid oxidation by other commonly used methods like PV, AV and Oxipres has been rejected for milt powder in a previous project (3). The use of TBARS for the analysis of secondary oxidation products resulted in a deviating and overlapping color complex with unreliable results.

Conclusions

- Mill-dried herring milt powder in the presence of antioxidants may be stored for at least 3 months at 35 °C with still acceptable sensory quality
- A combination of rosemary extract / propyl gallate seems to have the best antioxidant effect in herring milt powder
- The major volatiles in herring milt powder is TMA and DMA which has a undesirable fishy and ammonia-like smell

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