Concentration of Total Mercury in Convenience Fish Products and Cooked Fish

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Abstract

Convenience fish products are very popular culinary items among South African customers because they do not require any preliminary preparation before cooking. To the best of our knowledge, convenience fish products never had been a subject of analysis for mercury (Hg) content. The RA-915+ Mercury Analyzer (Lumex, Russia) was used for direct Hg determination in food and fish samples. The Hg concentration in convenience fish products “Hake crumbed AA portions” and “Hake AA portions” was found to be at very low level, 8.1±1.1ng/g and in others convenience fish products “Fish bites” and “Battered mince portions”, in the range of 48-64ng/g. In “ready-to-eat” fried fish, concentration of Hg varied in much wider range: from 55 to 306ng/g. To avoid risk of Hg contamination from these products by consumers, the recommended amount of fish and convenience fish products was calculated.

Introduction

Convenience food is food that is commercially prepared and is usually ready to eat without further preparation. Recent developments in fish processing technology are oriented towards technology up-gradation, diversification and quality assurance. These have led to a great demand for seafood/seafood-based convenience products in ready-to-eat or ready-to-cook forms. There are several factors, which have influenced this demand. One is the consequential changes that have influenced the eating habits, which have resulted in the demand for diversely processed value added convenience products based on fish. There is also an increasing trend of eating away from home and this has triggered the growth of fast food trade serving value added fish based products. Consumers of “ready to eat” fried fish should be better informed on the food quality they purchase, and mercury content is one of the most important factors to assess (US FDA, 2010, FAO/WHO, 2011).

Materials and Methods

A Model RA-915+ Zeeman Mercury analyzer (Lumex, St. Petersburg, Russia) was used for Hg determination. The working principle of the instrument is based on the direct thermal decomposition (DTD) of wet or dry fish samples [1,2]. Fish or fish products were analyzed without any chemical pre treatment, minimizing the risk of sample contamination [3].

Direct thermal decomposition (DTD) analysis of fish samples affords many benefits. First, eliminating wet chemistry greatly reduces chemical waste generation during fish samples acid digestion, prevents Hg loss and sample contamination. The limit of detection (3s criteria) and limit of quantification (10s criteria) for the determination of Hg in fish samples with mass of 250mg was found to be 0.6ng g⁻¹ and 2.0ng g⁻¹, respectively [3]. Time taken for the analysis of one sample (three replicates) is about 10min. The accuracy of the measurements was confirmed by the analysis of CRM TORT-2 (Lobster hepatopancreas). The measured value was found to be 280±15ng g⁻¹ (one standard deviation, n=6), which is in a good agreement with certified value 270±60ng g⁻¹.

Results and Discussion

In our studies we tested four “ready to cook” fish convenience products (Table 1). It was difficult to specify any particular fish inside, because the products were labeled only with possible fish ingredients like “Hake and/or Pollock and/or Blue Whiting and/or Pangasius and/or Hoki”. All samples of the convenience fish products and deep-fried Snoek and Hake were analyzed as wet samples, without drying. The result of Hg determination, obtained after analysis of taken at random samples of “Hake crumbed AA portions” and “Hake AA portions” (Table 1), show that these convenience fish products have very low Hg...
concentration (8.1±1.1ng/g, f=26). The other convenience fish products “Fish bites” and “Battered mince portions” also have relatively low Hg concentration, in the range of 48-64ng/g. In all fish convenience products, Hg concentration in breadcrumbs and batter was found to be at a “trace” level: 2.6±0.4ng/g, f=9.

Table 1: Hg content in convenience fish products and some “ready to eat” fishes with recommended amounts of weekly consumption.

<table>
<thead>
<tr>
<th>Name of a product and its state at purchase and measurement</th>
<th>Mean concentration on each product category, C±SD, ng/g, n or f</th>
<th>Safe consumption of the products for a person of 60 kg body weight/per week, kg</th>
<th>Comment*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hake crumbed AA portions, frozen, wet</td>
<td>8.1±1.1, f=26</td>
<td>5.187</td>
<td>Partly cooked as sold.</td>
</tr>
<tr>
<td>Hake AA portions, frozen, wet</td>
<td>50.8±2.9, f=6</td>
<td>0.873</td>
<td>Additionally cooked on a pan with sunflower oil.</td>
</tr>
<tr>
<td>Battered mince portions, frozen, wet</td>
<td>64.6±2.7, f=12</td>
<td>0.650</td>
<td>Partly cooked as sold.</td>
</tr>
<tr>
<td>Fish bites, frozen, wet</td>
<td>2.6±0.4, f=9</td>
<td>0.192</td>
<td>Breadcrumbs and batter from fish products.</td>
</tr>
<tr>
<td>Fried Snoek samples, wet</td>
<td>219±19, n=3</td>
<td>0.192</td>
<td>Deep fried, ready to eat.</td>
</tr>
<tr>
<td>Fish bites, frozen, wet</td>
<td>93±1.2, n=3</td>
<td>0.452</td>
<td>Deep fried, ready to eat.</td>
</tr>
<tr>
<td>Fried Hake samples, wet</td>
<td>83±1.1, n=3</td>
<td>0.506</td>
<td>Deep fried, ready to eat.</td>
</tr>
<tr>
<td>Fish bites, frozen, wet</td>
<td>55±0.6, n=3</td>
<td>0.764</td>
<td>Deep fried, ready to eat.</td>
</tr>
</tbody>
</table>

Concentration of Hg in "ready to eat" fried Snoek and fried Hake samples corresponds to moderate Hg concentrations in fresh species of Snoek and Hake [3]. The calculation of recommended amounts of fish convenience product, which may be consumed without health risk, was performed using the norm of Provisional Tolerance Weekly Intake (PTWI) 0.7µg/kg body weight/week (USA FDA). The calculated data show that while convenience fish products can be consumed practically without limitation, the consumption of deep fried Snoek should be limited to one and deep fried Hake to three 125-150g portions per week with orientation on the highest Hg concentration found in fried fish samples [4-6].

Acknowledgement

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