Fish and their Byproducts

SUMMARY:

Fish is a unique source of micro-nutrients. However, many parts of larger fish, such as the head and the bones, are discarded during fish processing despite the high levels of nutrients, and particularly micro-nutrients found in these parts. Thus the promotion and use of fish byproducts to create low-cost, high-quality food could help reduce malnutrition. This practice illustrates the nutritional benefits of incorporating fish byproducts in the diet and suggests recipes to guide their preparation.

KEYWORDS:

fish [1]  
Byproducts [2]  
Nutrition [3]  
cooking quality [4]  
fishery byproducts [5]

CATEGORY:

Fishery & aquaculture [6]  
Natural Resources Management [7]  
Nutrition for better life [8]  
Post-harvest and marketing [9]

DESCRIPTION:

I. FISH BYPRODUCTS

Small indigenous fish species, contain high levels of micronutrients such as minerals, iron, zinc as well as vitamins and essential fats. In this case, all parts of the fish are typically eaten. In contrast, many parts of larger fish, such as head, bones, frames, tails, skin and viscera, are considered as waste and of low value. Such parts of the fish which are considered to be byproducts can constitute as much as 70% of the fish. Improved use of these byproducts for human consumption would improve the nutritional value of the diet, could reduce waste generated by fish processing and provide greater economic sustainability for fish processors as new products and more of the fish can be sold instead of discarded.

II. NUTRITIONAL VALUE OF FISH BYPRODUCTS

Processing nutrient rich fish byproducts for human consumption, instead of discarding these parts, can play a vital role in improving human nutrition, especially in areas where malnutrition is prevalent.

Fish byproducts, provide high levels of essential micronutrients, such as vitamins A, D, B, particularly B-12, as well as minerals such as calcium, phosphorous, iron, zinc, selenium, and iodine. In addition to micronutrients, byproducts contain high quality proteins and lipids with long-chain omega-3 fatty acids.

Women of child bearing age (19-49), infants and children have particular need for a nutritious diet and fish byproducts provide vital omega-3 fatty acids, vitamins, minerals and proteins necessary for growth, cognitive development and a healthy immune system. Providing these nutrients through fish byproducts can
make these nutrients available, more affordable, and accessible to vulnerable women.

**Table 1: Nutritional Value of Fish and Byproducts**

<table>
<thead>
<tr>
<th>Fish &amp; Byproducts, a source of nutrients</th>
<th>Nutrient level per 100g</th>
<th>Daily need (RDI) for children:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin A; 250 million infants deficient</td>
<td>Cod liver oil: 5000µg</td>
<td>500µg</td>
</tr>
<tr>
<td>Iron; 1.6 billion people deficient</td>
<td>Dried tuna frames: 35 mg</td>
<td>8.9mg (at 10% bioavailability)</td>
</tr>
<tr>
<td>Iodine; seafood natural source, 2 billion people deficient</td>
<td>Cod fillets: 250µg, Seaweed: &gt;2000µg</td>
<td>120µg</td>
</tr>
<tr>
<td>Zinc; 800,000 child deaths per year</td>
<td>Bones from herring: 19mg</td>
<td>5.6mg (of moderate bioavailability)</td>
</tr>
</tbody>
</table>

Fish is a source of high-quality protein which serves as an integral component of people's diets, especially in low-income countries. One alternative to using byproducts is to use the whole fish. Small fish species, such as sardines, anchovies and small lake sardines are often eaten whole, meaning the skin, frames, head, bones and viscera of the fish are all consumed. Such parts in larger fish species are usually discarded. However, some fish species have higher nutritional value than others, in terms of vitamins, minerals and essential fats. A meal with whole small fish or fish byproducts contributes more minerals, especially calcium and phosphorous than a meal with a fillet of large fish. As with fish, fish byproducts deteriorate rapidly and must be optimally preserved. In processing plants refrigeration and freezing facilities must be used to store heads, frames, and eventually other byproducts.

Fish byproducts, especially when containing viscera, deteriorate very rapidly and therefore it is important that they are preserved as soon as possible after being extracted. This may not always be possible due to inadequate processing facilities or limited space making recovery of the byproducts non-profitable. Methods to preserve fresh fish byproducts are the same as to preserve fresh fish (see cooking freshwater Fish page 12 ? 15 and here [11]). Bacteria multiply in higher temperature. Therefore it is important to keep them under shadow and chilled (to slow the bacterial and enzymatic activities) by using clean ice and a clean container, and to cover them to avoid the contamination by flies and dirt as well.

**Table 2: Fish bone composition (lipid free dm)**
Chemical composition, mineral content and amino acid and lipid profiles in bones from various fish species, Toppe et al., 2007

There are nutritional gains to consuming fish byproducts. For example ten grams of byproducts powder made from tuna back bone would provide more than 100% of children's daily needs of omega-3, calcium and phosphorous and more than 40% of their iron needs. Thus consumption of byproducts can reduce nutrition deficiencies.

Table 3: Micronutrients of Tuna back bone Powder

<table>
<thead>
<tr>
<th>Content</th>
<th>Cod</th>
<th>Salmon</th>
<th>Herring</th>
<th>Mackerel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein (g/100g)</td>
<td>39</td>
<td>47</td>
<td>44</td>
<td>59</td>
</tr>
<tr>
<td>Ash (g/100g)</td>
<td>58</td>
<td>50</td>
<td>51</td>
<td>44</td>
</tr>
<tr>
<td>Calcium (g/100g)</td>
<td>19</td>
<td>14</td>
<td>16</td>
<td>14</td>
</tr>
<tr>
<td>Iron (mg/100g)</td>
<td>5</td>
<td>3</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Zinc (mg/100g)</td>
<td>10</td>
<td>23</td>
<td>19</td>
<td>13</td>
</tr>
<tr>
<td>Iodine (mg/100g)</td>
<td>0.4</td>
<td>0.3</td>
<td>0.1</td>
<td>0.2</td>
</tr>
</tbody>
</table>

RDI : the daily intake level of a nutrient that is considered to be sufficient to meet the requirements of 97-98% of healthy individuals.

III. BEST PRACTICES FOR HANDLING BYPRODUCTS

Unsuitable processing facilities, lack of relevant equipment or labour costs sometimes results in byproducts being handled in a manner unfit for human consumption. An essential step in ensuring byproducts are suitable for human consumption involves implementing systems such as Good Manufacturing Practice (GMP) and the Hazard Analysis and Critical Control Point (HACCP) during production (for more
information see here [14]). The benefits of byproducts must be realized to ensure fish powders (for more information see here [15]) of high quality, taste and colour are produced. Alternatively, fish byproducts can be used to make fishmeal, fish silage and fish oil, as fish feed for aquaculture, as an indirect way of providing healthy foods since the expanding aquaculture sector is by far the largest user of these products.

IV. RECIPES

Use of fish byproducts for cooking occurs in many regions of the world. The following are some recipe examples that can be altered with fish species, vegetables and spices of your choice.

Recipe 1: Fish head curry

Dish: Main course
Fish species: Any
Servings: 2 - 3
Method: Boiling

Ingredients:

Use fish and spices of your choice.

- Fish head 1/2 lb.
- 1 tbsp. cumin seeds
- 1 tsp chili powder
- 1/2 tsp turmeric powder
- 3 tsp coriander powder
- 1 red chili
- 1/2 tsp mustard seeds
- 1 tsp fenugreek seeds
- 3 inches of fresh ginger, chopped
- 5 garlic cloves, chopped
- 1 onion
- 2 inches of cinnamon
- 1 cup of coconut milk (preferably fresh)
- 2 tomatoes
- Salt
- Oil

Instructions:

1. Heat a pan and add 1/2 tsp cumin seeds, mustard seeds, fenugreek seeds, ginger, garlic, cinnamon stick, and curry leaves to stir-fry and bring out the aroma of the spices.
2. Pour the fried ingredients into a food processor, with a little water, to blend into a smooth paste.
3. In a heated pan again, add oil, chopped onion, and sliced tomato and fry until the mix is golden brown.
4. Add cumin powder, chili powder, and turmeric powder, coriander powder to stir-fry until the aroma is released, and then add in the ground paste you previously prepared.
5. Bring the mixture to boil, and then add in the cleaned fish head and a sprinkle of salt.
6. Cook the fish head on medium heat until the flesh is cooked well.
7. Add coconut milk and leave the dish to simmer for three minutes before serving.
**Recipe 2: Al tang (Salted Pollock Roe Soup)**

Dish: Main dish

Fish species: Roe of Pollock

Servings: 4

Method: Boiled

Time: 1 hour

**Ingredients:**
- 3 pieces of salted Pollock roe
- 2-3 ounces (70g) radishes, thinly sliced into about 1 inch squares
- About 2 cups of dried anchovy broth or water
- 1/2 pack of soft tofu
- 1 green chili, thinly sliced
- 1 red chili, thinly sliced
- 1 scallion, thinly cut diagonally
- Salted baby shrimp or salt for seasoning

**Instructions:**
1. Cut the salted Pollock roe into about 3/4 inch (2cm) pieces.
2. Spread the radish slices across the bottom of a small pot.
3. Place the Pollock roe on top and carefully pour about 2 cups of the dried anchovy broth on top.
4. Cook the dish slowly, on a medium heat to prevent the roe from falling apart.
5. Scoop out any foam that forms on the surface.
6. While the soup is cooking, soak the cut chilies in a cup of water to remove the seeds.
7. After about 10 minutes, add the tofu, chilies and scallion. Cook for another 5 minutes. Alternatively, to replace the chilies or to add extra spice, sprinkle about 1/2 tablespoon of red pepper powder.
8. Season with salted baby shrimp or salt.

**Recipe 3: Fried Cod Tongues**

Dish: Appetizer

Fish species: Cod tongues

Servings: 4 - 6

Method: Frying

**Ingredients:**
- 2 lbs. cod tongues
- ½ cup all-purpose flour
- ½ tsp. garlic
- Salt & pepper
• 4 tbsp. cooking oil

**Instructions:**

1. Rinse cod tongues under cold water and pat dry.
2. In a mixing bowl add flour, garlic and season to taste.
3. Add cod tongues to the mixing bowl and shake well until evenly coated.
4. In a skillet, add cooking oil of your choice and with medium-to-high heat, fry cod tongues on both sides until golden brown.
5. Serve with a white sauce and your favorite side dish.

**Recipe 4: Chickpeas Stew with Fish Powder**

For this recipe, Mukene (*Silver cyprinid*) powder was used (for more information see [here](#)). However any fish or fish byproduct may be used instead of Mukene powder.

**Dish:** Main dish

**Fish species:** Mukene (*Silver cyprinid*) (in powder)

**Servings:** 2-4

**Ingredients:**

- 1 can of chickpeas
- Fresh or canned tomatoes 200g
- 1 chopped onion
- 1 sliced eggplant
- Water 200ml
- 2 bay leaves
- Mukene fish powder 10g
- Olive oil 10ml (or any cooking oil of your preference)

**Instructions:**

1. In large pot, heat oil over medium heat
2. Add the chopped onion and sliced eggplant and stir occasionally until the eggplant softens.
3. Add the tomatoes, water, chickpeas and fish powder, allow to boil for three minutes and then reduce to a simmer for 5 minutes.
4. Take stew off the heat, to preserve nutrients in fish powder.
5. Serve with rice and bread or grain of your choice.

**Table 4: Nutrition information about Mukene fish power stew with chickpeas**
For more recipes with fresh fish please see here [17].

FURTHER READING:


SOURCE(S):

Fisheries and Aquaculture Department (FI) in FAO [19]

Country:
Source URL: http://teca.fao.org/technology/fish-and-their-byproducts

Links: