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Food and Agriculture Organization
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URUGUAY






Processing of Tilapia By-Products for use in School Meals in Honduras



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Introduction



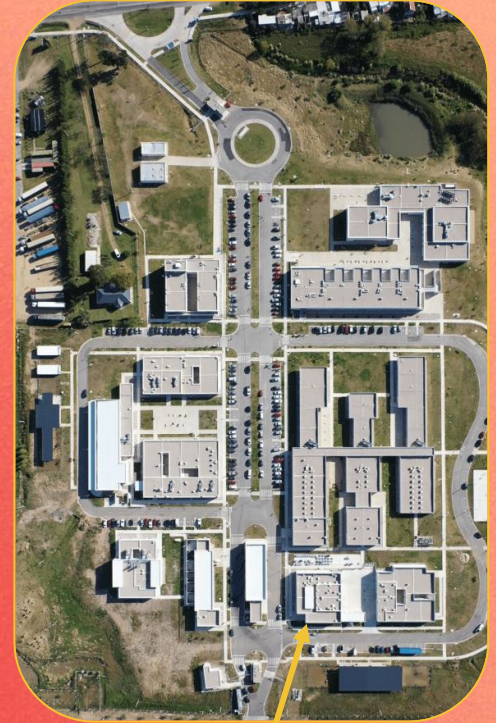
-  Malnutrition remains a problem in Latin America, including Honduras.
-  School feeding programs aim to improve food security and child nutrition.
-  Fish consumption in Honduras is relatively low compared to its production, particularly tilapia.



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Background

- Improving the nutrition of children in Honduras.
- Tasks were carried out in the Faculty of Veterinary (University of the Republic, Uruguay).





Unit of Science and Technology for Fishery Products



Objective



Develop foods using by-products from **tilapia** (*Oreochromis* spp.) fillet extraction, such as **heads, spines, and bones**, with the intention of including them in school feeding programs.





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Development

Raw material:

Tilapia suitable for consumption, obtained through the filleting process of whole refrigerated specimens.





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Whole fresh fish



Processing

Fish fillet



Heads



Evisceration
and cleaning

Broth



Fish spine
(with flesh)



Flesh extraction
(manual or
mechanical)



Burgers and
croquettes



Fleshless spines



Drying and smoking fish bones



Bone powder (natural and smoked)

Bread, crackers and stew






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Sensory evaluation





Presentation, flavor,
smell and texture.

 I loved it

 I liked it

 Indifferent

 I didn't like it

 I really didn't like it

La presentación



Me disgustó
1



No me gustó
2



Indiferente
3



Me gustó
4



Me encantó
5

El sabor (gusto)



Me disgustó
1



No me gustó
2



Indiferente
3



Me gustó
4



Me encantó
5

El aroma (olor)



Me disgustó
1



No me gustó
2



Indiferente
3



Me gustó
4



Me encantó
5

La textura y elasticidad



Me disgustó
1



No me gustó
2



Indiferente
3



Me gustó
4



Me encantó
5

Broth



- Made with tilapia heads, spines, and vegetables.
- Yields (% of whole fish's weight):
 - Cleaned heads: 19.3%
 - Spines: 12.4%.





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Broth



Heads were compressed dorsoventrally for better cleaning.



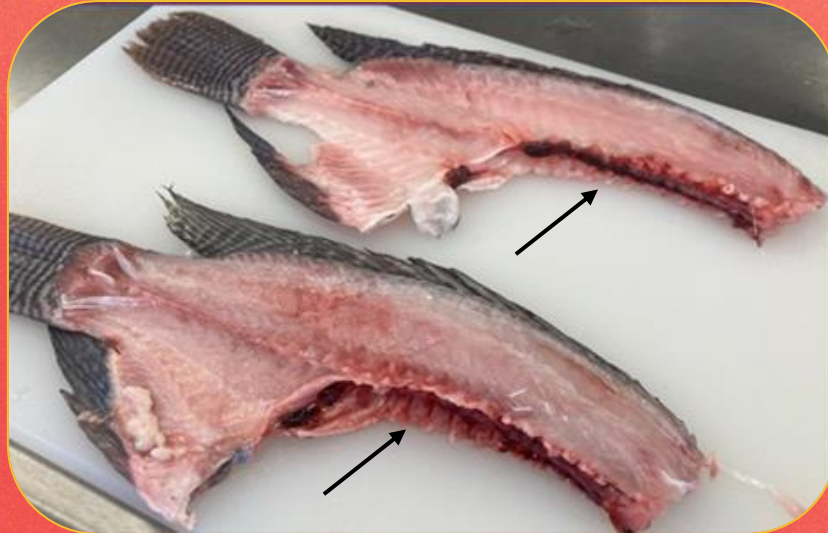


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Broth



Spines had their attached kidneys brushed to avoid a dark and unpleasant-tasting broth.





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Broth



- Vegetables added:



- Testing a **clarification** method with chicken egg albumin showed no significant differences in odor or taste compared to unclarified broth, so it's not recommended.



Precipitate

Flesh extraction



1. Manual extraction, **raw state**
2. Manual extraction, **from cooked spines**
3. Mechanical recovery



Flesh extraction



1. Manual extraction (raw state):

- Stainless steel forks used to separate flesh from the spine.
- Slow, raised temperatures, and had a 35% yield.



Flesh extraction



2. Manual Extraction (cooked spines):

- Spines were **boiled** and meat was manually removed using forks.
- Easier meat removal, less extraction time.
- Cooked spines weighed 25% less than raw.



Flesh extraction



3. Mechanical Recovery:

A fish deboning machine was used to extract flesh from spines.



Flesh extraction



A **yield of 46.8%** was achieved in relation to the total weight of the spine after two passes through the deboning machine.





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Burgers



- Fish meat
- Breadcrumbs (10%)
- Chicken egg yolk (5%)
- Salt (1%)

Mixture was **shaped** into patties **by hand**.

A light **breeding** with breadcrumbs was done to improve the product's **binding**.

Cooked by **deep frying** in high oleic sunflower oil.





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Croquettes



- Fish meat
- Breadcrumbs (10%)
- Chicken egg yolk (5%)
- Salt (1%)
- Dried parsley (*Petroselinum crispum*) and garlic (*Allium sativum*) (1% each)

Mixture was **shaped by hand**.

A light **breeding** with breadcrumbs was done to improve the product's **binding**.

Cooked by **deep frying** in high oleic sunflower oil.





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Preparations with bone powder



Drying methods:

- **Smoker** (80°C for 3 hours)
- **Electric oven** (100°C for 1 hour)

Two types of bone powder:

- **Smoked**
- **Non-smoked**





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Preparations with bone powder



- Bones were ground using an **electric grinder**.
- Powder was **sieved** through a **1.19 mm opening** sieve.
- The yield for the acceptable-sized powder was **7%** in relation to the original spine.





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Bread



- Wheat flour
- **Bone powder** in quantities of: **0%, 5%, or 10%**.
- **Broth** (made w/ **Fish head and spine**)
- Fresh yeast (0,4%).
- High oleic sunflower oil (10%).
- The dough rested for 30 minutes for leavening.
- Rolls baked at 180°C for about 10 minutes.





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Crackers



- Whole wheat flour
- **Bone powder** in quantities of: **0%**, **5% (non-smoked)** or **5% (smoked)**.
- **Broth** (made w/ **Fish head and spine**) (30%)
- Salt (2%)
- High oleic sunflower oil (15%).
- Ingredients were weighed, mixed into dough, rested for 15 minutes, rolled, cut, and baked at 180°C for 10-15 min.





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Stew



- Steamed rice
- **Broth** (made w/ **Fish head and spine**)
- **Smoked bone powder** (5% relative to rice)
- Chicken breast
- Onion, tomato, red bell pepper, garlic powder, salt, and sunflower oil.





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Results



Product	Presentation	Flavor	Smell	Texture	Evaluation
Burgers	4,6	4,4	4,2	4,3	4,4
Croquettes	4,3	4,6	4,3	4,3	4,4
Bread, w/ 10% bone powder	4,0	3,6	3,7	3,9	3,8
Bread, w/ 5% bone powder	4,0	4,0	3,9	3,9	4,0
Bread, without bone powder	4,5	4,3	4,0	4,3	4,3
Crackers w/ bone powder, non-smoked	3,2	3,3	3,6	3,6	3,4
Crackers w/ smoked bone powder	3,6	3,4	3,6	3,6	3,6
Crackers without bone powder	3,8	3,8	3,8	3,7	3,8
Stew	4,1	3,9	4,2	4,0	4,1



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Conclusions



Sensory evaluations showed:

- Similar acceptance of meat-based products like croquettes and hamburgers.
- Preference for 5% bone powder over 10% in bread.
- Higher preference for cookies with smoked bone powder.
- Stew received high ratings even without the inclusion of fish meat.



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Conclusions



- Manual flesh extraction was a laborious process with contamination risks.
- The mechanical method is more efficient, but its effectiveness varies with workload.
- Finally, the **use of filleting by-products is feasible and provides an opportunity to enrich nutrient-poor populations.**



Thank you



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