Quality and Safety of Channel Catfish (*Ictalurus punctatus*) Affected by Production, Harvest & Post-harvest Practices

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Food Science,
Nutrition and
Health Promotion
Muchas Gracias!

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CATFISH PRODUCTION
FARM TO PLATE

- **Pre-harvest**
  - Site selection
  - Soil
  - Water source
  - Water quality management and control
  - Maintenance of various life stages
  - Feed quality and feeding regime/practices
  - Fish health management
  - Animal control
  - Human hygiene and health
  - Proper sanitation and sanitary conditions
  - Chemical applications

- **Harvest & Post-harvest**
  - Harvest
  - Live hauling
  - Receiving/Holding
  - Stunning
  - Beheading/bleeding
  - Time to Ice/Brine
  - Chilling
  - Packing
  - Marinating
  - Freezing
Catfish Quality and Safety

Spoilage
- Off-color and off-flavor
- Enzymatic
- Microbiological
- Oxidative

Hazards
- Chemical residues
- Drugs
- Microbiological
- Metals
Species, site selection & soil

- **Species**
- **Site selection**
  - floods,
  - soil,
  - animals
- **Soil**
  - heavy metals,
  - chemicals
Production practices

- Stocking density
- Environmental management
Water source & water quality

- Water source
  - pathogens,
  - chemical residues
  - Off-flavors

- Water quality management and control
  - chemical residues
  - Off-flavors
Greenish discoloration

- May be the result of water quality, heme pigment changes due to iron or reducing agents, or other causes like too much blood in the muscle.

- Pink fillets may be the result of nitrites in the water, cure, or elsewhere.
Feed quality and feeding regime

Feed quality
- Protein
- Antioxidants
- Pigments
- Pathogens/Toxins
- Drugs

Feeding regime/practices
- Season
- Satiation
Yellow pigmentation

- Usually the result of yellow pigments (asthaxanthins) in the feed or lagoon (yellow corn feed, algae), usually along fatty tissue
Diseases, chemicals, animals

- Fish health management
  - Diseases
  - Chemicals & drugs
- Chemical applications
  - Chemical residues
- Animals
  - Pathogens
- Human hygiene and health
  - Pathogens
  - Virus
- Proper sanitation and sanitary conditions
Drug and chemical residues

- Drug residues
- Chemical residues

- Records of proper labeling, use, handling
- Monitor chemical disposition, chemical use in adjacent properties
Harvesting and handling
SHANK FILLET YIELD AS AFFECTED BY SEASON

Bosworth and Wolters, Unpublished
SHANK FILLET YIELD

FEMALES  MALES
NUGGET YIELD

FEMALES MALES

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Catfish Rigor and Quality

- Catfish is subtropical
- Stress factors: handling/harvest hold, rapid chilling live fish, transportation, oxygen starvation
- Rested or anesthetized have longer onset than stressed or chilled/stressed
- Rigor onset could be as short as less than one hour to more than 12 hours
Fish culture/Capture Applications

– A) shocking catfish shocked and held in
tubs 2 days:
  - Lactate = 49-79 mg% (no deaths)

– B) hoop netting and transported 25 min,
weighed, measured, held 2 days:
  - Normal appearing fish had Lactate = 39 -112;
  - Fish with noequilibrium had Lactate= 66 -138%;
  - Moribund had lactate = 157 -285mg%
Figure 1. Comparison of white muscle surface pH values for Atlantic Salmon harvested using CO₂ treatment and the anaesthetic, AQUI-S™.

Figure 2. Apparent failure stress in 20 mm tissue strips over 40 hr in “rested” and “exhausted” Chinook salmon white muscle.

Figure 3. Percentage shrinkage through rigor mortis at different storage temperatures for rested and exercised Chinook salmon flesh.
Effect of treatment on onset of rigor of catfish
Nunez and Silva, 2001
pH & PPC of catfish fillets affected by handling
Post morten changes in fish tissue

- Slime secretion in skin: (stops w/ onset of rigor)
- Rigor mortis: 10-30% shrinkage, soft, spoil, gapping, proteolysis
- Autolysis and enzymatic decomposition
- Microbiological spoilage
Catfish rigor and quality

- Rapid onset leads to reddening and tissue softening: Red-Soft-Exhudative (RSE)

- Diseases/holding in the sock lead to stress and rapid onset of rigor

- Rapid rigor onset may lead to shorter shelf-life

- Red fillets have lower pH and about one log cycle lower PPC/TCC than “white” fillets (Lu et al., 2003)

- Red fillets may have 2-3 days longer microbiological shelf-life.
RSE fillets

- Red, Soft and Exhudative, RSE
- Red fillets may be the result of stress, on rigor cut fillets, fish that did not bleed completely
Fish Muscle Softening

Causes:
- Spawning, starvation, disease, injury, death

Upon death:
- Proteolytic enzymes released
- Muscle protein breakdown

Retarded by:
- Reduce handling/manipulation
- Store @~0C
- Do not stack or crush
Processing

- Temperature
- Time
- Interventions
- Icing
- Marinating
Icing effect on SL

Scores

Storage time (days)

WI

WO
PPC on nuggets

Log CFU/g

Control
Treatment

Day1  Day5  Day8

Time (day)

Silva et al., Unpublished
Silva et al., Unpublished
Summary

- **UNIFORMITY OF QUALITY AND STANDARDS**
- Off-flavor management and intervention
- Yield (edible) improvement
- Rigor onset and its implications
- Yield and quality increases through processing
MALAHO

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