DEVELOPMENT OF DRY CURED CHICKEN SAUSAGES USING SPENT LAYER HEN MEAT

Screening of Starter Cultures and Optimisation of Formulation and Processing Conditions – PHASE 2

Mr Kamlesh Boodhoo and Dr Sunita J. Santchurn
Faculty of Agriculture
University of Mauritius
RESEARCH QUESTIONS

- How efficient is the use of spent hen meat for making dry-cured sausages?
- What is the optimum mix of ingredients needed to produce the dry cured sausage?
- What are the manufacturing process conditions (e.g., temp, RH)?

WHAT WE FOUND?
- Technologically feasible to use spent hen meat
- Characteristic brick-red colour
- Slow drop in pH
- Ununiform distribution of meat/fat particles
- Absence of typical gelled texture
- Mould growth on surface of the casings
Objective

To produce a quality and safe 100% chicken dry cured sausage inoculated with starter cultures

Specific Objectives

- Investigate feasibility of using existing starter cultures
- Optimise the fermentation/drying
- Refine the formulation
- Eliminate mould growth
- Improve compactness of the sausages
MEAT (72%)
- Breast, Thigh
- Drumstick
- Fat (Skin and Abdominal) (15%)

INGREDIENTS (13%)
- Salt
- Glucose
- Nitrite
- Dried Garlic
- Ice Chilled Water

Formulation

Screening Starter Cultures

Bactoferm, Chr. Hansen
- RM52 – a fast culture
- RM53 – a medium culture

Biovitec
- MF 750 – a medium culture
- MF 42 – a fast culture
- BC10 – a bio-protective culture

2 kg batter was inoculated with one of the starter culture
PROCESS FLOW DIAGRAM FOR PRODUCTION OF DRY-CURED FERMENTED POULTRY SAUSAGES

- Spent Birds (Slaughter)
- Dressed Carcass
- Removal of Primal Cuts (Breast, Thigh and Drumstick)
- Removal of Fat (Skin and Abdominal Fat)
- Freezing
- Grinding
- Mixing
- Stuffing and Hand Clipping
- Stored Overnight in Refrigerator
- Antifungal treatment
- 2 phase Fermentation and Drying
- Dry-Cured Chicken Sausages
PREPARATION of SAUSAGES
Physico-Chemical and Microbiological

2 sausages from each batch was sampled on day 0, 3, 6, 9 and 15 days for physico-chemical and microbiological determination

- pH and Titratable acidity
- Water Activity
- Mass Loss
- Lactic Acid
- Staphylococcus and TVC
- Colour and Compactness

ALL PARAMETERS WERE DETERMINED ACCORDING TO STANDARD PROTOCOLS
Findings

All 5 starter cultures showed similar trends in the physico-chemical and microbiological parameters over time.

At 15 Days

Physico-Chemical Parameters

- pH: $4.46 \pm 0.05$
- D-lactic acid: $0.66 \pm 0.105$ g/100g wet basis
- L-lactic acid: $0.78 \pm 0.090$ g/100g wet basis
- Mass loss: 56%
- Water activity: $0.860 \pm 0.013$
- TVC: $8.6 \log \text{cfu/g}$
- Lactic acid bacteria: $9 \log \text{cfu/g}$
- *Staphylococcus spp*: $<1 \log \text{cfu/g}$
WHAT WE FOUND

- Existing **commercial starter cultures** can be used
- Improved bacteriological quality
- More **rapid initial acidification** of the sausages
- **Better compactness** of the sausages
BUT Differences among the fast fermenting cultures were noted in the rate or extent of change in the essential parameters:

- pH
- D- and L-lactic acid acid contents
- TVC and *Staphylococcus* spp counts

MF42 was selected for further optimisation of the process using a modified formulation
Modified Formulation (F1)

MEAT and FAT (100%)
- Breast, Thigh
- Drumstick without skin
- Skin and Abdominal fat

NON MEAT INGREDIENTS
- Salt
- Glucose → Sucrose
- Nitrite
- Dried Garlic
- Pepper
- Ice Chilled Water

□. The 2-step process was modified: 25°C and 85% RH followed by 12 days at 15°C and 75% RH TO PROMOTE GROWTH OF THE MF42 CULTURE
TITRATABLE ACIDITY

RAPID DROP in pH, day 3
Microbial Count (Log CFU/g)

Time (Day)

Formulation 1

Formulation 2

Staphylococcus spp.

Total Viable Counts
SUMMARY OF RESULTS

- 2 stage process favoured acidification and drying.
- A rapid 1-unit decrease in the pH in the first day of fermentation.
- Rapid growth of the LAB to a load of 9.8 log cfu/g in the first 24 h of fermentation.
- Staphylococcus population showed a gradual increase to a maximum of 6.9 log cfu/g at day 6 and a slight decline thereafter to 5.2 log cfu/g.
- Water activity ($a_w$) dropped sharply from to 0.814 - 0.858.
- More compact sausages (Uniform Distribution of Meat and fat particles).
• **Rapid drop in pH** causes denaturation and coagulation of meat proteins
  • High Initial Load of LAB cultures (10⁶/g)

• Increased salt content would favour the **solubilisation** of meat proteins
  • Extrusion of water through solubilisation
  • **Faster Drying**
  • Improved firmness and cohesiveness and **eliminate spaces** in the sausage

• Develop **good colour** and **flavour** in the sausage (presence of nitrate-reductase due to Staph spp)
DISCUSSION

• Low pH
• Increased salt content
• Presence of Nitrite
• Higher LAB counts
• Decrease in Water Activity
• Faster Drying

SYNERGISTIC ACTIONS
Major hurdles for growth of pathogenic and spoilage microorganisms
CONCLUSION OF PHASE 2

Dry Cured Poultry Sausage (USING MF42)
- Improved bacteriological quality
- Optimised formulation and process conditions
- Suppression of mould growth
- Improved compactness, and hence sliceability.

A stable dry-cured poultry sausage with physico-chemical, microbiological and sensory characteristics typical of comparable dry-cured pork-based products.
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