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DEVELOPMENT OF DRY CURED CHICKEN SAUSAGES USING SPENT LAYER HEN MEAT

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

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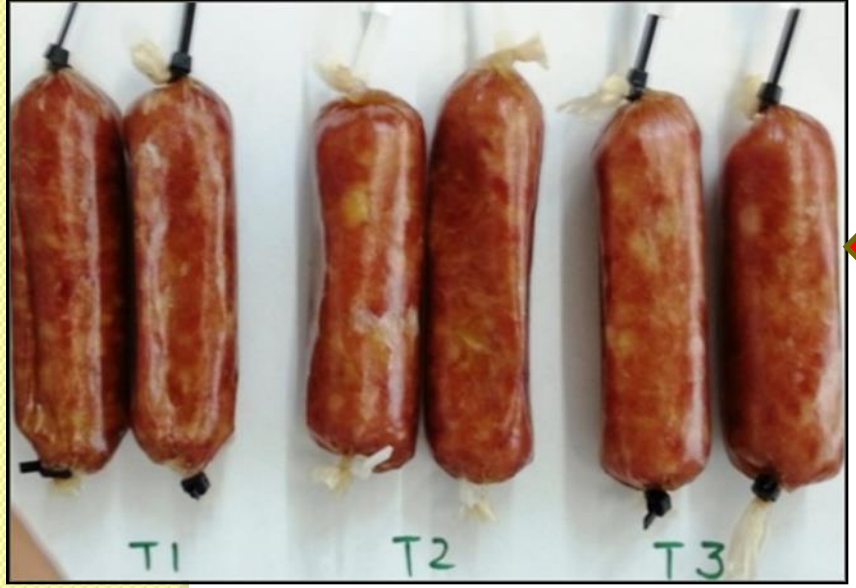
THE CONTEXT – PHASE 1

- 1.2 million of spent hens produced per year
- Adding value to spent layer meat from the egg industry

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)?

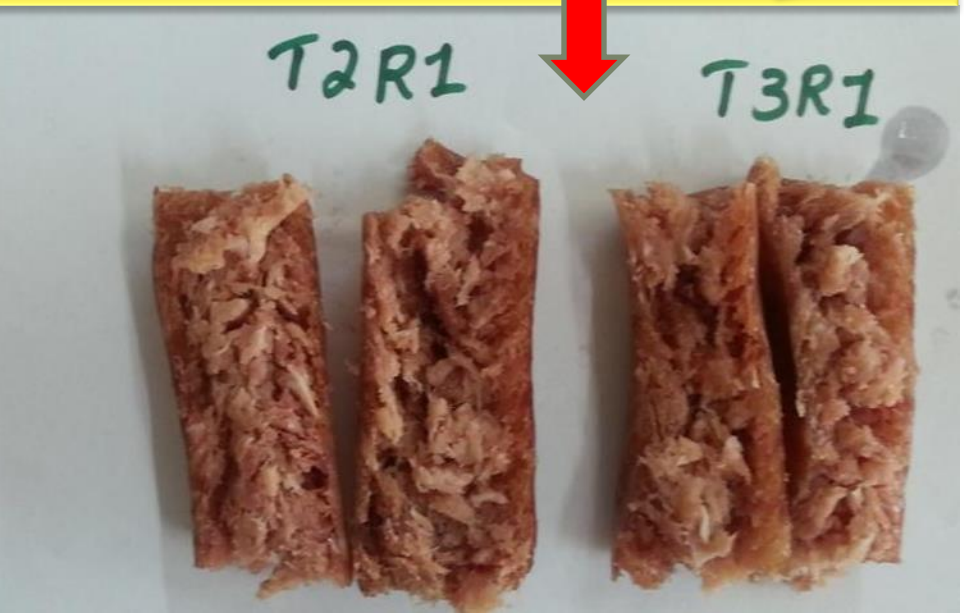
- **WHAT WE FOUND?**



- 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

PHASE 2 –Screening of Starter Cultures

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

Formulation

MEAT (72%)

- Breast, Thigh
- Drumstick
- Fat (Skin and Abdominal) **(15%)**

INGREDIENTS (13%)

- Salt
- Glucose
- Nitrite
- Dried Garlic
- Ice Chilled Water

Screening Starter Cultures

Bactoferm, Chr. Hansen

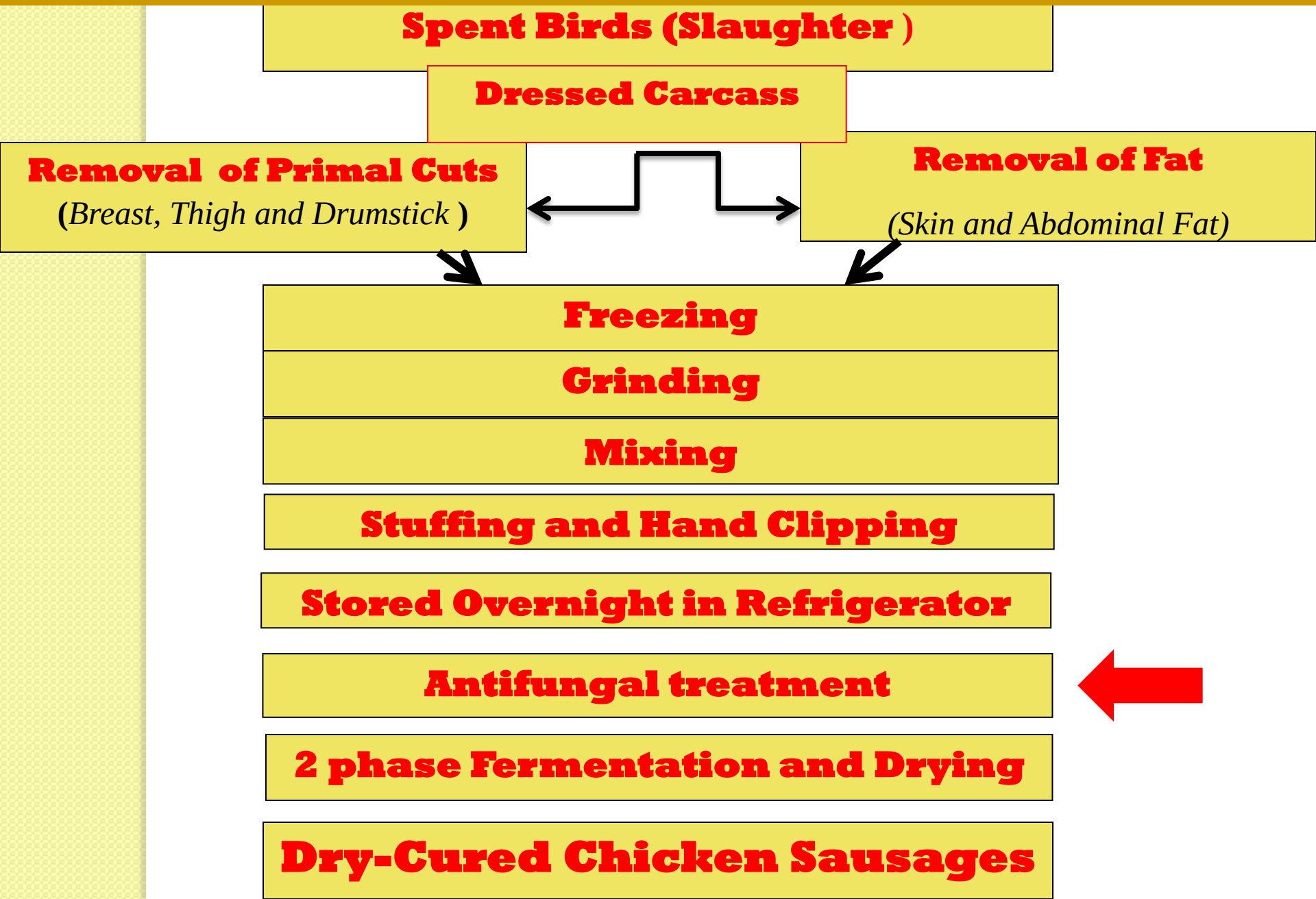
- **RM52 – a fast culture**
- **RM53 – a medium culture**

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



PREPARATION of SAUSAGES

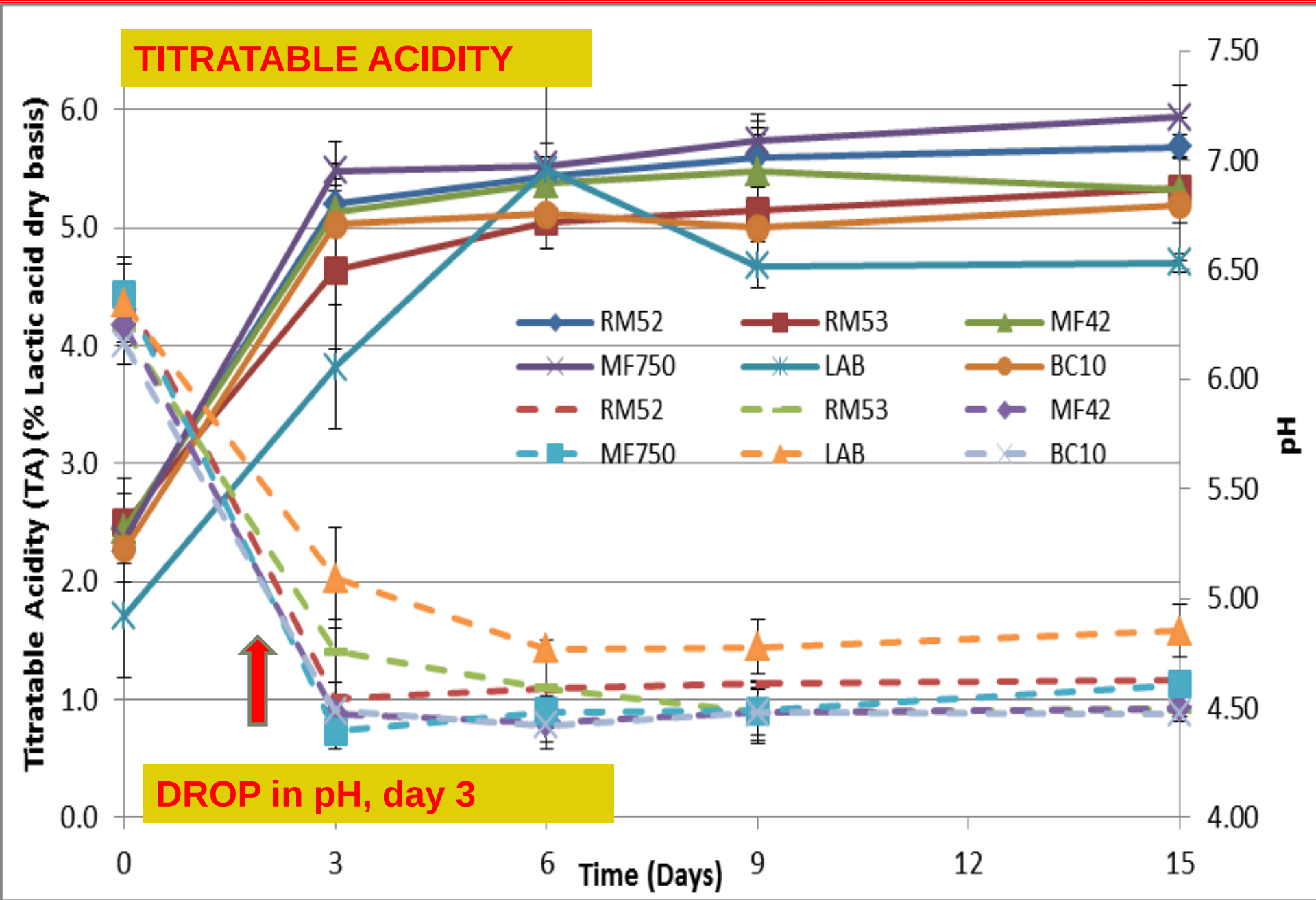
Physico-Chemical and Microbiological

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

TITRATABLE ACIDITY AND pH



Findings

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

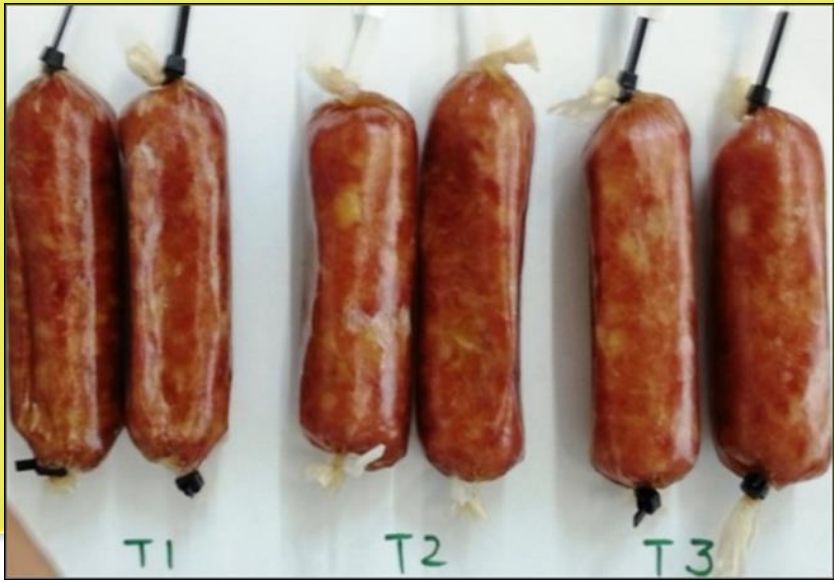
At 15 Days

Physico-Chemical Parameters

pH	**4.46±0.05**
D-lactic acid g/100g wet basis	**0.66±0.105**
L-lactic acid g/100g wet basis	**0.78±0.090**
Mass loss	**56%**
Water activity	**0.860±0.013**
TVC	**8.6 log cfu/g**
Lactic acid bacteria	**9 log cfu/g**
Staphylococcus spp	**< 1 log 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



SELECTION OF STARTER

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 *Staphylcoccus 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

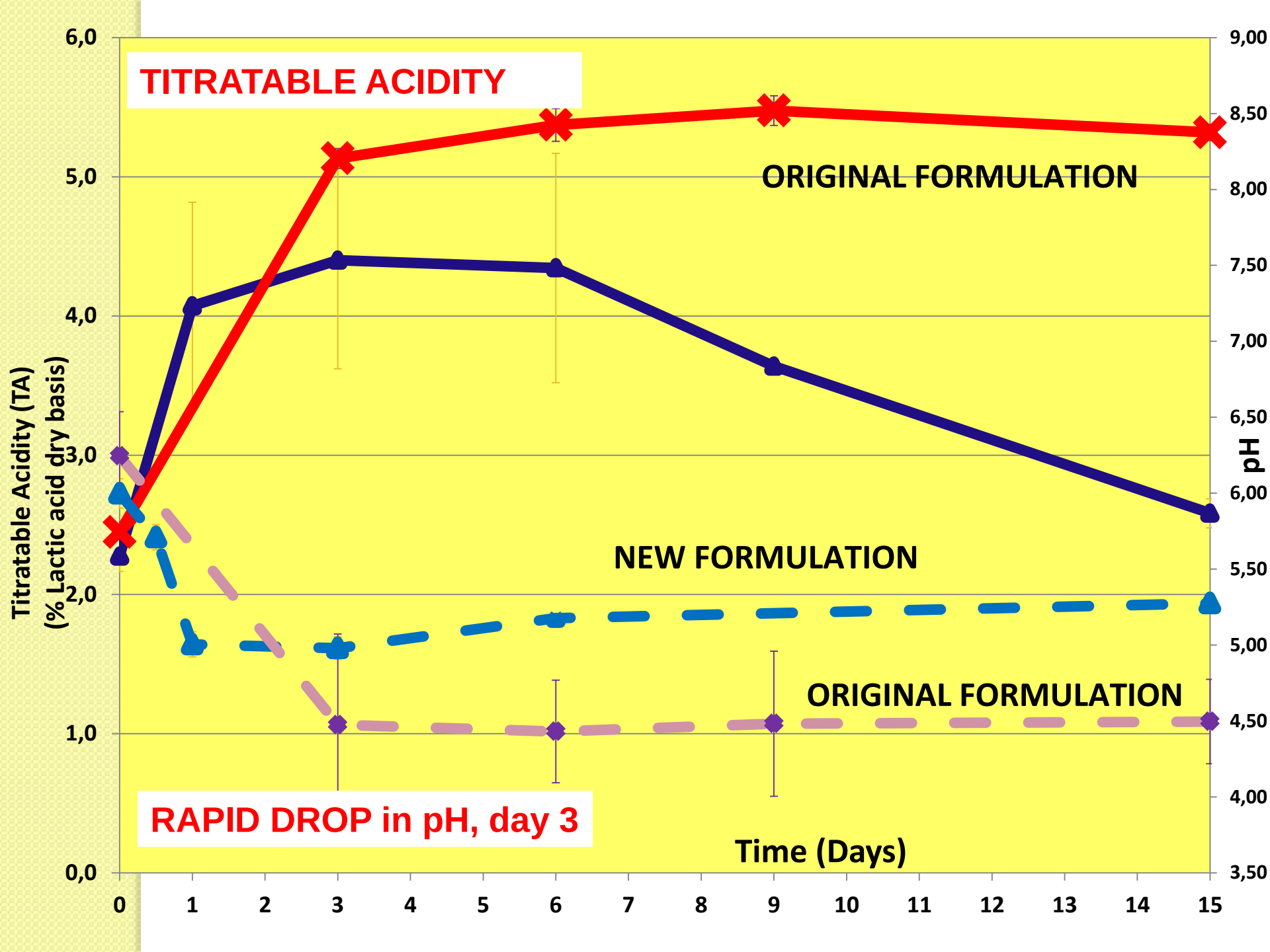
} 85%

NON MEAT INGREDIENTS

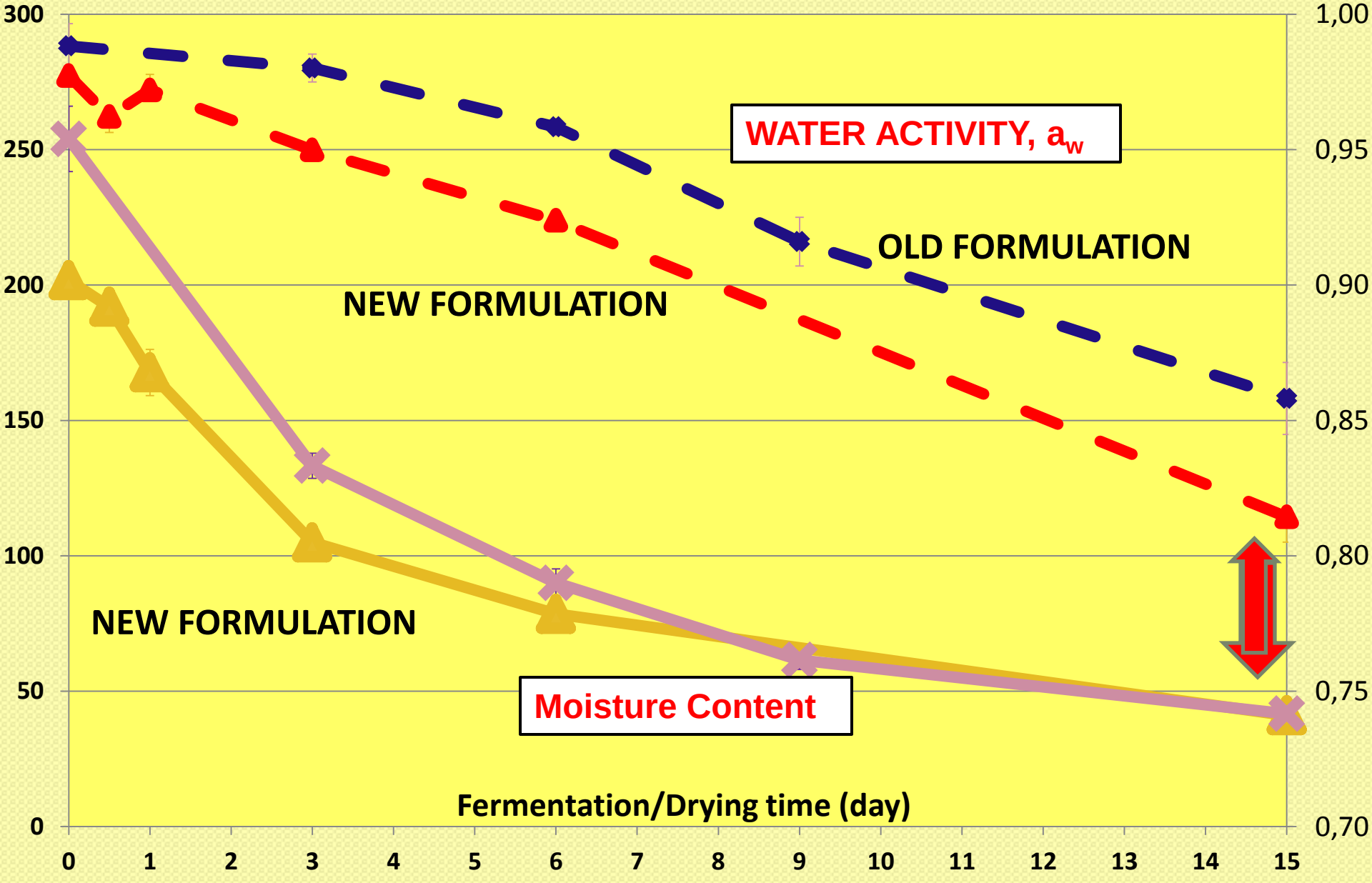
- Salt ↑
- Glucose → Sucrose
- Nitrite
- Dried Garlic ↓
- Pepper ←
- ~~Ice Chilled Water~~

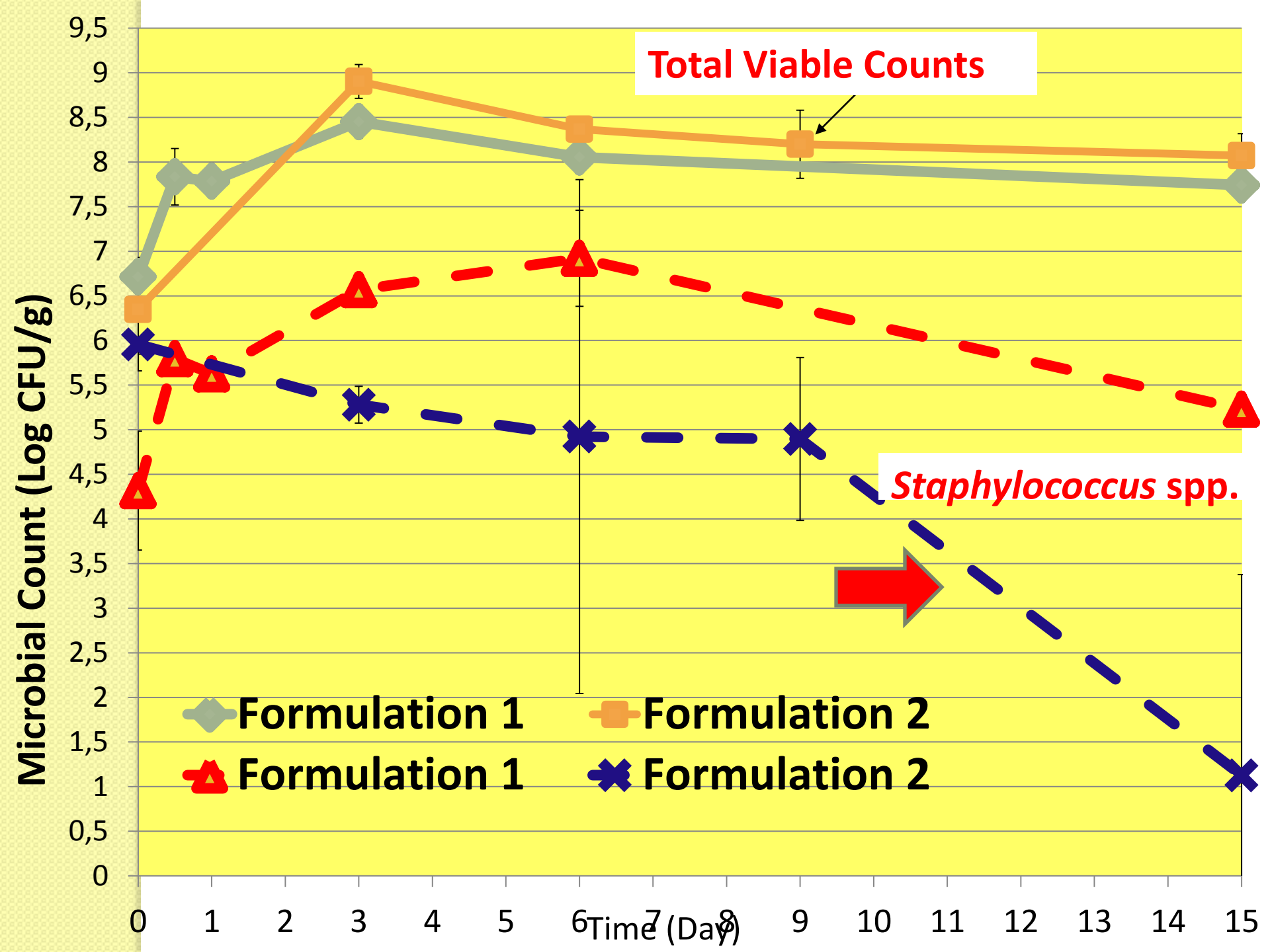
TO PROMOTE GROWTH OF THE MF42 CULTURE

□. **The 2-step process was modified: 25°C and 85% RH followed by 12 days at 15°C and 75% RH**


TITRATABLE ACIDITY
ORIGINAL FORMULATION
NEW FORMULATION
ORIGINAL FORMULATION
RAPID DROP in pH, day 3
Time (Days)
Titratable Acidity (TA)
(% Lactic acid dry basis)
pH
6,0
5,0
4,0
3,0
2,0
1,0
0,0
9,00
8,50
8,00
7,50
7,00
6,50
6,00
5,50
5,00
4,50
4,00
3,50
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

MASS LOSS AND MOISTURE CONTENT




Total Viable Counts
Staphylococcus spp.
Microbial Count (Log CFU/g)
Time (Day)
Formulation 1
Formulation 2
Formulation 1
Formulation 2
9,5
9
8,5
8
7,5
7
6,5
6
5,5
5
4,5
4
3,5
3
2,5
2
1,5
1
0,5
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

SUMMARY OF RESULTS

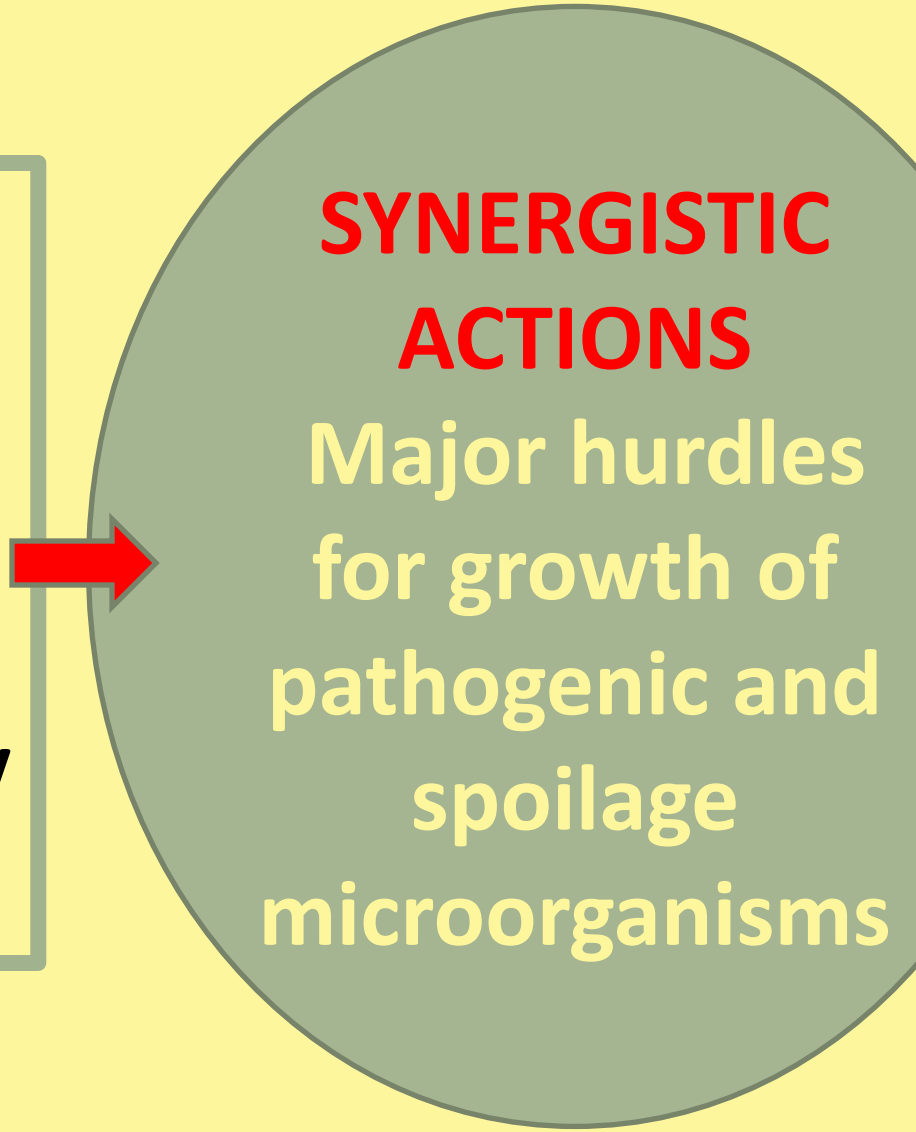
- 2 stage process favoured acidification and drying .
- A rapid 1-unit decrease in the pH in the first day of fermentation
- Rapid growth of the LAB to a load of **9.8 log cfu/g** in the first 24 h of fermentation.
- Staphylococcus population showed a gradual increase to a maximum of **6.9 log cfu/g** 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

DISCUSSION

- **Rapid drop in pH** causes denaturation and coagulation of meat proteins
  - High Initial Load of LAB cultures (10^6/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



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

ACKNOWLEDGEMENT

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