Selection of starter cultures for production of dry fermented Sausages



Presented

by:

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INTRODUCTION

Dry sausages are the fermented meat products which are made with the help of microbial starter cultures. Prior to commercial application of pure cultures and in a traditional way even today, the dry sausage production relies upon natural fermentation which is caused by "in-house microflora".

- Natural fermentation leads to development of wild flavors.
- This necessitates the use of pure or selected starter cultures
- Shortens the fermentation schedule and helps in achieving unique product qualities, consistency and shelf life

- Primary genera of microorganisms - as meat starter cultures are *Lactobacillus* sp. *Micrococcus* sp., *Pediococcus* sp., yeasts and moulds,

- *Micrococci* are added for their nitrate reduction and catalase activity which help in the development of colour in the meat product.

- LAB ferment the sugar to lactic acid primarily during the fermentation process, reducing the pH of the product and providing prolonged stability against the food spoilage microorganisms.

- LAB - contribute to the flavour, texture, nutritional value and microbial safety of fermented foods (Caplice and Fitzgerald, 1999; Coretti,1977a).

A study was carried out to select suitable bacterial cultures for production of dry fermented sausages.

Micrococcus roseus (MTCC-1532), *Lactobacillus plantarum* (MTCC-1407 and L-89) and *Pediococcus acidilactici* (NCIM-2292 and NCIM-2293) were tested for their growth in presence of sodium chloride, sodium nitrite, sodium nitrate and at various temperatures. Their ability to ferment sugar was also assessed. These hurdles were used alone and in combination.

Nutrient media:

Nutrient broth: *Lactobacilli*
(De-Man.*et.al.*1960)

MRS agar = *Pediococci*
(De-Man.*et.al.*1960)

M-153 = *Micrococci*
(MTCC, 1994)

Bacterial cultures :

IMTech - Chandigarh

M.Roseus

MTCC-1532

L. plantarum

MTCC-1407

NCL- PUNE

P. acidilactici

NCIM-2292

NCIM-2293

NDRI – KARNAL (Haryana)

L. Plantarum

L-89

Growth of different bacterial cultures at various temperatures

Bacterial cultures	Temperatures °C					
	7	13	16	25	45	50
M.roseus (MTCC-1532)	-	+	++	+++	++	-
L. plantarum (MTCC-1407)	-	+	++	+++	-	-
L. plantarum (L-89)	-	-	+	+++	+	-
P. acidilactici (NCIM-2292)	-	+	++	+++	+	±
P. acidilactici (NCIM-2293)	-	±	++	+++	+	±

+++ Very good growth, ++ Good growth, + Slight growth,
- No growth, ± Growth variable

Growth of bacterial cultures at various levels of salts

Bacterial cultures	Sodium chloride (%)				Sodium nitrite(%)			Sodium nitrate(%)		
	0	2	3	4	0	0.012	0.12	0	0.08	0.8
M.roseus (MTCC-1532)	+	++	++	++ +	++	++	+	++	+++	+
L.plantarum (MTCC1407)	+++	++	++	+	+	++	++	+	++	±
L.Plantarum (L-89)	+++	++	++	+	++	++	+	++	+	+
P.acidilactici (NCIM-2292)	++	+++	++	++	++	+++	++	++	++	+
P.acidilactici (NCIM-2293)	+++	+++	++	+	+++	+++	++	++	+++	+

+++ Very good growth, ++ Good growth, + Slight growth, - No growth, ± Growth variable

Fermentation activity of different bacterial cultures

Bacterial cultures	Sucrose		Glucose		Lactose	
	Fermentation	Co_2	Fermentation	Co_2	Fermentation	Co_2
M. roseus (MTCC-1532)	++	-	+++	-	±	-
L.plantarum (MTCC-1407)	+++	-	+++	-	+	-
L. plantarum (L-89)	+++	-	++	-	+	-
P.acidilactici (NCIM-2292)	+++	-	+++	-	++	-
P. acidilactici (NCIM-2293)	+++	-	+++	-	++	-

+++ Very good growth, ++ Good growth, + Slight growth, - No growth, ± Growth

Sugars were used at a level of 1%

Suitability of starter cultures based on performance

Starter cultures	NaCl	$NaNO_2$	$NaNO_3$	Temperature			Fermentation	Suitab
	3%	0.012%	0.08%	13ºC	16ºC	50ºC	Sucrose	
M. roseus MTCC1532	+++	++	+++	+	++	-	++	**Yes**
L. plantarum MTCC1407	++	++	++	+	++	-	+++	**Yes**
L. plantarum L-89	++	++	+	-	+	-	+++	No
P.acidilactici NCIM2292	++	+++	++	+	++	±	+++	**Yes**
P.acidilactici NCIM2293	++	+++	+++	-	++	-	+++	No

+++ Very good growth, ++ Good growth, + Slight growth,
- No growth, ± Growth variable

cultures

Bacterial cultures	Sodium nitrate reduction
M.roseus (MTCC-1532)	+
L. plantarum (MTCC-1407)	-
L. plantarum (L-89)	-
P. acidilactici (NCIM-2292)	-
P. acidilactici (NCIM-2293)	-

+ Reduced - Not reduced

Formulation of Dry Sausages

Ingredients	Per cent
Pork	50.0
Back fat	10.0
Lean buffalo meat	40.0
Salt (Sodium chloride)	3.0
Sugar (Sucrose)	1.0
Sodium nitrite	0.012
Sodium nitrate	0.08
Black pepper	0.23
Garlic	0.10
Red pepper	0.20
Nutmeg	0.05
Ascorbic acid	0.02

FERMENTATION OF SAUSAGES AT 16 ±10°C (RH, 85-90%) in B.O.D



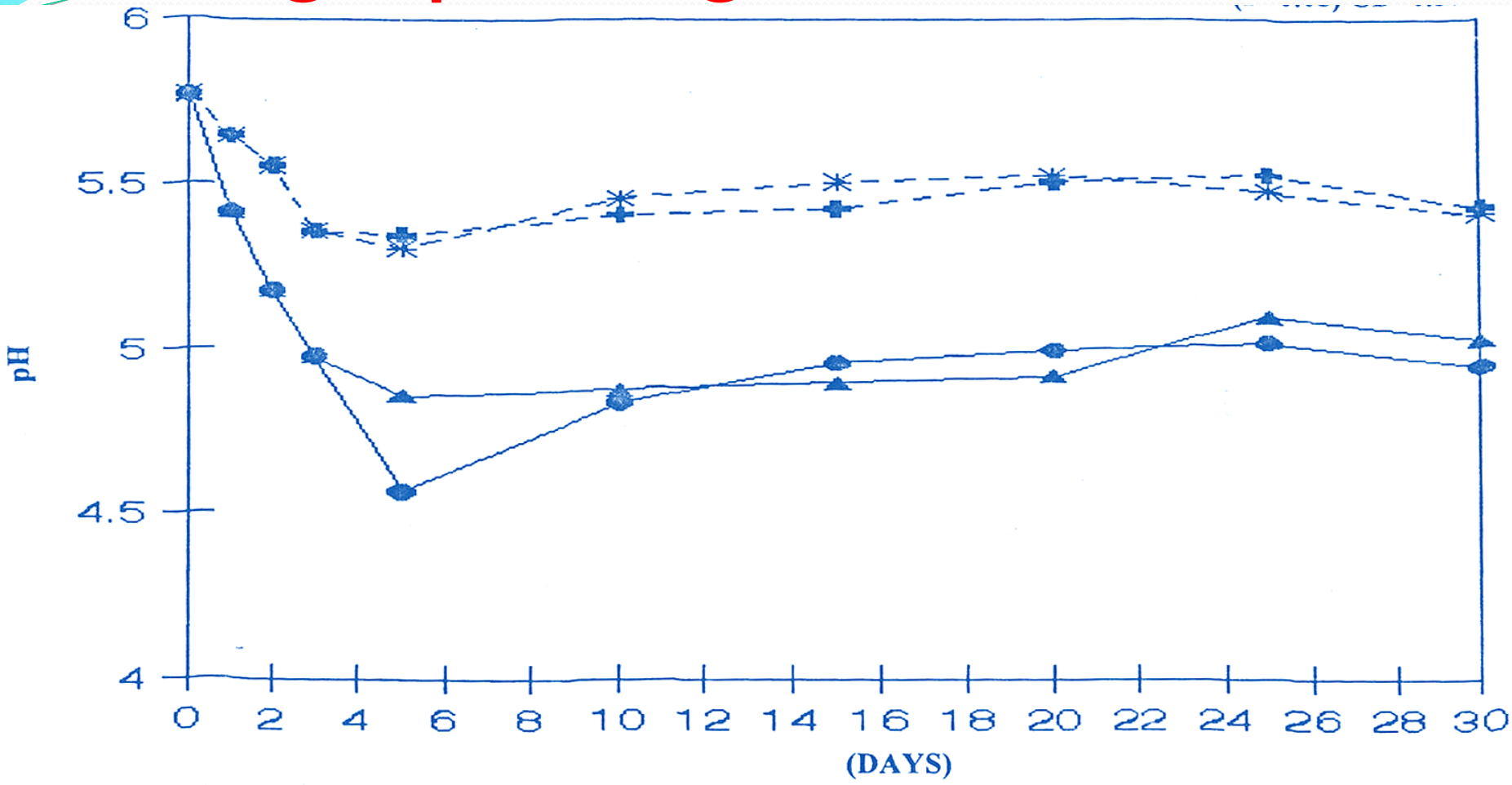
SMOKING OF SAUSAGES AT CONTOLLED TEMPERATURE AND HUMIDITY



SAUSAGE VARIANTS



during ripening



Selection of bacterial starter cultures: Criteria

- Should have salt tolerance to an extent of 2.5-3.5% and should be able to grow in the presence of 0.012% sodium nitrite and 0.08% sodium nitrate, and at 13ºC with a range of 10-16ºC.

- It should be homo-fermentative, producing only lactic acid from dextrose

- Should be inactivated at 50ºC (Diebel, 2014).

Conclusions:

L. plantarum (MTCC-1407) and *P. acidilactici* (NCIM-2292) fulfilled almost all requirements except for nitrate reduction test. *M. roseus* (MTCC-1532) fulfilled all requirements except for pH. where as the dry sausages to be manufactured are low pH products in the range of 4.9 to 5.2 but the bacteria from micro cocaceae were not active in this range of pH.

Keeping the finding in view, *M. roseus* (MTCC-1532) *L. plantarum* (MTCC-1407) and *P. acidilactici* (NCIM-2292) are most suited for use as starter culture.

It was concluded that *M. roseus* (MTCC-1532), *L. plantarum* (MTCC-1407) and *P. acidilactici* (NCIM-2292) can be used in combination as starter cultures for production of dry fermented sausages.

CONTACT INFORMATION
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