BIODEGRADATION AND BIOPRESERVATION OF ANIMAL SKIN

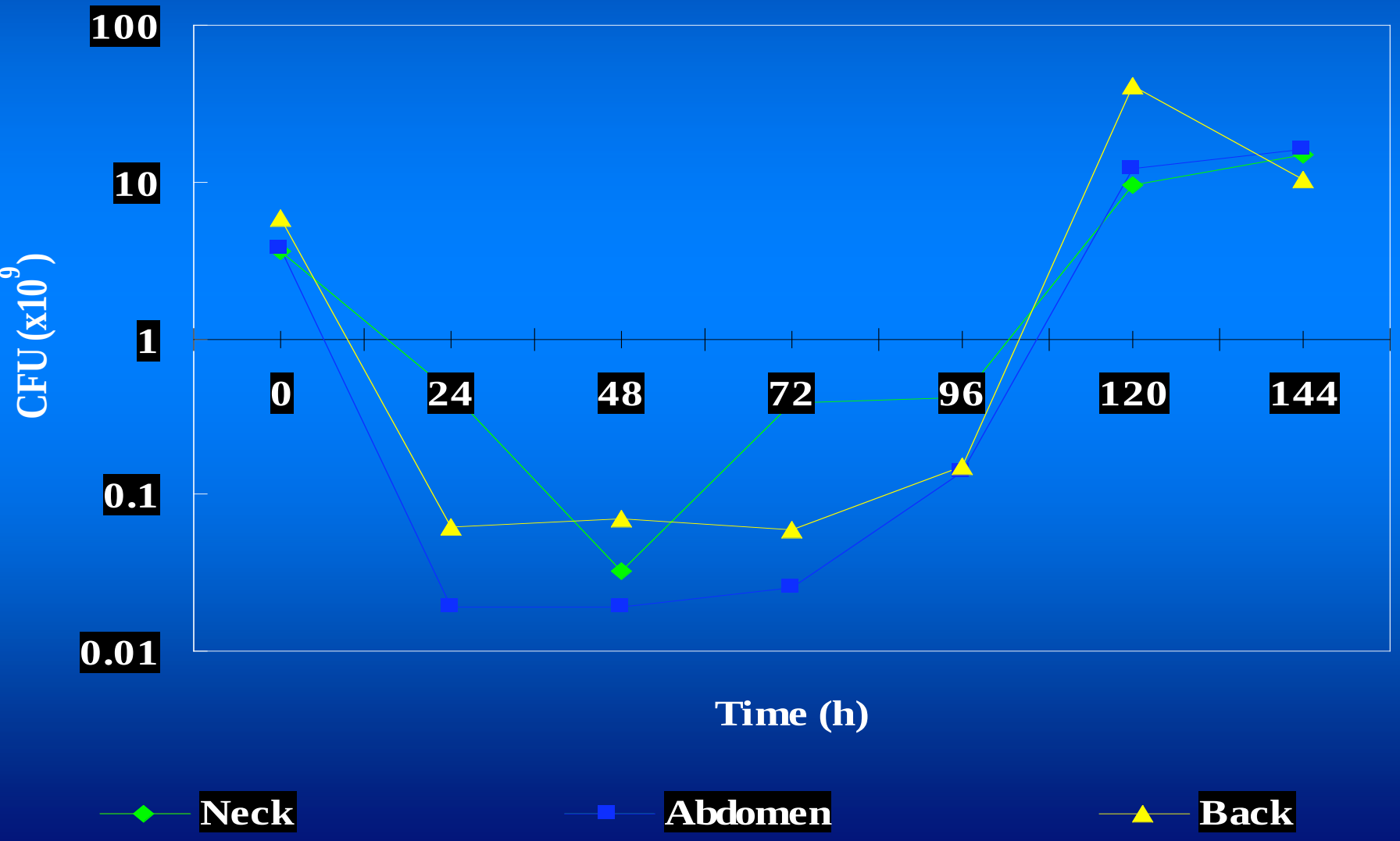
PROF. P. GUNASEKARAN

SCHOOL OF BIOLOGICAL SCIENCES
MADURAI KAMARAJ UNIVERSITY
MADURAI – 625 021

BIODEGRADATION AND BIOPRESERVATION

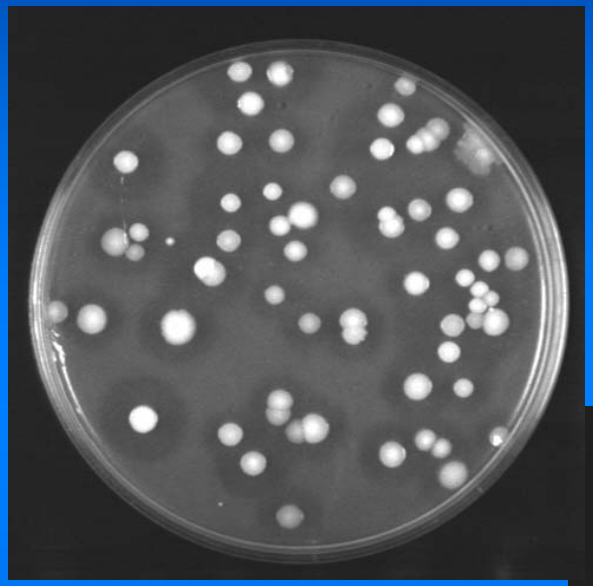
- Microorganisms associated with the animal skin.
- Characterization and cataloguing of the microbial strains associated with the skin.
- Bio-degradation of the skin and microbial succession associated with it.
- Biopreservation of skin.

Bacterial population dynamics during deterioration of goat skin

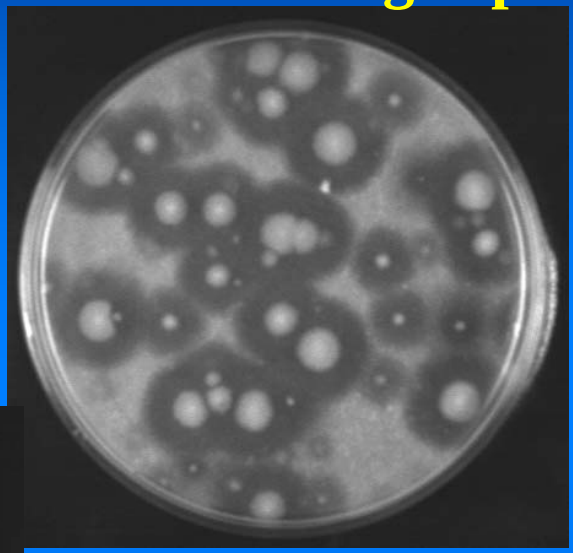


SCREENING OF SKIN MICROFLORA

Tributyrin agar plate



Skimmed milk agar plate



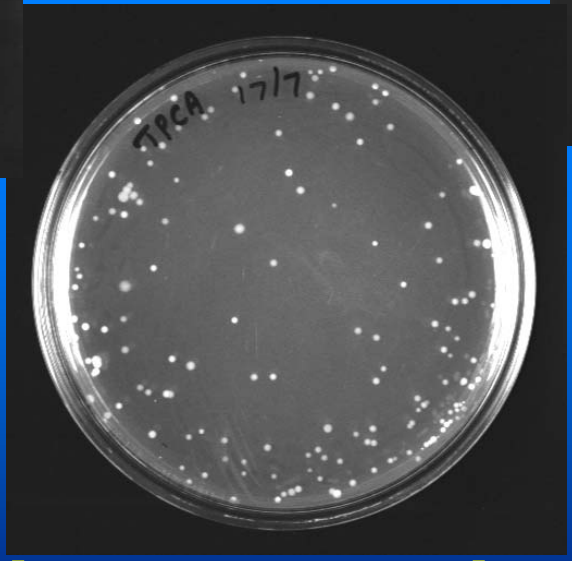
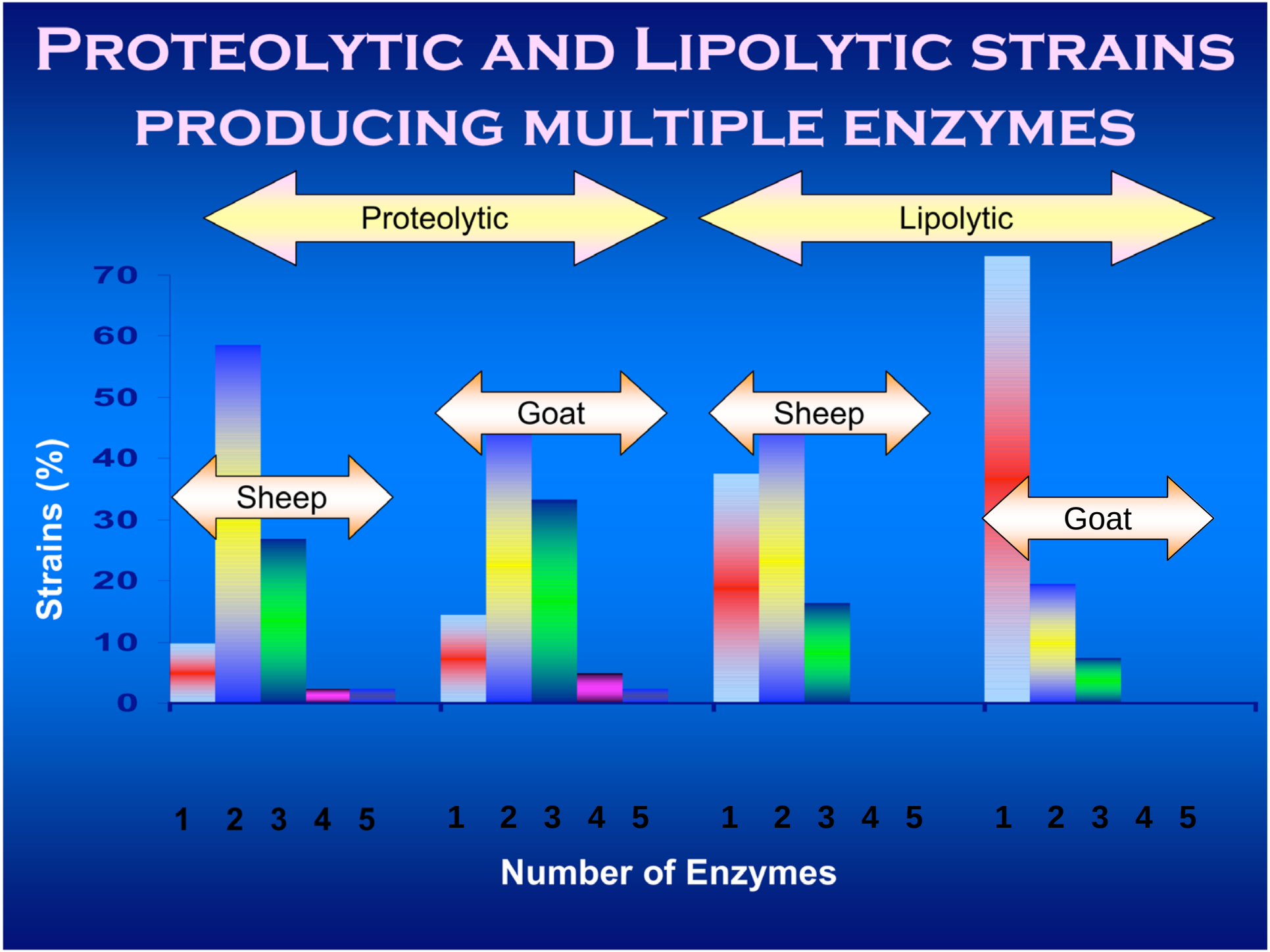


Plate count agar plate

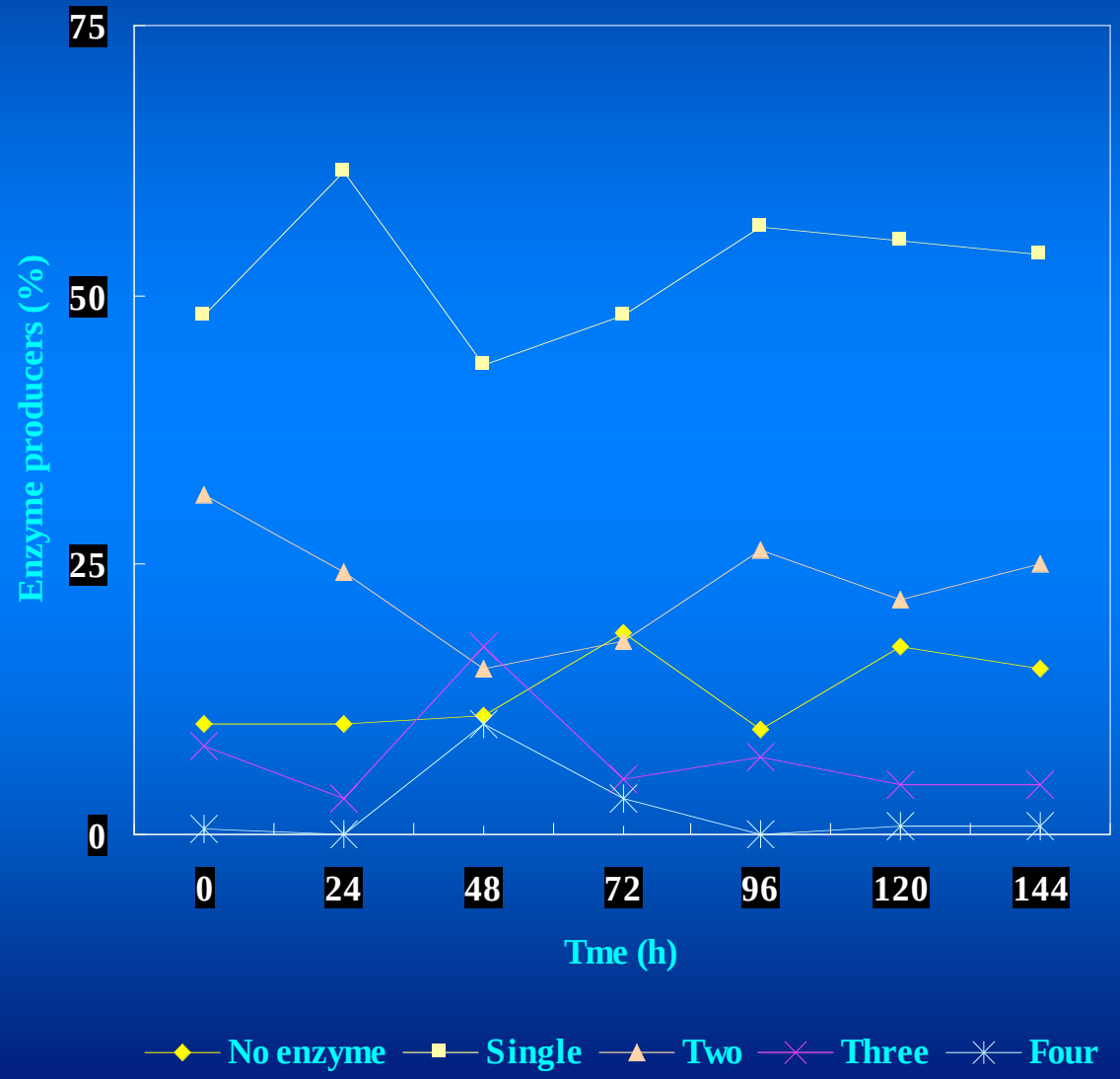
Abundance of hydrolytic enzymes producing strains in Sheep- and Goat-skins

No. of Hydrolytic Enzymes	No. of strains from Sheep skin	Goat skin
Single	118 (43.2%)	25 (31.3%)
Two	66 (24.2%)	28 (35%)
Three	27 (9.9%)	22 (27.5%)
Four	12 (4.4%)	3 (3.8%)
Five	2 (0.7%)	2 (2.5%)

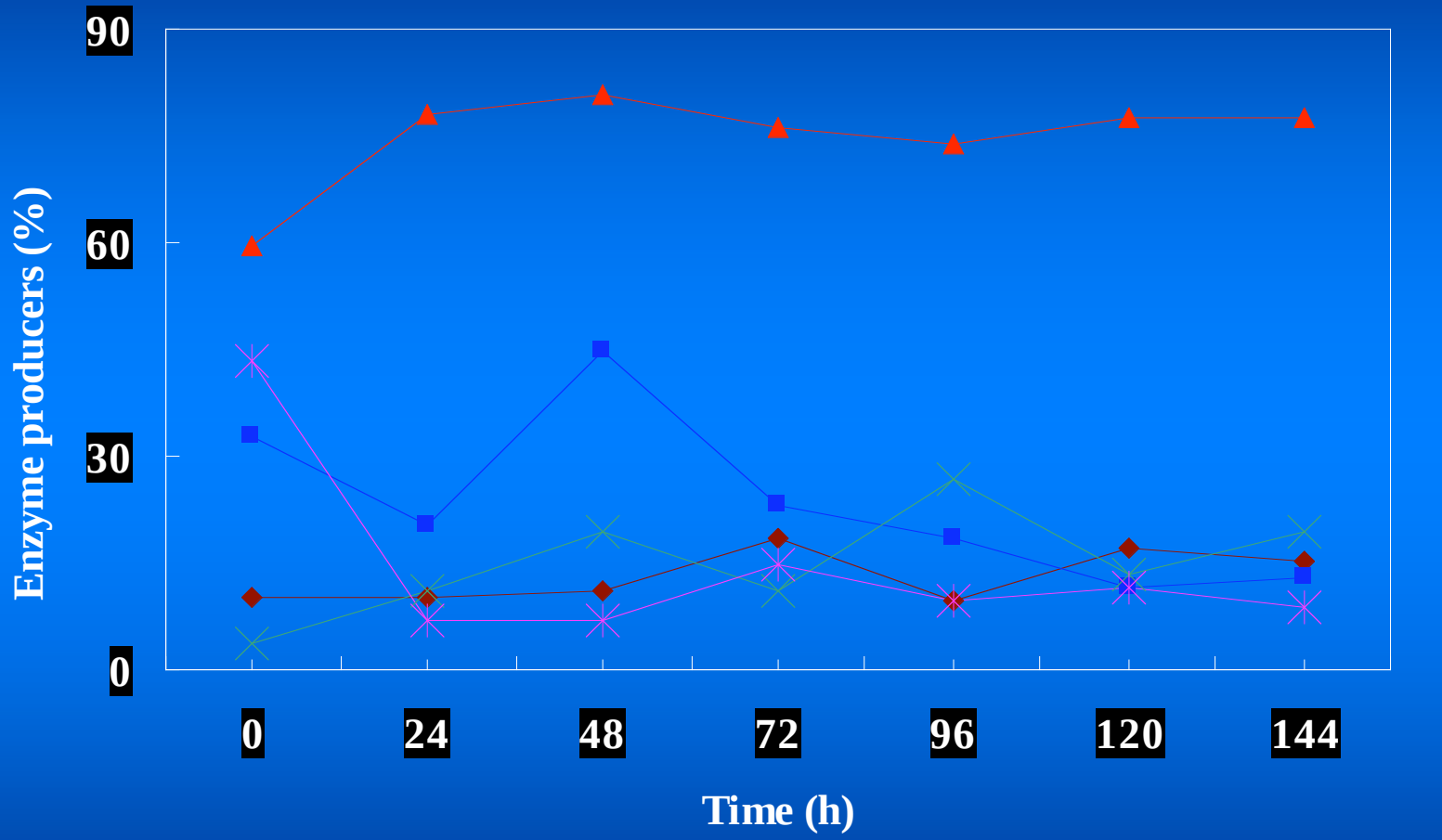
Proteolytic and Lipolytic strains producing multiple enzymes



Single and multiple hydrolytic enzyme producing bacteria during deterioration of goat skin



Hydrolytic enzyme producing bacterial population associated with Goat skin



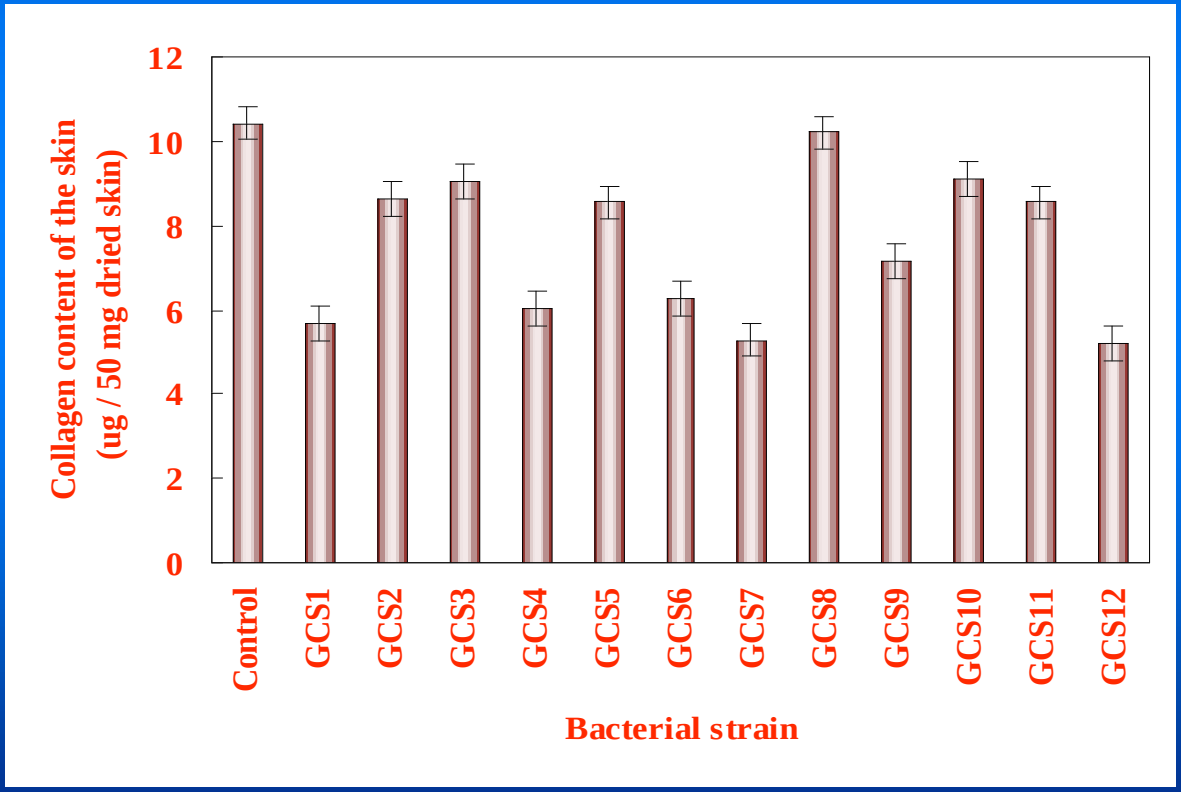
Bacterial strains producing two hydrolases

Lipase + Protease	*B. cereus, Lactobacillus sp., Pseudomonas* sp., *Neisseria sp.*
Lipase+amylase	*Lactobacillus sp, B. cereus, S.aureus, Micrococcus sp* and *Pseudomonas sp.*
Protease +amylase	*Pseudomonas* sp. *Lactobacillus* sp. and *Bacillus* sp.
Lipase or Protease +Hemolysin	*Proteus* sp.

Bacterial strains producing single hydrolase

Lipase	*Micrococcus luteus*, *Bacillus cereus*, *Staphylococcus epidermidis*, *S. aureus*, *Proteus mirabilis* *Lactobacillus acidophilus*
Protease	*B. cereus*, *Micrococcus luteus* and *Lactobacillus casei*.
Amylase	*Lactobacillus sp.*, *Pseudomonas* sp.and *S. epidermidis*
Hemolysin	*Proteus mirabilis*

Collagen content of goatskin incubated with different bacterial isolates



Selection of bacterial strains for bioassay of goatskin preservation

Strain No	Hydrolytic Activity	Name of the strain
GCS 1	Protease and Lipase	*Staphylococcus aureus*
GCS 2	Protease and Lipase	*Bacillus cereus*
GCS 3	Protease and Lipase	*Bacillus cereus*
GCS 4	Protease	*Staphylococcus epidermidis*
GCS 5	Protease	*Staphylococcus epidermidis*
GCS 6	Protease and Lipase	*Bacillus subtilis*
GCS 7	Protease and Lipase	*Micrococcus luteus*
GCS 8	Lipase	*Bacillus subtilis*
GCS 9	Protease and Lipase	*Streptococcus mitis*
GCS 10	Protease and Lipase	*Bacillus cereus*
GCS 11	Protease and Lipase	*Bacillus cereus*
GCS 12	Protease and Lipase	*Lactobacillus acidophilus*

Texture of goat skin incubated with proteolytic bacteria

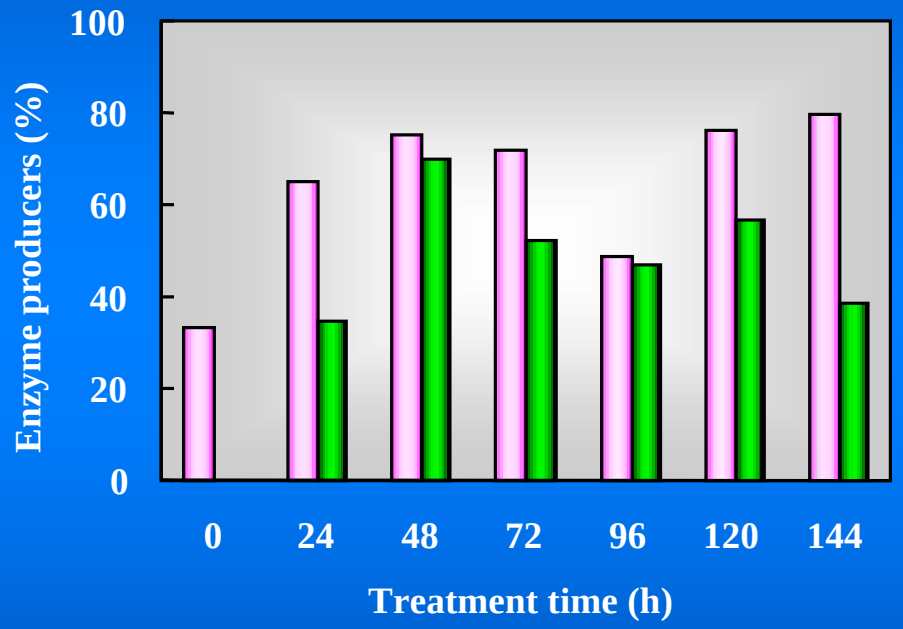
Control *Staphylococcus aureus* *S. epidermidis* *Bacillus subtilis*

Proteolytic strains have important role in spoilage of goatskin

Lipolytic and proteolytic bacterial population on the neem treated skin samples

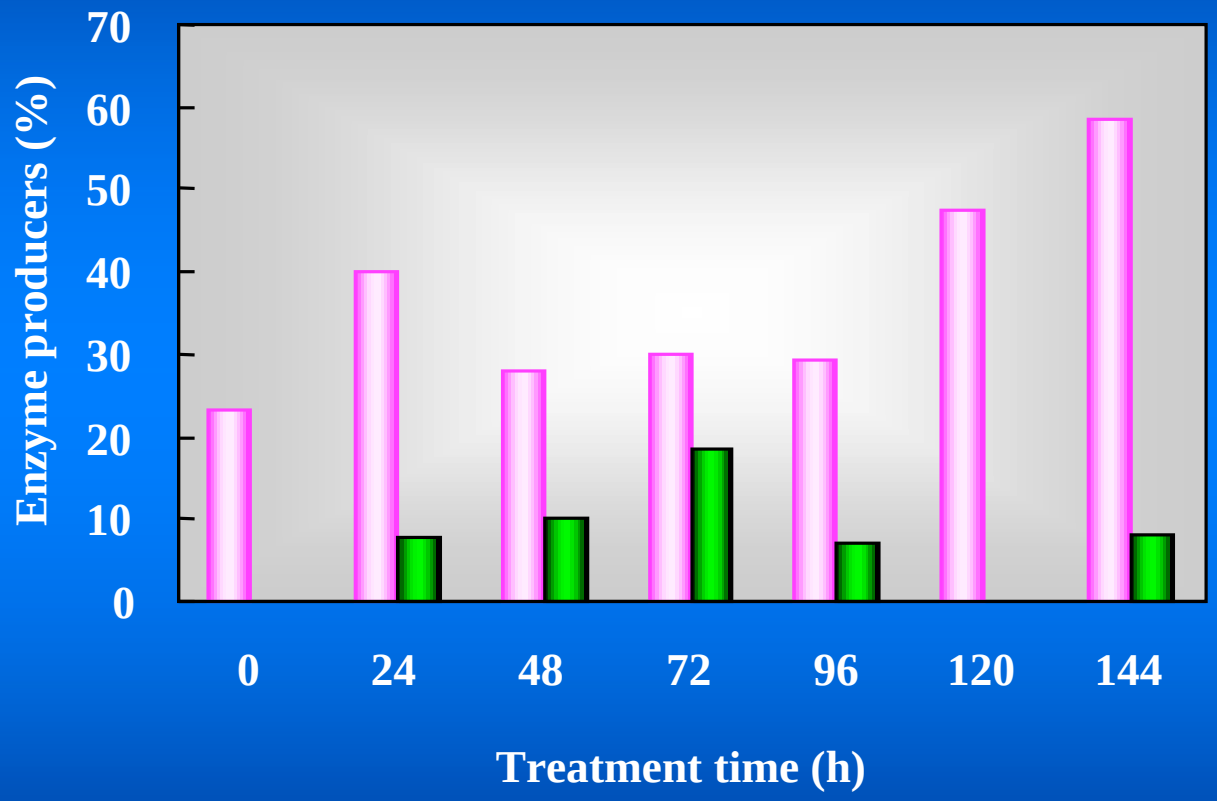
Time(h)				Neem treated (%)		
	Lipolytic	Proteolytic	L+P	Lipolytic	Proteolytic	L+P
0	33.3	23.3	10.0	-	-	-
24	65.0	40.0	17.5	34.6	7.7	1.0
48	75.0	27.8	27.8	70.0	10.0	2.9
72	71.7	30.0	15.0	47.1	18.5	4.6
96	48.8	29.4	36.2	52.3	7.0	4.7
120	76.2	47.6	43.0	56.7	-	-
144	79.3	58.6	55.2	38.8	8.2	-

Lipolytic population on neem leaf treated goatskin



Lane 1: Untreated goatskin
Lane 2: Neem treated goatskin

Proteolytic population on neem leaf treated goatskin



Lane 1: Untreated goatskin
Lane 2: Neem treated goatskin

THANK YOU

Antagonistic effect of selected bacterial isolates

Strain No.	Skin putrefying bacterial strains											
	GCS1	GCS 2	GCS 3	GCS 4	GCS 5	GCS 6	GCS 7	GCS 8	GCS 9	GCS 10	GCS 11	GCS 12
AnBa 1	+	-	+	-	-	+	-	-	-	+	+	+
AnBa 2	+	+	+	-	-	+	-	-	-	+	+	+
AnBa 3	-	+	+	+	+	+	+	-	-	+	+	+
AnBa 4	+	+	+	-	+	+	-	-	-	-	-	-
AnBa 5	+	+	+	+	-	+	-	-	-	+	+	+
AnBa 6	+	+	+	+	+	+	-	-	-	+	+	+
AnBa 7	+	+	+	+	+	+	-	+	+	+	-	-
AnBa 8	+	+	+	+	-	+	-	-	-	+	-	+
AnBa 9	+	+	+	+	+	+	+	+	+	+	+	+
AnBa 10	-	-	+	+	+	+	-	-	-	-	+	-

Effect of various additives in spray drying

Additives (15%)	Recovery (g)	Activity (AU ml-1)
Sucrose	-	-
Lactose	34	9000
Gum Arabic	62	10,000
Skimmed Milk Powder	75	9,000
Nestle Milk powder	-	-
Maltodextrin	69.86	9,000

Note: Volume of the culture supernatant spray dried was 500 ml

- Several gram positive bacterial species were found present in abundance on the goat and sheep skin. Majority of them produced number of hydrolytic enzymes such as lipase, protease etc
- All of them were identified based on their biochemical characteristics and 16S rDNA sequence analysis.
- Twelve bacterial strains involved in animal skin deterioration were confirmed
- Ten bacterial strains that showed antagonistic effect against at least 5 skin putrefying bacteria were isolated and identified