HYGIENIC PROCESSING TECHNIQUE FOR QUALITY PIG CASING MANUFACTURE

By

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DISSERTATION

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DECLARATION

I hereby declare that this dissertation entitled "**HYGIENIC PROCESSING TECHNIQUE FOR QUALITY PIG CASING MANUFACTURE**" is a bonafide record of research work done by me during the course of research and that the dissertation has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title of any other University or Society.

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Dedicated to

my family

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Introduction

INTRODUCTION

Production and consumption of meat and meat products are low in India when compared to other countries. The global meat production is estimated as 130 million tonnes, whereas India's contribution is only 1 per cent of this quantity. The production of pigs in Kerala as per 1987 census is 1,37,090.

Recently an increase in the consumption of fresh meat and meat products is noticed in Kerala. Among the meat products, sausages rank first in its production and consumption mainly of pork.

Casings are generally manufactured from the gastrointestinal tracts of sheep, goat, cattle and pigs. Different parts of gastrointestinal tracts are used in the manufacture of different types of casings. In India sausage casings are generally manufactured from the small intestine of sheep, goat and cattle. Now a days the small intestine of sheep and goat are mainly used for the manufacture of surgical catgut because of better profit. This leads to acute scarcity of sheep and goat casings for the manufacture of sausage casings, while the gastrointestinal tract of pigs are disposed off as waste. The complete gastrointestinal tract of pigs can be salvaged into valuable sausage casings. This can not only enhance the economic viability of pork industry but also abate the environmental pollution.

Even now the sausage casings are prepared by the conventional fermentation technique. In the case of pig intestine it will take 1 or 2 days for the manufacture of casings. The fermentation technique is laborious and time consuming. The gut processing time is highly related to the weather conditions. Consequent to these problems, pig intestines get spoiled due to overfermentation or some times underfermentation. Higher the time for processing lower the quality of the casings.

Therefore, the study has been undertaken to:

i) replace the conventional fermentation technique of processing of pig intestines with suitable chemical treatment

ii) to evolve a suitable technique for the hygienic production, storage and quality assessment of pig casing and also

iii) to study the economic feasibility of scientific production and storage of pig casings.

Review of literature

REVIEW OF LITERATURE

For centuries animal casings have been traditionally used as containers for sausage materials. The material from the domestic animals gastrointestinal tract that is used for the casings is the collagen layer in the submucosa. The treatment of collagen during the various steps in casing processing has a definite effect on the utility for the final product.

1. Preparation of pig casing (Rounds)

The gastrointestinal tract of domestic animals have been used as casings. As different countries have preferences for different types of sausages, different types of casings are also required. Similarly, different sizes of casings are required for different varieties of sausages. Narrow and very thin casings that are obtained from sheep, goat and pig intestines are used for the preparation of cocktail sausages or hot dogs. Pig stomach is generally used for blood sausages (Mann, 1962 and Mahendrakumar, 1981).

Preferences for a particular type of casing varies widely from country to country and the same part of gastrointestinal tract may also be used in different ways in different countries (Ockerman and Hansen, 1988).

2. Fermentation technique

Mann (1962) discussed in detail the traditional method of casing manufacture from pig intestine by fermentation technique in developing countries. Ockerman and Hansen (1988) reported that fermentation was a primitive technique for the manufacture of casings and was not permitted under current federal inspection procedures.

The different parts of the intestines should be separated and individually treated to have different casings. The pig gastrointestinal tract being very fragile and thin should be hand pulled. Careless manual stripping would cause cuts and holes, thus making the casing unsuitable for sausage manufacture. Similarly, flushing of pig intestine with water running direct into it is not practiced they being very long and narrow (Mann, 1962). Kondaiah *et al.* (1979) also suggested the pulling of intestine by hand starting from the wider end towards narrower end. Mahendrakumar (1981) recommended careful handling while pulling of hog intestine because of the large amount of mesenteric fat.

3. Chemical sliming

Kondaiah *et al.* (1979) reported that the traditional process of fermentation of intestine could be replaced by chemical processing of fresh intestine. He also recommended the use of sliming solution of 0.2 per cent sodium pyrophosphate and 1 per cent sodium chloride. Madhwaraj *et al.*

(1980) observed that the collection of intestine soon after evisceration and stripping in 0.1 N sodium hydroxide solution not only helped in the complete removal of slime but also prevented weakening of casing due to bacterial proliferation.

In a study on the desliming efficiency of various deslimers on sheep and goat intestines, Sahu (1991) observed that the efficiency of 0.1 per cent peracetic acid was the highest followed by 0.5 per cent hydrogen peroxide, 1 per cent sodium bicarbonate and 1 per cent sodium chloride.

4. Storage

The slimed and washed casings are to be dry salted with 40 per cent w/w of clean, fresh common salt of medium fineness (Kondaiah *et al.*, 1979 and Ockerman and Hansen, 1988).

5. Quality parameters of pig rounds

Mann (1962) suggested that the casing should be inspected for cleanliness, odour, holes, parasitic nodules, blood spots, ulcers, fat particles, stains and such other defects which prevent the casing from being used as an unperforated container or making it objectionable to the consumer. Though pig casing could be prepared in one or two days, the quality of the casing deteriorated as a result of uncontrolled fermentation and prolonged time of fermentation. He also suggested that in tropical countries, the use of a little common salt in the water for soaking the intestine would control fermentation.

Baliga and Chatterjee (1972) pointed out the following deficiencies in casing manufacture by fermentation method, viz., incomplete sliming, dull colour, inadequate salting, improper sanitation and non-uniformity of calibration.

The value and quality of animal casing depend on the age of the animal, breed, feed consumed and other management practices (Ockerman and Hansen, 1988). They have described in detail the various parameters to be considered in evaluating the sausage casing such as cleanliness, strength, length, calibre, curing and packing.

Indian Standard Institute (1962) specified the method of testing the strength of the casings by filling it with air or water to its normal capacity and by gently pressing. Similarly, the hog casings are calibrated by measuring the diameter using a suitable calibration frame and specified that the calibre should be between 26-36 mm. Although, Mann (1962) graded hog casings on the basis of the length, the International Natural Sausage Casing Association (INSCA), USA published grades based on the approximate diameter.

Ockerman and Hansen (1988)suggested that small calibre hog casings are substitutable for large size sheep casing although the principal demand for hog casing is 35 mm and over.

Rust (1986) reported that the excess curing of casings on preservation lead to reduced tenderness. However, small diameter hog casings were used for some type of fresh sausages with slightly reduced casing tenderness compared to the sheep casings.

Radhakrishnan *et al.* (1987) observed that the treatment of hog casings with 2 per cent sodium carbonate solution for 24 hours had a very good effect on the feel, appearance and strength of the casing.

6. Bacteriological quality and shelf-life

Richardson *et al.* (1968) reported that the salt content, storage time, temperature and pH of the sausage casings were the factors often adjusted to reduce the load of salmonella. Gabis and Silliker (1974) observed the virtual elimination of salmonella in naturally contaminated hog casings after 21 days of storage in crystalline sodium chloride. Kondaiah *et al.* (1979) observed a very low microbial count in pig casings even after the preservation and storage for 120 days in 40 per cent salt. They also reported that the overall acceptability and tenderness of chicken sausage prepared in hog casings deslimed with chemicals were same as that of casings prepared by the fermentation technique.

Materials and methods

MATERIALS AND METHODS

Fresh gastrointestinal tracts from healthy Large White Yorkshire pigs slaughtered in the Department of Livestock Products Technology (Meat Technology Unit) were harvested in order to evolve a hygienic and efficient processing technique for pig casing manufacture. All the pigs were of eight to nine months of age and maintained on the same nutritional status.

Processing of Pig Small Intestine

1. Pulling

The fresh gastrointestinal tracts harvested immediately after evisceration were placed on a stainless steel table and inspected for holes and cuts. The mesenteric fat was removed manually without puncturing the gastrointestinal tract and further contamination. Other adhering viscera, if any, were also removed.

After pulling, the total length of the gastrointestinal tract and the length of the small intestine were measured. The yield of the small intestine was calculated and expressed as percentage of the total length of the gastrointestinal tract.

The small intestine was ligated at the duodenal and caecal ends and separated from the rest of the gastrointestinal tract without spilling the contents.

2. Stripping

The ligature applied at both the ends of the small intestine were removed and the intestinal contents were stripped out manually with a plastic stick starting from the wider end towards the narrower end.

After the complete evacuation of the intestinal contents, the intestines were thoroughly flushed with clean running water. Any remnant fat adhering to the intestine was also carefully removed.

The clean fresh intestines thus harvested were cut into portions of 2 m length and subjected to different methods of sliming.

3. Sliming

i) Fermentation technique

A pair of 2 m portions of small intestine were fully soaked in plastic trays containing sufficient water with a little common salt. The trays with the intestine were kept for fermentation at an ambient temperature of 26° C. These intestines were slimed by manual scraping using the edge of a smoothened and blunt blade of an acrylic sheet after 12, 24 and 30 hours. The easiness of sliming and the quality of the pig rounds were studied.

ii) Chemical sliming

Aqueous solutions of calcium hydroxide, sodium carbonate, sodium bicarbonate and sodium hydroxide, each in two different concentrations, were used as sliming solutions for the pig small intestine. The chemicals used were of Laboratory Reagent grade. The different concentrations were:

Calcium hydroxide 0.5 per cent and 1.5 per cent,

Sodium carbonate 1 per cent and 2 per cent,

Sodium bicarbonate 2 per cent and 3 per cent and

sodium hydroxide 0.5 per cent and 1 per cent

Portions of intestine, in duplicate, were soaked in each sliming solution for different periods of time at ambient temperature. The intestines were scraped till all the layers other than the submucosa are completely removed. The optimum period of soaking required for the easy and satisfactory sliming in each sliming solution was noted.

4. Salting

All the portions of intestine scraped (shorts) were washed thoroughly with water. After squeezing the excess water in the casings, they were preserved by dry salting in 40 per cent w/w fine graded common salt in plastic trays with holes and stored at room temperature.

The experiment was repeated ten times and the data analysed statistically (Snedecor and Cochran, 1968).

5. Evaluation of The Qualities of Pig Rounds

i) Inspection

The washed and cleaned pig rounds were inspected for holes after filling with water. The presence of any defects such as discoloration, foul odour, fat particles, parasitic nodules and ulcers were also noted.

ii) Calibre

The calibre of the pig rounds in terms of the diameter was measured using vernier calipers. The mean of three different readings were recorded and expressed in millimetres. The rounds were graded as per the INSCA (undated) standards.

iii) Strength

The strength of the casings was tested by pressing after filling with water. Similarly, the strength of the rounds to withstand the pressure exerted during filling, stuffing and cooking were also noted.

iv) Bacteriological quality and shelf life

Aerobic plate count (APC) of the mesophilic bacteria in the pig rounds prepared by the various methods was determined on zero, 7th, 15th and 30th day of storage using AOAC (1990) standard methods. The APC is expressed as the colony forming units/g of the casing.

6. Organoleptic evaluation

On the 7th day of storage of the salted pig rounds, three shorts were chosen at random from each treatment and used for stuffing fresh pork sausage mix. All the casings were thoroughly flushed with water prior to stuffing.

A few links of the fresh pork sausage were cooked in boiling water for 10 minutes. The water is drained off from the cooked sausage and low fat fried in vegetable oil. The fried sausage was subjected to organoleptic evaluation by a trained taste panel using a score card to study the following characteristics of the casing:

i) appearance of the cooked sausage

ii) case hardening

iii) chewability of the casing and

iv) overall acceptability (Appendix I)

7. Economic feasibility of production

The economic feasibility of the hygienic production of quality pig rounds were calculated on the basis of the net returns from the total number of hanks processed in a day of 8 hr.

Results

RESULTS

Small intestines harvested from healthy Large White Yorkshire pigs of eight to nine months of age having body weight ranging from 70-90 kg were used for the hygienic production and storage of pig rounds. The efficiency of sliming by the traditional fermentation technique and by chemicals and the quality of the pig rounds thus prepared were studied.

1 PROCESSING OF PIG SMALL INTESTINE

i) Fermentation technique

The efficiency of sliming of the pig small intestine by the traditional fermentation technique was determined. The removal of the mucus and other unwanted layers of the intestine was much easier and satisfactory after 30 hr of fermentation compared to 12 or 24 hr. There were no signs of putrifaction of the intestine till 30 hr.

ii) Chemical sliming

The different concentrations of the sliming chemicals and the mean period of soaking of pig small intestine are presented in Table 1.

The efficiency of the sliming solutions was determined on the basis of the period of soaking of the small intestine sufficient enough for the quicker, easier and satisfactory removal of the mucus and other unwanted layers.

Table 1 Concentration of the Sliming Solutions and the Mean Period of Soaking of Pig Small Intestine

Sliming solutions	Concentration (%)	Mean period of soaking (min)
Calcium hydroxide	0.5	60 ± 0.6^{a} *
	1.5	5 ± 0.47^{b}
Sodium carbonate	1	240 ± 22.38^{c}
	2	180 ± 10.96^{d}
Sodium bicarbonate	2	90 ± 3.58^{a}
	3	60 ± 1.97^{a}
Sodium hydroxide	0.5	360 ± 15.65^{e}
	1	240 ± 10^{c}

*Standard Error
Means with the same superscripts are not significantly different ($P < 0.01$)

The intestines could be slimed satisfactorily without any defects after 5 minutes of soaking in 1.5% calcium hydroxide solution. This was significantly quicker than all the other treatments. The period of soaking in both the concentrations of sodium bicarbonate and 0.5% calcium hydroxide solutions ranged from 60-90 minutes, which were not significantly different. The period of soaking in both 0.5% and 1% sodium hydroxide and 1% sodium carbonate solutions were significantly more than in the other solutions for satisfactory sliming (240 min).

2 EVALUATION OF THE QUALITIES OF PIG ROUNDS

i) Cleanliness and appearance

On inspection of the pig rounds on the day of processing, they were found to be free of parasitic nodules, ulcers, holes, cuts and other defects. They were clean, almost transparent and white. The rounds processed by fermentation technique and stored in 40% common salt showed discoloration on the 15th day and started putrifaction on the 30th day.

The rounds processed using calcium hydroxide and sodium carbonate showed deterioration evidenced by pink colouration on the 30th day of storage, but without putrifaction.

ii) Yield and calibre

The mean length of the gastrointestinal tract, small intestine, yield and calibre of pig rounds are presented in the Table 2.

Table 2 Mean Length of the Gastrointestinal Tract, Small Intestine, Yield and Calibre of Pig Rounds

Length of the gastrointestinal tract (m)	Length of the small intestine (m)	Yield (%)	Calibre (mm)
22.99±0.77*	17.90±0.72*	77.60±0.75*	29±0.59*

* Standard error

Table 3 Aerobic Mesophilic Bacterial Count in Pig Rounds on Storage (CFU/g)

Treatments	Period of storage (days)			
	0	7	15	30
Fermentation	40 x 20^3	30 x 10^3	12.3 x 10^3	10 x 10^3
Calcium hydroxide	14.2 x 10^3	7.6 x 10^3	3.5 x 10^3	1.8 x 10^3
Sodium carbonate	12 x 10^3	7.9x 10^3	8 x 10^3	4 x 10^3
Sodium bicarbonate	10.5 x 10^3	7.8 x 10^3	4 x 10^3	2.8 x 10^3
Sodium hydroxide	20 x 10^3	7 x 10^3	6 x 10^3	6 x 10^3

The total length of the gastrointestinal tract of pigs of 8-9 months of age ranged from 18-29 m with a mean length of 22.99 m. The average length of the small intestine was recorded as 17.9 m with an yield of 77.6%.

The diameter of the pig rounds ranged from 25-33 mm with a mean of 29 mm. All the pig rounds under study were of the grade `Narrow'.

iii) Strength

The rounds processed by the various methods withstood the pressure applied after filling with water and also on stuffing with fresh pork sausage mix. A few links of the fresh pork sausage stuffed in the casing processed using calcium hydroxide ruptured during frying. In all other cases the rounds were intact without any deformity after cooking or frying.

iv) Bacteriological quality and shelf-life

The aerobic plate count of the mesophilic bacteria in pig rounds on storage for zero, 7, 15 and 30 days is presented in Table 3.

The mesophilic bacterial load in the rounds prepared by the traditional fermentation technique was significantly higher on zero, 7th, 15th and 30th day than that of all other treatments. Although the load of the bacteria significantly declined gradually from the day of preparation to the 30th day of storage at ambient temperature in 40% salt, the rounds started putrifaction on 30th day.

The bacterial load in the pig rounds processed using chemical deslimers showed a significant gradual decrease from the zero day to 30th day.

The shelf life of the rounds prepared by the fermentation technique was for 15 days in 40% common salt as they showed discolouration. But those processed using chemical deslimers could be stored for more than 30 days.

v) Organoleptic evaluation

The score card for the organoleptic evaluation of the pig rounds is illustrated in Table 4.

It was observed that the rounds processed using sodium bicarbonate and sodium hydroxide were the most acceptable and ranked `Good'. The fresh pork sausage prepared using these rounds maintained their shape and was easily chewable. These rounds were the most tender and smooth in texture and those of clacium hydroxide were the toughest and least acceptable.

The overall acceptability score of the rounds prepared by the fermentation technique was almost the same as that of the other rounds and not significantly different. In the decreasing order of the overall acceptability score, the pig rounds could be categorised into those processed using sodium bicarbonate, sodium hydroxide, sodium carbonate, fermentation technique and calcium hydroxide.

Table 4 Score Card for the Organoleptic Evaluation of Pig Rounds

Treatments	Concentration of solutions (%)	Appearance of cooked sausage	Case hardening	Residual nature or ease of penetration	Overall acceptability	Total score
Fermentation	-	1.3±0.34*	1.67±0.34	2.33±0.34	1.67±0.34	6.97
Calcium hydroxide	0.5	2.00	2.00	2.67	2.3	8.97
	1.5	2.00	2.00	2.67	2.3	8.97
Sodium carbonate	1	1.00	1.3±0.34	1.67	1.3	5.27
	2	1.00	1.3±0.34	1.67	1.3	5.27
Sodium bicarbonate	2	1.00	1.3±0.34	1.33	1.00	4.63
	3	1.00	1.3±0.34	1.00	1.30	4.60
Sodium hydroxide	0.5	1.00	1.3±0.34	1.33	1.30	4.93
	1	1.00	1.3±0.34	1.33	1.30	4.93

* Standard error
Total score from 4-7 Good; 8-11 Satisfactory; 12 Bad

3. ECONOMIC FEASIBILITY OF PRODUCTION

Output

The number of pig small intestines of an average length of 17.9 m that could be processed in a day of 8 hr.	:	48
ie., number of hanks of pig rounds (1 hank = 91.4 m)	:	9.4
The cost of 9.4 hanks of pig rounds of 29 mm diameter @ Rs.150/-	:	**Rs.1410/-**

Input for processing and storage

Cost of 48 pig small intestine @ Rs.5/-	:	Rs. 240.00
Common salt	:	Rs. 5.00
Water charge	:	Rs. 5.00
Chemicals @ Re.1/- per small intestine	:	Rs. 48.00
Skilled labour	:	Rs. 100.00

Total input	:	**Rs. 398.00**

Net returns = Rs.1012.00

Discussion

DISCUSSION

With a view to evolving a suitable technique for the hygienic production and storage of pig rounds, fresh small intestines from healthy Large White Yorkshire pigs slaughtered were used. The pigs were eight to nine months old and of the body weight 70-90 kgs.

The efficiency of sliming by the traditional fermentation method and by different concentrations of alkaline chemicals such as calcium hydroxide, sodium carbonate, sodium bicarbonate and sodium hydroxide was determined. The various quality parameters of the pig rounds such as cleanliness, appearance, yield, calibre, strength, bacteriological quality, shelf-life and organoleptic qualities were studied. The economic feasibility of production of the rounds was also computed.

1. Processing of pig small intestine

In the fermentation technique, sliming was easier and satisfactory after 30 hr. of soaking. Even then the intestines did not putrify due to over fermentation. This could possibly be due to the inhibitory effect of sodium chloride in the soaking water as reported by Mann (1962).

When calcium hydroxide was used as sliming solution, the time required for the removal of mucus and other unwanted layers were significantly lesser

than in the other methods. It is observed that the period of soaking decreased as the pH of the alkaline chemicals decreased. Sodium bicarbonate was found to be better for sliming than sodium hydroxide and sodium carbonate as the period of soaking was significantly lesser.

2. Evaluation of the qualities of pig rounds

The pig rounds under study were inspected immediately after processing. They were found to be clean, almost transparent and white without holes, ulcers and other defects. The rounds processed by the fermentation technique and stored in 40 per cent sodium chloride at ambient temperature showed discolouration on the 15th day and signs of putrifaction on the 30th day. The total viable counts of the mesophilic bacteria in these rounds immediately after processing and on storage upto 30 days were significantly higher than those processed by chemicals. The discolouration and spoilage of the rounds were due to the increased bacterial load.

There was a gradual decline in the bacterial load on storage from the day of preparation to the 30th day, irrespective of the sliming methods. This was due to the higher salt concentration and reduced water activity which inhibited the proliferation of the mesophilic spoilage bacteria. Richardson *et al.* (1968) reported that the salt content of the sausage casing, among other factors, would reduce the load of salmonella.

The rounds processed using calcium hydroxide and sodium carbonate showed pink discolouration on the 30th day of storage. This deterioration was

possibly due to the growth of some halophilic bacteria that produce a fat soluble red pigment. These bacteria grow in very high salt concentrations at temperatures above 5°C. The same observation was reported by Rust (1986).

Although, the principal demand for hog casing was 35 mm and over as reported by Ockerman and Hansen (1988) the mean diameter of the pig rounds under study was 29 mm and were of the grade `Narrow' as they were from young pigs of eight to nine months. The economic value of the rounds depends on the calibre and grades. Ockerman and Hansen (1988) reported that the value and quality of the casing depend on the age of the animal, breed, feed consumed and other management practices.

The fresh pork sausage stuffed in the rounds processed using calcium hydroxide ruptured during frying unlike in the other cases. Calcium hydroxide would have weakened the collagen of the casing during the processing.

On organoleptic evaluation of pig rounds by a trained taste panel observed that the rounds processed using sodium bicarbonates and sodium hydroxide were the most acceptable and were ranked `good'. The texture of rounds were smooth and had a good feel. These rounds were the most tender as a result of less deleterious effect on the collagen of the rounds. On the contrary, calcium hydroxide treated pig rounds were the toughest and least acceptable due to the quicker action on the intestinal layers and drying effect on the casing. This render the casing impermeable to moisture and tough.

The overall acceptability score of the rounds prepared by the fermentation technique was not significantly different from other treatments. However, because of the increased fermentation period of 30 hr and significantly higher bacterial load, the shelf-life of the pig rounds was less than 15 days without deterioration of the quality. While the casings processed by the chemical deslimers could be stored in 40% salt for not less than 30 days at ambient temperature.

3. Economic feasibility of production of pig rounds

The hygienic processing of pig small intestine into good quality rounds using different concentration of sodium bicarbonate (2% and 3%) and sodium hydroxide (0.5% and 1%) is economically feasible, if sufficient number of small intestines are available daily for processing. A net profit of Rs.1,012/- will be obtained daily on processing of 48 pig small intestines by a skilled labourer.

Summary

SUMMARY

Fresh gastrointestinal tracts of healthy Large White Yorkshire pigs slaughtered in the Meat Technology Unit were harvested in order to evolve a suitable technique for the hygienic production and storage of pig rounds. All the pigs were 8-9 months old and of the body weight 70-90 kg were maintained on the same nutritional status.

The efficiency of sliming of the pig small intestine by the traditional fermentation technique and by different concentrations of alkaline chemicals such as calcium hydroxide, sodium carbonate, sodium bicarbonate and sodium hydroxide was studied. The period of soaking of the intestine sufficient enough for the quicker, easier and satisfactory sliming was recorded to determine the efficiency.

The various quality parameters of the pig rounds such as cleanliness, appearance, yield, calibre, strength, texture, aerobic plate count of the mesophilic bacteria, shelf-life and organoleptic qualities after stuffing with fresh pork sausage mix were investigated. The economic feasibility of production of the rounds was also computed. The experiment was repeated ten times.

The pig rounds were clean, almost transparent white and without holes, cuts or ulcers. The mean length of the round was 17.9 m and yield 77.6% of

the total length of the gastrointestinal tract. The average diameter was 29 mm and the rounds under study were of the grade 'Narrow'. All the rounds were strong on filling with water and on stuffing with sausage mix.

The sliming of the pig small intestine was easier and satisfactory after 30 hr of fermentation. Addition of a little sodium chloride in the water for soaking prevented over fermentation and putrifaction of the intestine till 30 hr. However, these rounds cured in 40% sodium chloride and stored at an ambient temperature had a shelf-life of less than 15 days only without deterioration of the qualities. It was due to the significantly higher mesophilic bacterial load than in other rounds. The overall acceptability score of these rounds was not significantly different from other treatments.

In the case of chemical sliming, calcium hydroxide was the most efficient followed by sodium bicarbonate, sodium carbonate and sodium hydroxide, at their respective concentrations under study. The period of soaking ranged from 5 min. to 360 min. in the various concentrations of the chemicals. Nevertheless, on inspection and evaluation of the various qualities it was observed that the rounds processed using sodium bicarbonate (2% and 3%) and sodium hydroxide (0.5% and 1%) were the most acceptable and ranked 'Good'. Their shelf-life was also not less than 30 days on storage in 40% sodium chloride at ambient temperature.

The commercial production of good quality pig rounds using sodium bicarbonate (2% and 3%) and sodium hydroxide (0.5% and 1%) as slimirg chemicals is economically feasible.

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Appendix

APPENDIX I

SCORE CARD FOR ORGANOLEPTIC EVALUATION

Sl. No.	Parameters considered	Characteristics of cooked sausage casing	Points given
1	Appearance of cooked sausage	Good looking	1
		Shape maintained	2
		Shape not maintained	3
2	Case hardening	Browning proper	1
		Skin formation	2
		Not so	3
3	Residues on chewing	Easily chewable	1
		Less residue left over	2
		Residue leftover	3
4	Overall acceptability	Good	1
		Satisfactory	2
		Bad	3

Total score from 4 - 7 - Good
Total score from 8 - 11 - Satisfactory
Total score above 12 - Bad

HYGIENIC PROCESSING TECHNIQUE FOR QUALITY PIG CASING MANUFACTURE

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ABSTRACT

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ABSTRACT

The fresh small intestines of Large White Yorkshire pigs slaughtered in the Meat Technology Unit were harvested in order to evolve a suitable technique for the hygienic production and storage of pig rounds and to study the economic feasibility of its production. All the pigs were 8-9 months old and of the body weight 70-90 kg and maintained on the same nutritional status.

The efficiency of sliming of the pig small intestine by the fermentation technique and by different concentrations of alkaline chemicals such as calcium hydroxide, sodium carbonate, sodium bicarbonate and sodium hydroxide was studied. The various quality parameters of the pig rounds such as cleanliness, appearance, yield, calibre, strength, texture, aerobic mesophilic counts on storage, shelf life and organoleptic qualities after stuffing with fresh pork sausage mix were evaluated. The economic feasibility of production of the rounds was also computed.

The pig rounds processed were clean, white, almost transparent and without holes or cuts. The mean length of the round was 17.9 m and the yield was 77.6%. The rounds obtained were of `Narrow' grade having 29 mm diameter. The casings were strong enough to withstand the pressure of stuffing.

Although the overall acceptability of the rounds processed by fermentation technique was `good' the shelf life of the casings on storage in 40% sodium chloride at ambient temperature was less than 15 days. Addition of a little common salt in the water for soaking prevented over fermentation and putrifaction of the intestines till 30 hr.

In order to improve the quality of the rounds by reducing the processing time and deteriorative changes, chemical sliming could be resorted to. On inspection and evaluation of the various qualities it was observed that the rounds processed using sodium bicarbonate (2% and 3%) and sodium hydroxide (0.5% and 1%) were the most acceptable and ranked `good'. Their shelf life was also not less than 30 days.

The commercial processing of pig small intestine into good quality pig rounds using sodium bicarbonate and sodium hydroxide was economically feasible.