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THE DESIGN OF A SHELF-STABLE SAUSAGE  
FOR THAILAND

A thesis presented in partial fulfilment of  
the requirements for the degree of  
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## ABSTRACT

Sai Krok Prew is the naturally fermented sausage in Thailand made from pork, fat, cooked rice, sugar and spices. This sausage has a very short shelf life of three days, and inconsistent quality. Studies were carried out to find the basis for a process to increase the shelf life without using refrigeration, and to give a consistently high quality product. Simulated commercial conditions as found in Thailand were used in the laboratory, by mixing in a bowl chopper, mechanical stuffing, storage at 30-32°C, 75% R.H. for two days (factory conditions), and then further storage at 30-32°C, 97-99% R.H. (transport and retail sale).

Lactic acid and GDL were used to produce chemically acidified Sai Krok Prew. Lactic acid gave a completely unacceptable flavour and texture; GDL gave a satisfactory texture but a harsh flavour. There might be a good possibility of producing a low quality Sai Krok Prew by using GDL.

A satisfactory process for microbiologically fermented sausage was developed using starter culture, straight nitrite and sugar. The starter culture did not give a quicker rate of pH reduction than chance fermentation, as used commercially in Thailand, but suppressed the growth of other microorganisms.

An extreme vertices designs were used to study the effect of pork, fat and rice composition upon texture acceptability. Texture was improved with increased pork and fat and decreased with increased rice and an optimum composition was obtained. This would have to be related to cost before commercial production could be considered.

Sensory testing was used in an attempt to correlate the attributes of texture - firmness, rubberiness, juiciness, oiliness, smoothness, stickiness. Only rubberiness was correlated directly with fat content; a decrease in fat caused an increase in rubberiness. The other texture attributes appeared to have complex relationships with chemical composition. Generally, pork increased firmness and rice increased grittiness.

The shelf life was increased by dipping the sausage in 4% potassium sorbate solution for one minute and/or vacuum packaging. Over 14 days shelf life was obtained with potassium sorbate, and ten days with vacuum packaging.

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## INTRODUCTION

Fermented sausages can be classified as dried and semi-dried sausages. The meat mixture is allowed to ferment, either by naturally occurring bacteria, or by the addition of a culture of prepared bacteria. The major biochemical changes are due to the action of lactic acid producing bacteria, both homofermentative and heterofermentative lactic acid bacteria. The new approach is the use of chemical acidulant as a substitute or part substitute for the acid produced by lactic acid bacteria. Glucono-Delta-Lactone (GDL) is the most widespread chemical acidulant used in fermented sausage manufacturing. Straight lactic acid was also reported to be used as a chemical acidulant.

After fermentation or addition of chemical acidulant, the sausages are dried to the desired moisture content. Fermented and chemically acidulated sausages are normally consumed in an uncooked form.

Generally, there are three types of fermented sausages in Thailand. These sausages are named Nam, Sai Krok Prew and Mum. Nam is fermented from pork, pork skin (sliced), rice, salt, potassium nitrate and various seasonings. Nam can be classified as moist fermented sausage because a drying period is not required. The components when mixed together are wrapped with plastic film. Around this plastic film, the sausage is wrapped with many layers of banana leaves. The ripening period at room temperature (30-32°C) for Nam is usually about three to four days. The consumer can either consume it in the uncooked or cooked form. Sai Krok Prew is a semi-dry fermented sausage. It is fermented from pork, pork fat, rice, salt, sugar, potassium nitrate and various seasonings. These components are mixed together and stuffed into casings made from the small intestine of pigs and then sun-dried for two to three days. After this period, fermentation will have occurred, giving the desired level of sourness. The sausage is then packed in plastic bags ready for sale. The consumer

Mum is a large size fermented sausage. It can be classified as a semi-dried fermented sausage. This sausage is formulated from lean beef, liver, spleen, roasted rice and various seasonings. These components are mixed together and stuffed into casings made from beef large intestines. Mum needs to be sun-dried on the first day after production, then air-dried for the rest of the period.

Fermented sausages in Thailand are mainly produced by small scale industries. The production is considered as an art that continues to be passed down from generation to generation. The uniformity of product quality is quite varied from day to day, and even from batch to batch.

Sai Krok Prew was selected for this project because it is the most popular and dominant product for Northeast Thailand. The potential of becoming a national product is high if a few attributes can be improved. The attributes that need to be improved are as follows:

(a) Uniformity of product quality:

The consistency of this sausage, batch to batch and day to day, is very variable. A procedure that can increase the product uniformity is required.

(b) Texture:

The texture of this sausage is poor. The sausage lacks firmness before being cooked. After being cooked, sausage meat crumbles when cut. Texture improvement for this sausage is required.

(c) Shelf life:

The shelf life of this sausage is only three days at room temperature (30-32°C). The cause of this short shelf life is mould growth on the casings. Refrigerated conditions can extend the shelf life. Nevertheless, few distributors have refrigerated storage trucks or

display cabinets. The cause of this short shelf life is

that can extend the shelf life when being stored or transported at ambient temperature. This attribute is considered to be the most important in restricting increased production and national sales.

Therefore, the aim of this project was to study the method that could increase the shelf life of Sai Krok Prew at ambient temperature. Within this aim, there were a number of objectives:

- To produce and evaluate Sai Krok Prew by chemical acidulants instead of bacterial fermentation;

To do this, the most acceptable pH of Sai Krok Prew was determined. The levels of chemical acidulants (lactic acid solutions and GDL) required to reduce the sausage pH to the desired value were investigated. The uniformity of Sai Krok Prew quality when using GDL was investigated using the rate of pH reduction as a judgement criteria.

- To improve the texture of Sai Krok Prew;

To study this, the proportions of pork, fat and rice in the formulation were varied, and an optimum formulation determined by sensory testing.

- To produce Sai Krok Prew by using starter cultures;

To study this, commercial starter cultures were used in the optimum Sai Krok Prew formula. Nitrite levels and types of sugar were varied to study the effects on starter cultures. The uniformity of Sai Krok Prew quality when using bacterial fermentation was investigated in the same manner as Sai Krok Prew production using chemical acidulant.

- To extend the shelf life of Sai Krok Prew up to 14 days at room temperature (30-32°C);

In order to extend the shelf life of this sausage, the experiments were concentrated on the use of potassium sorbate. The minimum effective level of potassium sorbate that could extend the shelf life for both chemically acidified and microbially fermented sausages up to 14 days under the simulated commercial condition was investigated. Acceptability as judged by a taste panel was also evaluated for the sausage produced using potassium sorbate. Experiments with vacuum packing to increase the shelf life of fermented sausage were also carried out.