



UNIVERSITI PUTRA MALAYSIA

**EFFECT OF RICE QUALITY, FORMULATION AND
STORAGE ON THE QUALITY OF CANNED RICE PORRIDGE**

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**MASTER OF SCIENCE
UNIVERSITI PUTRA MALAYSIA**

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By

MA YONG QIN

**Thesis Submitted in Fulfilment of the Requirements for the
Degree of Master of Science in the Faculty of
Food Science and Biotechnology
Universiti Putra Malaysia**

May 2000



Dedicated to

*My beloved parents, husband, daughter,
sisters and brother*

*for their love,
patience
and understanding*



Abstract of the thesis presented to the Senate of Universiti Putra Malaysia in
fulfilment of the requirements for the degree of Master of Science

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Chairman : Sharifah Kharidah Syed Muhammad, Ph.D.

Faculty : Food Science and Biotechnology

Long-grain rice was mixed with broken rice or glutinous rice at a ratio of 0:100, 25:75, 50:50, 75:25 and 100:0, respectively. Each mixture was processed into canned plain rice porridge. The physical and sensory properties of the products were evaluated. An optimum ratio was selected for the preparation of savoury rice porridge (chicken, beef, fish and bean flavours). The freshly prepared savoury rice porridges were then evaluated to determine their physicochemical, microbiological and sensory qualities. A storage study was also carried out to determine the quality changes of canned savoury rice porridges stored at 27°C and 4°C for 12 weeks.

The results obtained showed that plain rice porridge was best prepared using 100% long-grain rice. However, plain rice porridge prepared using a mixture of broken rice and long-grain rice at a ratio of 50:50 was found to be as acceptable as that containing 100% long-grain rice. Incorporation of glutinous rice reduced phase



separation but in excess of 25 percent led to a significant decrease in acceptability. Physical characteristics of the plain rice porridge were relatively unchanged with the substitution of long-grain rice with broken rice. When long-grain rice was substituted with increasing amounts of glutinous rice, the pH value and whiteness of the plain rice porridge tended to decrease but its %Brix and viscosity increased gradually. For the savoury rice porridges, the results of the ranking test revealed that the fish rice porridge was the most preferred followed by the beef, chicken and bean rice porridges in terms of colour, texture, flavour and taste. Results of the nutrient composition analyses showed that the beef rice porridge provided the highest protein, fat, and caloric contents and the most amounts of calcium and iron. Results of the storage study indicated that the temperature and time of storage did not affect dry matter, ash, protein, fat, caloric, calcium and iron content of the porridges. However, low storage temperature caused the porridges to have a lower %Brix and increase in whiteness. Porridges stored at room temperature were more stable in appearance, colour, flavour and taste than those stored in the refrigerator.

A composite of broken rice and long-grain rice at a ratio of 50:50 is recommended for the production of plain rice porridge. A can of the four types of savoury rice porridges designed can provide 1/4-1/5 of the recommended daily allowance (RDA) for energy and nutrients for 7-12 years old children. All samples stored at room temperature or in the refrigerator complied with the standard for food hygiene and safety up to 12 weeks of storage. However, canned rice porridge stored at room temperature gave better sensory characteristics.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

**KESAN KUALITI BERAS, FORMULASI DAN PENYIMPANAN
KEATAS KUALITI BUBUR NASI DALAM TIN**

Oleh

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Beras panjang dicampurkan dengan beras hancur atau beras pulut masing-masing pada nisbah 0:100, 25:75, 50:50, 75:25 dan 100:0. Setiap campuran telah dijadikan bubur nasi tawar dalam tin. Seterusnya, ciri-ciri fizikal dan deria produk-produk tersebut dinilai. Satu nisbah optima telah dipilih untuk penyediaan bubur nasi berperisa (perisa ayam, daging lembu, ikan dan kacang). Bubur nasi berperisa di nilai sejeurus selepas disediakan untuk menentukan ciri-ciri fiziko-kimia, mikrobiologi dan derianya. Satu kajian penyimpanan juga telah dijalankan untuk menentukan perubahan kualiti bubur nasi berperisa dalam tin yang disimpan pada suhu 27°C dan 4°C selama 12 minggu.

Keputusan yang diperolehi menunjukkan bahawa bubur nasi tawar yang terbaik boleh disediakan menggunakan 100% beras panjang. Namun demikian bubur nasi tawar yang disediakan dengan campuran beras hancur dan beras panjang pada nisbah 50:50 dapat diterima setanding dengan bubur nasi tawar yang mengandungi

100% beras panjang. Penambahan beras pulut mengurangkan pemisahan fasa tetapi jika melebihi 25% mengakibatkan penerimaan bubur nasi tawar berkurangan secara bererti. Ciri fizikal produk didapati tidak berubah apabila beras panjang digantikan dengan beras hancur. Apabila beras panjang digantikan dengan kuantiti beras pulut yang semakin meningkat, nilai pH dan keputihan produk didapati berkurangan manakala %Brix dan kepekatan meningkat secara beransur-ansur. Bagi bubur nasi berperisa, keputusan ujian mengikut susunan keutamaan menunjukkan bahawa bubur nasi ikan paling disukai diikuti dengan bubur nasi daging lembu, bubur nasi ayam dan bubur nasi kekacang dari segi warna, tekstur, perisa dan rasa. Melalui analisis komposisi nutrien didapati yang bubur nasi daging lembu mempunyai kandungan protein, lemak, kalori, kalsium dan zat besi yang tertinggi. Keputusan kajian penyimpanan pula menunjukkan bahawa suhu dan masa penyimpanan tidak mempengaruhi kandungan bahan kering, abu, protein, lemak, kalori, kalsium dan besi dalam bubur nasi. Walau bagaimanapun, suhu penyimpanan yang rendah mengakibatkan bubur nasi mengalami pengurangan nilai %Brix dan penambahan kesan keputihan. Bubur nasi yang telah disimpan pada suhu bilik didapati lebih stabil dari segi rupa luaran, warna, perisa dan citarasa jika dibandingkan dengan bubur nasi yang telah disimpan dalam peti sejuk.

Campuran beras hancur dan beras panjang pada nisbah 50:50 disarankan untuk penghasilan bubur nasi tawar. Setiap tin daripada empat jenis bubur nasi berperisa yang dicipta akan memberikan 1/4-1/5 tenaga dan nutrien-nutrien yang disyorkan bagi kanak-kanak berusia di antara 7-12 tahun. Semua sampel yang

disimpan pada suhu bilik atau dalam peti sejuk memenuhi piawaian makanan bersih dan selamat sehingga jangka penyimpanan 12 minggu. Walau bagaimanapun, bubur nasi dalam tin yang disimpan pada suhu bilik telah memberikan ciri-ciri deria yang lebih baik.

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CHAPTER I

GENERAL INTRODUCTION

Rice porridge is a very popular food in the Asian region, particularly in China, Japan and Korea (Lu, 1987). It is usually home-made, and also available to consumers in the restaurants in freshly cooked form. Commercial rice porridges based on the state of the products are divided into two types: quick-cooking rice porridge and ready-to-eat rice porridge. The former can be served as rice porridge after rehydration in excess of hot or boiling water. This product has been developed and patented over the past years (Roberts, 1972; Luh and Liu, 1980; Robert et al., 1980; Juliano and Sakurai, 1985). However, the greatest disadvantage of this product is its relatively long preparation time compared to ready-to-eat rice porridge, which can be eaten after opening the package or heating.

Ready-to-eat rice porridge includes three kinds: plain rice porridge, savoury rice porridge and sweet rice porridge. As is well known, the preparation of plain rice porridge is rather simple, its essential ingredients are regular rice and water. However, study has yet to be conducted concerning the development of plain rice porridge into a commercial product suitable for local market.

Naivikul (1988) reported that glutinous rice tastes better than regular rice. It is often added into regular rice in small amounts to increase cooking and eating quality of the rice (Luh, 1991; Chen et al., 1995). Chang (1988) reported that rice 'congee' in Taiwan was all sweet, used glutinous rice as a base, and incorporated other ingredients. Other researchers also developed rice porridge using glutinous rice (Zhao, 1995; Yang, 1995). In Malaysia, there is a lot of broken rice from local milling and it is normally used for rice flour or other processed products such as vermicelli and noodles. The price of broken rice is very low, just a half of that of long-grain rice. Therefore, efforts should be made to determine the optimum composite rice based on the percentages of broken rice, glutinous rice and long-grain rice for producing plain rice porridge.

Plain rice porridge is less attractive to consumers because it is basically a bland food and low in nutritional value. Thus, it is often incorporated with ingredients containing dehydrated chicken, fish, beef, egg, legumes, vegetables and seasonings to compensate for the lack of nutrition and improve attractiveness to consumers. It can also be adapted to develop a wide range of products such as ready-to-eat savoury rice porridge by varying the ingredients used. Recently, the formulations of sweetened rice porridge were studied widely (Ding, 1995; Zhao, 1995; Yang, 1995). However, as reported by Jiang and Zhang (1995), the study on sweetened rice porridge was overwhelming and lesser has been conducted to study the formulation of savoury rice porridge. Therefore, it is also necessary to develop

ready-to-eat savoury rice porridges with fresh meats, fish, legumes, vegetables and seasonings to meet local people's preference for this kind of product.

A survey of food products available in the market showed that ready-to-eat nutritious food products for children are lacking. The recommended daily dietary allowances for 7-12 years old primary school children in Malaysia are 2150-2600 kcal, 35-54 g protein, 450-650 mg calcium and 10 mg iron (Siong et al., 1988). To meet this requirement, a child aged 7-12 years has to consume combinations of cereal, wheat, fish, egg and vegetables or fruit per meal. These combinations can be presented to a Malaysian child in the form of a rice-based dish. The rice-based dish, however, can be further categorised into boiled or steamed rice dish and rice porridge.

There is no standards available for the quality of rice porridge and the quality characteristics reported by various researchers were quite varied from each other (Ding, 1995; Zhao, 1995; Yang, 1995; Jiang and Zhang, 1995). In general, they evaluated the quality of rice porridge in terms of physicochemical, microbiological and sensory characteristics. Observations on the quality changes of ready-to-eat rice porridge on storage, however, have not been reported.

A study was therefore conducted with the following objectives:

1. To formulate canned plain rice porridge which is physically, organoleptically and economically acceptable
2. To formulate tasty, nutritious, and shelf-stable ready-to-eat canned savoury rice porridges for 7-12 years old children
3. To determine the quality changes of ready-to-eat canned savoury rice porridges during storage at different temperatures