UNIVERSITI PUTRA MALAYSIA

MODIFICATION AND IMPROVEMENT OF 'KHAO KRIAP WAUE' (A TRADITIONAL THAI GLUTINOUS RICE-BASED SNACK FOOD)

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MODIFICATION AND IMPROVEMENT OF 'KHAO KRIAP WAUE' (A TRADITIONAL THAI GLUTINOUS RICE-BASED SNACK FOOD)

By

SOMCHAI JOMDUANG

Dissertation Submitted in Fulfilment of the Requirements for the Degree of Doctor of Philosophy at the Faculty of Food Science and Biotechnology, Universiti Pertanian Malaysia.

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Dedicated to

my wife, Mrs. Jinantana Jomduang

for her understanding and encouragement

which has been a constant source of inspiration.

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TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

LIST OF ABBREVIATIONS

A_w	water activity
Ala	alanine
ANOVA	analysis of variance
AOAC	Association Official of Analytical Chemists
Arg	argenine
Asp	aspartic acid
B.D.	bulk density
CM	coconut milk
CRD	completely randomised design
CP	chickpea flour
Cys	cystein
d.b.	dry basis
df	degree of freedom
DMRT	Duncan's Multiple Range Test
DSC	differential scanning colorimetry
E.R.	expansion ratio
EVM	evaporated milk
FAO	Food and Agriculture Organisation
FM	fresh milk
G	glutinous rice flour
Glu	glutamine
Gly	glycine
HCl	hydrochloric acid
HDPE	high density polyethylene
His	histamine
Hypo	hydroxyprolein
Iso	isoleucine
KKW	Khao Kriap Waue
LDPE	low density polyethylene
Leu	leucine
Lys	lysine
MB	mungbean flour
MBI	mungbean protein isolate
Met	methionine
N	nitrogen
NMR	nuclear magnetic resonance
NPU	net protein utilisation
p	level of probability
PE	polyethylene
PMR	proton magnetic resonance
PP	polypropylene
PDA	potato dextrose agar
Phe	phenylalanine
Pro	proline
R	rice flour
RD6	Rice Department No. 6

RH	relative humidity
SB	soybean flour
Ser	serine
SM	skim milk powder
SPI	soy protein isolate
T	tapioca flour
T.R.	thickness ratio
Temp.	temperature
Thre	threonine
TMA	thermo mechanical analysis
Tyr	tyrosine
Val	valine
w.b.	wet basis
WHO	World Health Organisation

Abstract of the dissertation submitted to the Senate of Universiti Pertanian Malaysia in fulfilment of the requirements for the degree of Doctor of Philosophy.

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By

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JULY 1994

Chairman : Assoc. Prof. Dr. Suhaila Mohamed
Faculty : Food Science and Biotechnology

'Khao Kriap Waue' (KKW) is a popular Thai snack food made from glutinous rice. Traditional KKW mainly constitutes carbohydrate (92.8%) since its major ingredients are glutinous rice and sugar. Its other chemical constituents are 5.7% protein, 0.7% fat, 0.6% ash and 0.2% crude fibre. KKW has a low fat content and differs from other deep fried snack foods in that it is puffed by roasting, not deep frying. The production of KKW requires several elaborate steps. The glutinous rice grain is soaked, steamed and then pounded with sugar (sucrose), water and caramel to a moisture content of about 50%. The sticky dough is then made into balls and manually rolled flat, before sun drying. The intermediate moisture product can be stored for less than a week at room temperature and is puffed by roasting on a direct flame before serving.

The labour intensive traditional process could be simplified by using a dough mixer and a mechanical sheeter to replace manual pounding and sheeting. The sticky dough could also be hardened at a low temperature (0-4°C) and mechanically sliced to the optimum thickness of 2 mm. Drying was best done in a 50±5°C hot air dryer for 4 hr to a moisture content of 17±3%. Puffing by microwave or 225±25°C oven could replace the traditional direct flame roasting resulting in a good product devoid of burnt spots. The modified technology for KKW production could be utilised at both cottage and industrial levels.

Wet milled glutinous rice flour was found to be the most suitable raw material for making good quality KKW compared to dry milled glutinous rice flour, glutinous rice grain, glutinous rice-non-glutinous rice flour mixtures or glutinous rice-tapioca flour mixtures. This is related to the amylopectin content and starch damage of the flour. The optimum salt and sucrose content were 2 g and 15-35 g/100 g flour, respectively which was best added during the pounding process, to improve the puffed product characteristics. Soybean flour, mungbean flour, chickpea flour, legume protein isolate and skim milk powder could be added at 10, 20, 30, 20 and 30 g/100 g flour, respectively to increase the protein content from 6.6% to approximately 10%. The addition of proteinaceous materials also helped to improve the amino acid balance in KKW. Fresh milk and coconut milk when used in place of water improved the appearance and flavour of KKW.

Palm olein:lecithin mixture (20:1 w/w) was superior to the traditional cooking oil:boiled egg yolk mixture for greasing the dough during the sheeting process because it resulted in a cheaper and more microbiologically stable product.

The storage life of unpuffed intermediate moisture KKW could be extended to three months in vacuumed packaging before mould growth was detected. Butyl paraben at 1000 ppm could reduce but not prevent mould growth on KKW during storage. Reducing the moisture content resulted in a brittle unpuffed KKW which did not puff well. Sucrose could be used as a humectant at 35 g/100 g flour to reduce water activity to 0.6 and in extending the storage life of unpuffed KKW to about four weeks. Puffed KKW could be stored in aluminium/polyethylene laminates or polypropylene for more than six months without any change in quality.

Abstrak disertasi yang dikemukakan kepada Senat Universiti Pertanian Malaysia sebagai memenuhi syarat keperluan untuk ijazah Doktor Falsafah

MODIFIKASI DAN PENINGKATAN MUTU "KHAO KRIAP WAUE" (SEJENIS MAKANAN SNEK TRADISI THAI YANG BERASASKAN BERAS PULUT)

oleh

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JULAI 1994

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'Khao Kriap Waue' (KKW) yang diperbuat daripada beras pulut adalah sejenis makanan snek Thailand yang popular. Karbohidrat (92.8%) adalah kandungan utama KKW tradisional ini memandangkan ramuan utamanya hanya terdiri daripada beras pulut dan gula sahaja. Kandungan kimianya yang lain terdiri daripada 5.7% protin, 0.7% lemak, 0.6% abu dan 0.2% serabut kasar. KKW mengandungi kandungan lemak yang rendah berbanding dengan makanan snek lain yang biasanya digoreng dengan minyak; tetapi KKW hanya dikembangkan dengan cara memanggangnya di atas api tanpa menggorengnya di dalam minyak panas. Pemprosesannya melibatkan beberapa cara iaitu beras pulut akan direndam terlebih dahulu, distim, dan kemudiannya tumbuk bersama-sama dengan gula, air, dan karamel sehingga kandungan kelembapan mencapai lebih kurang 50%. Doh yang melekit itu akan

dibentuk kepada bentuk bebola dan dicanai secara manual sehingga leper, sebelum dikeringkan di bawah cahaya matahari. Produk yang mengandungi kelembapan yang sederhana ini mempunyai hayat simpanan kurang daripada satu minggu pada suhu bilik. lanya disaji bila dikembangkan dengan memanggangnya atas api tanpa berlapik.

Proses tradisional boleh dipermudahkan dengan menggunakan mesin penggaul doh dan alat pelembar mekanikal untuk menggantikan penumbukan bahan dan pencanaian secara manual. Doh yang melekit itu boleh dikeraskan pada suhu rendah (0-4°C) dan dipotong secara mekanikal keketebalan optimum 2 mm. Pengeringan paling berkesan boleh dilakukan di dalam oven pada suhu 50±5°C selama empat jam sehingga kandungan kelembapan mencapai 17±3%. Pengembangan dengan alat gelombang mikro pada 225±25°C ataupun oven ini boleh memberikan produk yang lebih elok di mana kesan-kesan terbakar dapat dikurangkan berbanding dengan cara tradisional.

Tepung pulut yang dikisar basah didapati paling sesuai sebagai bahan mentah berbanding dengan tepung pulut dikisar kering, butir-butir beras pulut, campuran tepung pulut dengan tepung beras ataupun campuran tepung pulut dengan tepung ubi kayu untuk menghasilkan KKW yang berkualiti tinggi. Ini boleh dikaitkan dengan kandungan amilopektin dan kerosakan kanji di dalam tepung itu. Kandungan optimum garam dan gula ialah