



PRODUCT DEVELOPMENT OF RED KIDNEY BEANS AND BROWN RICE-BASED FLAKES BREAKFAST FOR WEIGHT MANAGEMENT

DINA ARAFA AHMED MOHAMED SHABAYEK



**STUDY PROGRAM OF NUTRITION SCIENCE
GRADUATE SCHOOL
IPB UNIVERSITY
BOGOR
2021**

- Hak Cipta Dilindungi Undang-undang
1. Dilarang mengutip sebagian atau seluruh karya tulis ini tanpa mencantumkan dan menyebutkan sumber :
 - a. Pengutipan hanya untuk kepentingan pendidikan, penelitian, penulisan karya ilmiah, penyusunan laporan, penulisan kritik atau tinjauan suatu masalah
 - b. Pengutipan tidak merugikan kepentingan yang wajar IPB University.
 2. Dilarang mengumumkannya dan memperbanyak sebagian atau seluruh karya tulis ini dalam bentuk apapun tanpa izin IPB University.



@Hak cipta milik IPB University

IPB University



IPB University
— Bogor Indonesia —

Hak Cipta Dilindungi Undang-undang

1. Dilarang mengutip sebagian atau seluruh karya tulis ini tanpa mencantumkan dan menyebutkan sumber :
 - a. Pengutipan hanya untuk kepentingan pendidikan, penelitian, penulisan karya ilmiah, penyusunan laporan, penulisan kritik atau tinjauan suatu masalah
 - b. Pengutipan tidak merugikan kepentingan yang wajar IPB University.
2. Dilarang mengumumkan dan memperbanyak sebagian atau seluruh karya tulis ini dalam bentuk apapun tanpa izin IPB University.



STATEMENT CONCERNING THESIS AND SOURCES OF INFORMATION AND THE EXTRAORDINARY OF COPYRIGHT

I hereby declare that the thesis entitled “*Product development of red kidney beans and brown rice-based flakes breakfast for weight management*” is my work with the guidance of the supervisory committee and has not been submitted in any form to any college. The sources of information derived from or quoted from published or unpublished works of other authors have been mentioned in the text and are listed in the Bibliography at the end of this thesis.

I hereby assign the copyright of my writing to the IPB University.

Bogor, July 2021

Dina Shabayek
I15119820

- Hak Cipta Dilindungi Undang-undang
1. Dilarang mengutip sebagian atau seluruh karya tulis ini tanpa mencantumkan dan menyebutkan sumber :
 - a. Pengutipan hanya untuk kepentingan pendidikan, penelitian, penulisan karya ilmiah, penyusunan laporan, penulisan kritik atau tinjauan suatu masalah
 - b. Pengutipan tidak merugikan kepentingan yang wajar IPB University.
 2. Dilarang mengumunkan dan memperbanyak sebagian atau seluruh karya tulis ini dalam bentuk apapun tanpa izin IPB University.



@Hak cipta milik IPB University

IPB University



IPB University
— Bogor Indonesia —

Hak Cipta Dilindungi Undang-undang

1. Dilarang mengutip sebagian atau seluruh karya tulis ini tanpa mencantumkan dan menyebutkan sumber :
 - a. Pengutipan hanya untuk kepentingan pendidikan, penelitian, penulisan karya ilmiah, penyusunan laporan, penulisan kritik atau tinjauan suatu masalah
 - b. Pengutipan tidak merugikan kepentingan yang wajar IPB University.
2. Dilarang mengumunkan dan memperbanyak sebagian atau seluruh karya tulis ini dalam bentuk apapun tanpa izin IPB University.

SUMMARY

DINA ARAFA AHMED SHABAYEK. Product Development of Red Kidney Beans and Brown Rice-Based Flakes Breakfast for Weight Management. Supervised by RIMBAWAN and SLAMET BUDIJANTO.

The global epidemic of obesity is growing at an unprecedented pace and obesity has become one of the world's most important public health issues. It is predicted that by 2030, 38% of the global adult population will be overweight without effective intervention. Globally more than 650 million obese and 1.9 billion overweight people. There are several influences correlated with obesity and metabolic disorders, including genetics and physiological differences (gender and age), living environments, and habits (diet, stress, smoking, alcohol, and exercise). Obesity contributes to many metabolic disorders, such as inflammatory-related diseases, cardiovascular disease, high blood pressure, coronary artery problems, obesity, and diabetes. In line with it was mentioned that one of the factors that cause overweight or obesity is skipping breakfast. This is because the one who Skips breakfast may eat street food often that contains a high in carbohydrates and fats like fried foods. Based on this, data from The Indonesian Food and Drug Authority (BPOM 2016) showed that there are about 1015 products that were officially registered with the keyword “grains” and only 67 products were officially registered with the keyword “flakes”. Most of the grains and flakes listed are generally made of corn and wheat. However, it is still rare to find flakes made from legumes. It is worth noting that breakfast meal flakes are a popular ready-to-eat breakfast food in several countries but the breakfast flakes on the market contain a high in carbohydrates, which makes the consumer has a limited choice of breakfast product, especially for people who suffer from obesity.

The nature of the problem described above inspired the design of this research to produce and develop breakfast flakes made with brown rice and red kidney beans as the main ingredients as sources rich in dietary fiber and protein to prevent obesity. The study was set up in design with four formulas (F1, F2, F3, F4) with five attributes. The results included the organoleptic data in the form of hedonic test and hedonic quality test, total fat, SFAs, MUFAs, PUFAs, dietary fiber, and proximate analysis and the results were analyzed by using Microsoft Excel 2010 and SPSS 26.0.

Based on the results of the analysis of organoleptic data, formula F4 had the highest hedonic score with the proportion of brown rice flour to red beans flour 40 %: 60 %, had the following characteristics: brownish yellow color, normal aroma, tasteful taste, and crispy texture. The determination of the flakes product selected was based on the preferences of the panelists for sensory tests, and there were significant differences in the attributes of taste, and texture ($p < 0.05$). Based on nutritional content analysis results of selected flakes (F4) were contain a high number of nutrients but a relatively low number of calories (373.81 kcal per 100 g), whereas nutrients (moisture, ash, protein, carbohydrate, fat, and dietary fiber) were 9.68 % w/b, 6.43 % w/b, 23.57 % w/b, 52.67 % w/b, 7.65% w/b and 14.53 %w/b

respectively. Furthermore, Fe, Ca, Na, and K content was 3.98 mg, 137.10 mg, 1381.64 mg, and 793.15 mg, respectively. The ash content was high due to sodium content; therefore, it is recommended to decrease sodium content by reducing the salt on the formula. The ratio between ω -6 to ω -3 fatty acids in flakes F4 was 0.53 that may provide nutritional benefits and remain within appropriate and safe consumption limits. Based on these results, no nutrition claim can be proposed to the F4 flakes due to their high sodium content. When reformulation is conducted to reduce the sodium content to become lower than 300 mg per serving size, the F4 flakes can be claimed as high protein, high fiber, and a source of iron and potassium. Hence, F4 flakes are likely to be beneficial and may help reduce obesity. Importantly, it is high in protein and fiber, which helps consumers feel full longer and may make it a weight loss-friendly food. It also contains essential minerals, including iron and potassium. In conclusion, expectedly, red beans flakes are suitable for consumption as a breakfast meal and maybe a good suggestion for weight management.

Keywords: breakfast meal, brown rice, flakes, functional foods, red beans, weight management

Hak Cipta Dilindungi Undang-undang

1. Dilarang mengutip sebagian atau seluruh karya tulis ini tanpa mencantumkan dan menyebutkan sumber :
 - a. Pengutipan hanya untuk kepentingan pendidikan, penelitian, penulisan karya ilmiah, penyusunan laporan, penulisan kritik atau tinjauan suatu masalah
 - b. Pengutipan tidak merugikan kepentingan yang wajar IPB University.
2. Dilarang mengumunkan dan memperbanyak sebagian atau seluruh karya tulis ini dalam bentuk apapun tanpa izin IPB University.



- Hak Cipta Dilindungi Undang-undang
1. Dilarang mengutip sebagian atau seluruh karya tulis ini tanpa mencantumkan dan menyebutkan sumber :
 - a. Pengutipan hanya untuk kepentingan pendidikan, penelitian, penulisan karya ilmiah, penyusunan laporan, penulisan kritik atau tinjauan suatu masalah
 - b. Pengutipan tidak merugikan kepentingan yang wajar IPB University.
 2. Dilarang mengumumkan dan memperbanyak sebagian atau seluruh karya tulis ini dalam bentuk apapun tanpa izin IPB University.

© Copyright IPB, the Year 2021
Copyright reserved

No part or all of this thesis may be expected without inclusion or mentioning the sources, the exception only for research and education use, writing for a scientific paper, reporting, critical writing, or reviewing of a problem, exception thus inflict a financial loss in the properties of IPB University.

No part or all of this thesis may be transmitted and reproduced in any form without or written permission from IPB University



@Hak cipta milik IPB University

IPB University



IPB University
— Bogor Indonesia —

Hak Cipta Dilindungi Undang-undang

1. Dilarang mengutip sebagian atau seluruh karya tulis ini tanpa mencantumkan dan menyebutkan sumber :
 - a. Pengutipan hanya untuk kepentingan pendidikan, penelitian, penulisan karya ilmiah, penyusunan laporan, penulisan kritik atau tinjauan suatu masalah
 - b. Pengutipan tidak merugikan kepentingan yang wajar IPB University.
2. Dilarang mengumumkan dan memperbanyak sebagian atau seluruh karya tulis ini dalam bentuk apapun tanpa izin IPB University.



PRODUCT DEVELOPMENT OF RED KIDNEY BEANS AND BROWN RICE-BASED FLAKES BREAKFAST FOR WEIGHT MANAGEMENT

DINA ARAFA AHMED MOHAMED SHABAYEK

Thesis
as a requirement for the award of a
Master of Science degree in
Study Program of Nutrition Science

**STUDY PROGRAM OF NUTRITION SCIENCE
GRADUATE SCHOOL
IPB UNIVERSITY
BOGOR
2021**



@Hak cipta milik IPB University

IPB University

Examiners:

1. Dr. agr. Eny Palupi, STP, MSc.



IPB University
— Bogor Indonesia —

Hak Cipta Dilindungi Undang-undang

1. Dilarang mengutip sebagian atau seluruh karya tulis ini tanpa mencantumkan dan menyebutkan sumber :
 - a. Pengutipan hanya untuk kepentingan pendidikan, penelitian, penulisan karya ilmiah, penyusunan laporan, penulisan kritik atau tinjauan suatu masalah
 - b. Pengutipan tidak merugikan kepentingan yang wajar IPB University.
2. Dilarang mengumunkan dan memperbanyak sebagian atau seluruh karya tulis ini dalam bentuk apapun tanpa izin IPB University.



Thesis Title : Product Development of Red Kidney Beans and Brown Rice-Based Flakes Breakfast for Weight Management
Name : Dina Arafa Ahmed Mohamed Shabayek
ID : I151198201

Supervisor 1:
Dr. Rimbawan

Approved by



Supervisor 2:
Prof. Dr. Ir. Slamet Budijanto, M. Agr.



Head of the study program:
Dr. Rimbawan
NIP 196204061986031002

Acknowledged by



Dean of Graduate School:
Prof. Dr. Ir. Anas Miftah Fauzi, M. Eng
NIP 196004191985031002



Examination Date: 23 June 2021

Graduated Date:

Hak Cipta Dilindungi Undang-undang
1. Dilarang mengutip sebagian atau seluruh karya tulis ini tanpa mencantumkan dan menyebutkan sumber :
a. Pengutipan hanya untuk kepentingan pendidikan, penelitian, penulisan karya ilmiah, penyusunan laporan, penulisan kritik atau tinjauan suatu masalah
b. Pengutipan tidak merugikan kepentingan yang wajar IPB University.
2. Dilarang mengumumkan dan memperbanyak sebagian atau seluruh karya tulis ini dalam bentuk apapun tanpa izin IPB University.



@Hak cipta milik IPB University

IPB University



IPB University
— Bogor Indonesia —

Hak Cipta Dilindungi Undang-undang

1. Dilarang mengutip sebagian atau seluruh karya tulis ini tanpa mencantumkan dan menyebutkan sumber :
 - a. Pengutipan hanya untuk kepentingan pendidikan, penelitian, penulisan karya ilmiah, penyusunan laporan, penulisan kritik atau tinjauan suatu masalah
 - b. Pengutipan tidak merugikan kepentingan yang wajar IPB University.
2. Dilarang mengumumkan dan memperbanyak sebagian atau seluruh karya tulis ini dalam bentuk apapun tanpa izin IPB University.



ACKNOWLEDGEMENTS

Firstly, I wish to extend my sincerest thanks to God; for giving me the energy, courage, and strength when all seemed impossible. Thanks to Allah because without God's permission, I would never have the ability to accomplish this research. This work is dedicated to the pure spirit of my father and I also express my gratitude to my family for providing me with unfailing support in all of my endeavors throughout my years of study.

I would like to give special thanks to my supervisors, Dr. Rimbawan and Prof. Dr. Ir. Slamet Budijanto, M.Agr for all support, advice, professional guidance, patience, encouragement, and knowledge until I completed this research that was a source of great inspiration to me. They consistently allowed this paper to be my work but steered me in the right direction whenever they think I need it. Thank you very much!

I want to acknowledge my sincere gratitude to the KNB scholarship management, faculty staff members, and my colleagues at the Department of Nutritional Sciences, IPB.

Lastly, I hope this scientific work contributes to the advancement of science and useful for all human beings worldwide.

Bogor, July 2021

Dina Arafa Shabayek

TABLE OF CONTENTS

LIST OF TABLES	xi
LIST OF FIGURES	xi
LIST OF APPENDIXES	xi
I INTRODUCTION	1
1.1 Background	1
1.2 Research Problem	3
1.3 Research Objectives	3
1.4 Hypothesis	3
1.5 Research Benefits	4
II LITERATURE REVIEW	5
2.1 Mechanisms in Obesity Pathogenesis	5
2.2 Nutrition	5
2.3 Functional Food	6
2.4 Functional Foods from Plant Sources	7
2.4.1 Red kidney bean	7
2.4.2 Brown rice	8
2.4.3 Rice flakes	10
2.4.4 Ginger	11
2.4.5 Coconut oil	12
2.4.6 Chia seeds	12
2.4.7 Honey	13
III RESEARCH METHODOLOGY	15
3.1 Place and Time	15
3.2 Materials and Equipment	15
3.3 Methods and Procedures	15
3.3.1 Raw ingredients preparation	15
3.3.2 Production of flakes	16
3.3.3 Sensory evaluation	17
3.3.4 Chemical analysis	17
3.3.5 Analysis of the Nutritional Contribution of Flakes	17
3.4 Statistical Analysis	17
IV RESULT AND DISCUSSION	19
4.1 Making Brown Rice Flour and Red Bean Flour	19
4.2 Flakes Formulation	19
4.3 Sensory Test Results	21
4.3.1 Hedonic Test	21
4.3.2 Hedonic Quality Test	21
4.4 Flakes Nutritional Content	23
4.4.1 Fatty Acid Content of F4 flakes (Fatty Acid Profile)	25
4.5 Nutritional Contribution of Flakes	26
4.6 Proposed Flakes Claims Nutrition Claims	27
4.7 Comparison of The Selected Flakes (F4) with other	28

commercial flakes	
4.8 The Potential Effects of Dietary Fiber on Appetite Regulation and Obesity	30
4.9 The Potential Effects of High Protein Diet and Weight Loss	31
V CONCLUSION AND RECOMMENDATION	33
5.1 Conclusion	33
5.2 Recommendation	33
REFERENCES	34
APPENDIXES	39
BIOGRAPHY	49



Hak Cipta Dilindungi Undang-undang

1. Dilarang mengutip sebagian atau seluruh karya tulis ini tanpa mencantumkan dan menyebutkan sumber :
 - a. Pengutipan hanya untuk kepentingan pendidikan, penelitian, penulisan karya ilmiah, penyusunan laporan, penulisan kritik atau tinjauan suatu masalah
 - b. Pengutipan tidak merugikan kepentingan yang wajar IPB University.
2. Dilarang mengumumkan dan memperbanyak sebagian atau seluruh karya tulis ini dalam bentuk apapun tanpa izin IPB University.

LIST OF TABLES

3.1	The Composition of four formulas	16
4.1	Hedonic test statistical analysis results	21
4.2	Hedonic quality test analysis results	22
4.3	Nutritional content of selected flakes (F4) /100 g)	24
4.4	The fatty acids content of selected flakes	25
4.5	Nutritional contribution of flakes	27
4.6	Proposed Flakes product nutrition claims	28
4.7	Comparison of the selected flakes (F4) with other commercial flakes	29

LIST OF FIGURES

2.1	Concept of metabolic syndrome	5
4.1	The process of making flakes	20
4.7	Packaging design of red beans flakes	30
4.8.	The effects of fiber in the gastrointestinal tract on parameters related to energy regulation.	31

LIST OF APPENDIXES

Appendix 1	Research Documentation of Flakes Making Process	40
Appendix 2	Commercial Product Pictures	41
Appendix 3	Sensory Analysis Form	43
Appendix 4	Procedure for Analysis of Chemical Characteristics	45