

ACKNOWLEDGEMENTS

The author would like to give thanks to God for His unending grace to the writer during preparation, research, and completion of the thesis report entitled “EFFECT OF RATIO OF AVOCADO FRUIT PUREE TO MARGARINE, AND TYPES OF WHEAT FLOUR ON PHYSICOCHEMICAL AND SENSORY CHARACTERISTICS OF BROWNIES” that is written as partial fulfillment of the academic requirements to obtain the degree of *Sarjana Teknologi Pertanian Strata Satu* Food Technology, Universitas Pelita Harapan. The author realized that this report could not be completed without the assistance, guidance, prayer, and support from many parties during laboratory experiment and completion of this report. Therefore, the author would like to express gratitude to those parties, whether directly or indirectly, including:

1. Mr. Eric Jobiliong, Ph.D., Dean of Faculty of Science and Technology.
2. Ms. Sunie Rahardja, M.S.CE., Acting Vice Dean of Faculty of Science and Technology
3. Mr. Laurence, S.T., M.T., Director of Faculty of Science and Technology.
4. Mr. Ir. W. Donald R. Pokatong, M.Sc., Ph.D., Head of Food Technology Study Program, and as Thesis Supervisor for constructive comments, insightful suggestions, from the beginning of thesis proposal, throughout the research, completion, and precise editing of the thesis.
5. Dr. Nuri Arum Anugrahati and Ms Lucia Crysanthi Soedirga, M.Sc. as the head of examiner and member of examiner, respectively for giving helpful input regarding thesis revision.
6. Dr. Tagor M. Siregar, M.Si, Head of Chemistry Laboratory and as academic supervisor for advices regarding academic aspect throughout the author study in university.
7. Ms. Natania, M.Eng., Head of Food Processing Laboratory and Ms. Yuniwaty Halim, M.Sc., Head of Quality Control and Research

Laboratories who had given permission for the author to conduct research in respective laboratory

8. Mr. Andra, Ms. Virly, Mr. Darius, Mr. Adjie, and Mr. Adi for the enormous help and guidance in the laboratories during the research.
9. All lecturers and staff of Food Technology Department for the help and information given to the author during thesis completion.
10. Beloved parents, Jeffrey Suryadi and Lidy Halim, for unconditional trust, endless love, prayers, and support during difficult times throughout the thesis completion.
11. Novini, Karina, Kenny, Charles, and Joshua as thesis partners who give support, help, and comfort during thesis completion.
12. Jeslyn Winata, Riviana Susanto, Felicia Wie, and Franz Fernando for the laughter, support, care, and comfort.
13. “Dayung’s Squad” Jessica Cahyadi and Anindya Angelina for the help, advice, support, care, and comfort during thesis days.
14. “GabJenBert” Jennifer Fransiska Andita and Gabriella Gratia Dei for the support, comfort, and care during the thesis days.
15. All members of Food Technology Class 2014 for the informative sharing and discussion shared together.
16. All Family, friends, and colleagues who cannot be mentioned one by one and contribute to the completion of the thesis report.

The author realize that this report is far from excellence and has room to be improved, therefore the author would appreciate any critiques and suggestions for better improvement of the report. Last but not least, the author hopes this report can be useful and informative for the readers.

Tangerang, February 9th, 2018

(Dea Lambertha)

TABLE OF CONTENTS

	Page
COVER PAGE	
STATEMENT OF THESIS AUTHENTICITY	
APPROVAL BY THESIS SUPERVISOR	
APPROVAL BY THESIS EXAMINATION COMMITTEE	
ABSTRACT.....	v
ACKNOWLEDGEMENTS	vi
TABLE OF CONTENTS	viii
LIST OF FIGURES.....	xi
LIST OF TABLES	xii
LIST OF APPENDICES	xiii
CHAPTER I INTRODUCTION	
1.1 Background	1
1.2 Research Problem.....	2
1.3 Objectives.....	3
1.3.1 General Objective	3
1.3.2 Specific Objectives	3
CHAPTER II LITERATURE REVIEW	
2.1 Avocado.....	5
2.2 Cholesterol.....	6
2.3 Raw Material	7
2.3.1 Wheat Flour.....	7
2.3.2 Sugar	10
2.3.3 Fats	11
2.3.3.1 Fat Replacer.....	13
2.3.4 Egg	13
2.3.5 Cocoa Powder	14
2.3.6 Baking Powder	14
2.4 Brownies	15
2.4.1 Brownies Processing	14
2.5 Dietary Fiber.....	15
2.6 Microwave Oven	15
CHAPTER III RESEARCH METHODOLOGY	
3.1 Materials and Equipment	19
3.2 Research Stages.....	19
3.2.1 Preliminary Stages	20
3.2.2 Main Research.....	20

3.3	Experimental Design.....	22
3.3.1	Preliminary Stage.....	22
3.3.2	Main Research.....	23
3.4	Analytical Procedures.....	25
3.4.1	Proximate Analysis of Avocado Puree.....	25
3.4.1.1	Moisture Content Analysis (AOAC, 2005) ...	25
3.4.1.2	Fat Analysis (Soxhlet Extraction) (AOAC, 2005).....	26
3.4.1.3	Protein Analysis (Kjeldahl Method) (AOAC, 2005).....	27
3.4.1.4	Ash Content Analysis (AOAC, 2005).....	27
3.4.1.5	Carbohydrate Analysis (AOAC, 2005).....	28
3.4.2	Physical Characterization of Brownies.....	28
3.4.2.1	Firmness (Texture Analyzer).....	28
3.4.2.2	Volume Expansion.....	28
3.4.2.3	Color Measurement (Chromameter).....	29
3.4.3	Sensory Evaluation of Selected Brownies.....	30
3.4.3.1	Scoring Test (Kemp et al, 2009).....	30
3.4.3.1	Hedonic Test (Kemp et al, 2009).....	30
CHAPTER IV RESULTS AND DISCUSSION		
4.1	Proximate Composition Result of Avocado.....	31
4.2	Physical Characteristics of Brownies.....	32
4.2.1	Cake Flour-Based Brownies Baked in Oven.....	32
4.2.1.1	Firmness.....	32
4.2.1.2	Volume Expansion.....	33
4.2.1.3	L*Value.....	34
4.2.1.4	°Hue.....	34
4.2.2	All-Purpose Flour-Based Brownies Baked in Oven ...	35
4.2.2.1	Firmness.....	35
4.2.2.2	Volume Expansion.....	36
4.2.2.3	L* Value.....	37
4.2.2.4	°Hue.....	37
4.2.3	Bread Flour-Based Brownies Baked in Oven.....	37
4.2.3.1	Firmness.....	37
4.2.3.2	Volume Expansion.....	38
4.2.3.3	L*Value.....	39
4.2.3.4	°Hue.....	40
4.2.4	Cake Flour-Based Brownies Baked in Microwave Oven.....	40
4.2.4.1	Cake Flour-Based Brownies Baked in Microwave Oven.....	40
4.2.4.2	Volume Expansion.....	41
4.2.4.3	L* Value.....	41
4.2.4.4	°Hue.....	42

4.2.5 All-Purpose Flour-Based Brownies Baked in Microwave Oven	42
4.2.5.1 Firmness.....	42
4.2.5.2 Volume Expansion	43
4.2.5.3 L* Value	44
4.2.5.3 °Hue	45
4.2.6 Bread Flour-Based Brownies Baked in Microwave Oven	45
4.2.6.1 Firmness.....	45
4.2.6.2 Volume Expansion	46
4.2.6.3 L* Value	47
4.2.6.4 °Hue	47
4.3 Selected Brownies Formulation Based on Physical Characteristics	48
4.3.1 Brownies Baked in Oven	48
4.3.2 Brownies Baked in Microwave Oven	49
4.2.3 Comparison of Baking Method Based on Physical Characteristics	50
4.3 Sensory Evaluation Results of Selected Brownies	50
4.3.1 Scoring Test Results.....	50
4.3.1.1 Scoring Test Results for Brownies Baked in Oven	50
4.3.1.2 Scoring Test Results for Brownies Baked in Microwave Oven	52
4.3.2 Hedonic Test Results.....	53
4.3.2.1 Hedonic Test for Brownies Baked in Oven	53
4.3.2.2 Hedonic Test for Brownies Baked in Microwave Oven	54
4.4 Selected Brownies Formulation Based on Hedonic Test Results	55
4.5 Proximate Composition Result of Selected Brownies.....	55
CHAPTER V CONCLUSIONS AND SUGGESTIONS	
5.1 Conclusions	57
5.1 Suggestions	57
BIBLIOGRAPHY	58
APPENDIX.....	62

LIST OF FIGURES

	Page
Figure 2.1 Oleic acid chemical composition	6
Figure 2.2 Wheat flour structure	8
Figure 2.3 Cis (left) and trans (right) configuration	12
Figure 2.4 Flowchart of brownies processing	16
Figure 3.1 Avocado puree making procedure	20
Figure 3.2 Brownies making procedure	22
Figure 4.1 Firmness of cake flour-based brownies baked in oven	32
Figure 4.2 Volume expansion of cake flour-based brownies baked in oven	33
Figure 4.3 Firmness of all-purpose flour-based brownies baked in oven.....	35
Figure 4.4 Volume expansion of all-purpose flour-based brownies baked in oven.....	36
Figure 4.5 Firmness of bread flour-based brownies made with oven	38
Figure 4.6 Volume expansion of brownies made with oven and bread flour	39
Figure 4.7 Firmness of cake flour-based brownies baked in microwave oven	40
Figure 4.8 Volume expansion of brownies made with microwave and cake flour.....	41
Figure 4.9 Firmness of all-purpose flour-based brownies baked in microwave oven	43
Figure 4.10 Volume expansion of all-purpose flour-based brownies baked in microwave oven	44
Figure 4.11 Firmness of bread flour-based brownies baked in microwave oven	46
Figure 4.12 Volume expansion of brownies made with microwave and bread flour	47



LIST OF TABLES

		Page
Table 2.1	Fresh avocado chemical composition.....	6
Table 2.2	Flour classification based on US system	8
Table 2.3	Flour classification based on ash content	9
Table 2.4	Different classes of dietary fiber	17
Table 3.1	Formulation for brownies with avocado puree.....	21
Table 3.2	Experimental design of main research	24
Table 3.3	Degree hue interpretation	29
Table 3.4	Sensory parameter for scoring test	30
Table 3.5	Sensory parameter for hedonic test	30
Table 4.1	Chemical composition of avocado	31
Table 4.2	Result of comparison of baking method based on physical characteristics	50
Table 4.3	Scoring test result of brownies made with oven.....	51
Table 4.4	Scoring test result of brownies made with microwave oven.....	52
Table 4.5	Hedonic test result of brownies made with oven.....	54
Table 4.6	Hedonic test result of brownies made with microwave oven.....	55
Table 4.7	Proximate analysis of brownies.....	56



LIST OF APPENDICES

	Page
Appendix A	
Moisture Content.....	A-1
Fat Content	A-1
Protein Content.....	A-2
Ash Content.....	A-3
Carbohydrate Content	A-3
Appendix B	
Firmness	B-1
Volume Expansion	B-7
L*Value and Hue	B-14
Appendix C	
Data of Scoring Test.....	C-1
Statistical Analysis for Scoring Test	C-21
Questionnaire for Scoring Test	C-25
Appendix D	
Data of Hedonic Test	D-1
Statistical Analysis for Hedonic Test	D-25
Questionnaire for Hedonic Test	D-28
Appendix E	
Moisture Content.....	E-1
Fat Content	E-2
Protein Content.....	E-4
Ash Content.....	E-6
Carbohydrate Content	E-8

