

**QUALITY EVALUATION OF BISCUITS PREPARED FROM  
COMPOSITE FLOUR OF SPROUTED SORGHUM,  
SOYBEAN AND FINGER MILLET**



BY

**A.M. UDENI THILANKA JAYAWEERA**



FAG496



Project Report  
Library - EUSL

**DEPARTMENT OF AGRICULTURAL CHEMISTRY  
FACULTY OF AGRICULTURE  
EASTERN UNIVERSITY  
SRI LANKA**

**PROCESSED**  
Main Library, EUSL

## ABSTRACT

Nutrient deficiencies such as protein-energy malnutrition and micronutrient deficiency are major problems especially among children in developing countries including Sri Lanka. Consumption of nutritious snacks could help to reduce protein-energy malnutrition especially in school children. This study was aimed at producing quality biscuit using composite flour blends from cheap and underutilized crops like sorghum, soybean and finger millet.

Sprouted sorghum flour in the amounts of 80%, 70%, 60%, 50% and 40% were incorporated with the amounts of 10%, 20%, 30%, 40% and 50% of soybean flour and 10% constant amount of finger millet flour was added to prepare 100% composite flour and biscuits were prepared. Biscuits prepared from 100% of wheat flour were used as control treatment. Biscuits prepared from different treatments of composite flour viz: T1 - 100% wheat, T2 - 80% Sprouted Sorghum + 10% Soybean + 10% Finger millet, T3-70% Sprouted Sorghum + 20% Soybean + 10% Finger millet, T4 - 60% Sprouted Sorghum + 30% Soybean + 10% Finger millet, T5 - 50% Sprouted Sorghum + 40% Soybean + 10% Finger millet, T6 -40% Sprouted Sorghum + 50% Soybean + 10% Finger millet were subjected to analysis of nutritional, organoleptic and microbial qualities with physical properties to evaluate the suitability of these biscuits for consumption after formulation. The nutritional qualities viz: moisture, ash, protein, fat, fiber and total sugar and physical properties viz: diameter, spread ratio, thickness, volume, and density were analyzed using the recommended standard methods. Analysis were carried out for three replicates for each parameter. Organoleptic qualities were evaluated using a sensory panel consisting of 30 semi trained panelists. The colour, texture, taste, flavour and overall acceptability were

evaluated using a seven-point hedonic scale. Total plate count was done for the fresh and stored samples to find out microbial quality. Results of the nutritional and organoleptic qualities were analyzed statistically by ANOVA using computer aided SAS statistical analysis package to evaluate the significance at  $P < 0.05$ . Comparison of means of sensory evaluation, nutritional and physical properties analysis were done by Turkey's Standardized Range Test (TSRT) and Duncan Multiple Range Test (DMRT) respectively. The nutritional analysis of the freshly prepared biscuits revealed that protein, ash, fiber, fat and total sugar were increased from 10.53-14.35%, 1.41-2.16%, 1.27-3.93%, 17.90-24.77% and 28.56-31.37% respectively while moisture content was decreased from 3.78-3.27% when increasing the soybean flour 10%-50% in the biscuits mixtures. The increment of total sugar content is very low. The physical properties of biscuits revealed that there were significant differences between the treatments of biscuits (at 5% level of significance) when the level of soybean increased. According to Turkey's test, the mean scores for all assessed organoleptic characters varied significantly ( $p < 0.05$ ) in freshly made biscuits. No harmful micro-organisms were observed in the freshly made biscuits.

Based on the nutritional and organoleptic qualities of freshly made biscuits, most preferred treatments of nutritionally enriched biscuit samples such as T3-70% Sprouted Sorghum + 20% Soybean + 10% Finger millet, T4 - 60% Sprouted Sorghum + 30% Soybean + 10% Finger millet, T5 - 50% Sprouted Sorghum + 40% Soybean + 10% Finger millet with control treatment were selected and subjected to storage studies in ambient conditions at 30°C and 70 - 80% RH for three months to evaluate shelf life of the biscuits. Nutritional analysis of the biscuits were carried out at two weeks' interval throughout the storage period. The results of nutritional analysis showed that, there were significance differences ( $p < 0.05$ ) between the tested treatments. These results revealed



the declining trends in protein, fat, fiber, ash and total sugar and an increasing trend in moisture content of the biscuits. The organoleptic analysis carried out at the end of 12 weeks revealed that there were significant ( $p < 0.05$ ) differences for the organoleptic characters between the formulations. From the overall acceptability rating, the biscuit sample prepared from composite flour with 60% sprouted sorghum flour, 30% soybean flour and 10% finger millet flour had the highest mean value compared with other treatments. There were no remarkable changes in organoleptic qualities observed up to 12 weeks of storage at 30<sup>0</sup> C and RH of 70-80% in this treatment. Microbial Analysis was done after three months of storage. Products were not affected by any microbial activities because of low moisture content. There was no harmful effect during storage on the quality of the product due to microbial growth at ambient temperature. Processes such as roasting and baking at high temperature destroy large number of micro-organisms. Therefore, it is safe for the consumption upon three months of storage. Based on the nutritional, organoleptic and microbial qualities, the biscuit sample prepared from composite flour with 60% Sprouted Sorghum flour, 30% Soybean flour and 10% Finger millet was the best treatment compared to other combinations at the end of storage period.

# TABLE OF CONTENTS

Page No.

ABSTRACT.....	i
ACKNOWLEDGEMENT.....	iv
TABLE OF CONTENT.....	v
LIST OF TABLES.....	xiv
LIST OF FIGURES.....	xv
LIST OF PLATES.....	xvi
CHAPTER 01 – INTRODUCTION.....	01
CHAPTER 02 – LITERATURE REVIEW.....	04
2.1 Biscuits.....	04
2.1.1 Ingredients used for making biscuits.....	05
2.1.1.1 Flour.....	05
2.1.1.2 Fat.....	05
2.1.1.3 Sugar.....	06
2.1.1.4 Egg.....	06
2.1.1.5 Milk Powder.....	06
2.1.1.6 Baking Powder.....	07
2.1.2 Baking of Biscuits.....	07

2.1.3 Technique for Making Cookies .....	08
2.2 Composite Flour.....	09
2.3 Sorghum.....	10
2.3.1 Taxonomy .....	10
2.3.2 Origin and Distribution.....	11
2.3.3 Description about the Plant.....	11
2.3.4 Nutritive Value of Sorghum.....	12
2.3.5 Uses and Health Benefits of Sorghum .....	12
2.3.6 Sprouted Sorghum .....	13
2.3.6.1 Germination/ Sprouting Process .....	13
2.3.6.2 Nutritional Improvement during Germination.....	14
2.3.6.3 Benefits of Sprouted Sorghum.....	14
2.4 Soybean.....	16
2.4.1 Taxonomy .....	16
2.4.2 Origin and Distribution.....	17
2.4.3 Plant Description.....	17
2.4.4 Health Benefits of Sorghum.....	18
2.5 Finger Millet .....	21

2.5.1 Morphological Description .....	21
2.5.2 Origin and Domestication .....	21
2.5.3 Health benefits of finger millet .....	22
2.6 Wheat Flour .....	24
2.7 Packaging and Shelf life of Products .....	25
2.8 Types of Packaging Materials .....	25
2.8.1 Polyethylene .....	25
2.8.2 Polyvinyl chloride .....	25
2.8.3 Paper and Paper-based Materials .....	26
2.8.4 Aluminium Foil .....	26
2.8.5 Glass .....	26
2.9 Sensory Evaluation .....	27
2.10 Panel Management .....	27
2.11 Hedonic Rating Test .....	27
2.12 Benefits of Sensory Evaluation .....	28
2.13 Problem of Sensory Evaluation .....	28
2.14 Rules of Sensory Evaluation .....	28
2.15 Qualities Assessed by Sensory Tests .....	29



2.15.1 Colour .....	29
2.15.2 Aroma .....	29
2.15.3 Taste .....	30
2.15.4 Texture .....	30
2.15.5 Overall Acceptability .....	30
<b>CHAPTER 03 – MATERIALS AND METHODS.....</b>	<b>31</b>
3.1 Materials .....	31
3.1.1 Materials Used .....	31
3.1.2 Collection of Materials .....	31
3.2 Methodology .....	32
3.2.1 Preparation of Raw Materials .....	32
3.2.1.1 Preparation of Sprouted Sorghum Flour .....	32
3.2.1.2 Preparation of Soybean Flour .....	32
3.2.1.3 Preparation of Finger Millet Flour .....	32
3.2.2 Development of Biscuits.....	34
3.2.2.1 Treatments.....	35
3.3 Nutritional Analysis of biscuits prepared from Sorghum	
Soybean and Finger Millet Composite Flour.....	36



3.3.1 Determination of Moisture Content .....	36
3.3.1.1 Principle .....	37
3.3.1.2 Materials .....	37
3.3.1.3 Procedure .....	37
3.3.1.4 Calculation .....	37
3.3.2 Determination of the Ash content .....	38
3.3.2.1 Principle .....	38
3.3.2.2 Materials .....	38
3.3.2.3 Procedure .....	38
3.3.2.4 Calculation .....	38
3.3.3 Determination of Crude Fat .....	38
3.3.3.1 Principle .....	38
3.3.3.2 Materials .....	39
3.3.3.3 Procedure .....	39
3.3.3.4 Calculation .....	39
3.3.4 Determination of Crude Protein .....	40
3.3.4.1 Principle .....	40
3.3.4.2 Materials .....	40

3.3.4.3 Procedure .....	41
3.3.4.4 Calculation .....	41
3.3.5 Determination of Crude Fiber .....	42
3.3.5.1 Principle .....	42
3.3.5.2 Materials .....	42
3.3.5.3 Procedure .....	43
3.3.5.4 Calculation .....	43
3.3.6 Determination of Total Sugar .....	43
3.3.6.1 Principle .....	44
3.3.6.2 Materials .....	44
3.3.6.3 Procedure .....	44
3.3.6.4 Calculation .....	45
 3.4 Physical Properties Analysis of Biscuits Prepared from Sprouted Sorghum, Soybean and Finger Millet Composite Flour .....	 45
3.4.1 Diameter .....	45
3.4.2 Thickness .....	45
3.4.3 Volume .....	45
3.4.4 Density .....	46

3.4.5 Spread Ratio.....	46
3.5 Organoleptic Analysis.....	46
3.5.1 Materials Used for Organoleptic Analysis.....	47
3.5.2 Coding of Samples.....	48
3.5.3 Serving the Samples for Organoleptic Analysis.....	48
3.6 Microbial Analysis.....	49
3.6.1 Materials.....	49
3.6.2 Procedure.....	49
3.6.3 Total Plate Count.....	50
3.7 Storage Studies.....	50
3.8 Shelf Life Evaluation.....	51
3.9 Statistical Analysis.....	51
<b>CHAPTER 04 – RESULTS AND DISCUSSION.....</b>	<b>52</b>
4.1 Preliminary Test.....	52
4.2 Nutritional analysis of Freshly Made Biscuits.....	53
4.2.1 Protein Content.....	54
4.2.2 Fiber Content.....	55
4.2.3 Fat Content.....	56



4.2.4 Moisture Content .....	57
4.2.5 Ash content .....	58
4.2.6 Total Sugar .....	59
4.3 Physical analysis of freshly made biscuit .....	60
4.3.1 Diameter.....	60
4.3.2 Spread Ratio.....	61
4.3.3 Thickness .....	61
4.3.4 Volume.....	61
4.3.5 Density .....	62
4.4 Sensory Evaluation of Freshly Made Biscuits .....	62
4.4.1 Texture .....	62
4.4.2 Colour .....	64
4.4.3 Taste.....	64
4.4.4 Flavour .....	64
4.4.5 Overall acceptability .....	65
4.5 Changes in Nutritional Characteristics of Biscuits during	
Storage at Ambient Temperature .....	65
4.5.1 Protein Content in Storage .....	66