

**Development of value added Noodle product with  
high fibre content**  
[with Kohila (*Lassia spinosa*) powder]

**By**

**A.A.S. Livera**

Thesis submitted to the University of Sri Jayawardenepura, Faculty  
of Applied Sciences, Sri Lanka, for the award of the degree of  
Master of Science in Food Science and Technology on 2006

## Declaration

The work described in this thesis was carried out by me under the supervision of Prof. Arthur Bamunuarachchi and Dr. K.K.D.S. Ranaweera, and a report on this has not been submitted in whole or in part to any University or any other institution for another degree or diploma.



A.A.S. Livera

We, Prof. Arthur Bamunuarachchi and Dr. K.K.D.S. Ranaweera, certify that the above statement made by the candidate is true and that this thesis is suitable for submission to the university for the purpose of evaluation.



(Supervisor)

Prof. Arthur Bamunuarachchi  
Coordinator  
Food Science & Technology Programme  
University of Sri Jayawardenepura,  
Nugegoda,  
Sri Lanka.



(Supervisor)

Dr. K.K.D.S. Ranaweera  
Coordinator  
Food Science & Technology Programme  
University of Sri Jayawardenepura,  
Nugegoda,  
Sri Lanka.

**Dedicated to my loving parents**

## Table of content

	Pages
List of Tables.	viii
List of Figures	viii
List of Charts	ix
List of Diagrams	x
List of Graphs	x
Abbreviations	xi
Acknowledgement	xii
Abstract	xiv-xv
<b>CHAPTER 1 – INTRODUCTION</b>	<b>1-3</b>
<b>CHAPTER 2 – LITERATURE SURVEY</b>	
2.1 <b>Definitions</b>	4
2.2 <b>Historical development of Noodles Technology</b>	4
2.3 <b>Classification of Noodles</b>	7-11
2.3.1 <b>Classification by Raw Materials</b>	7-9
2.3.1.I Japanese noodles	7
2.3.1.II Chinese type noodles	7
2.3.1.III Buckwheat noodles	7
2.3.1.IV Pea noodles	8
2.3.1.V Lentil noodles	8

2.3.1.VI	Wild rice mixture noodles	8
2.3.1.VII	Rice noodles	8
2.3.1.VIII	Kurakkan noodles	9
2.3.1.IX	Sweet potato starch noodles	9
2.3.2.	Classification by Size of Noodle Strands	9
2.3.3.	Classification by Method of Manufacturing	10
2.3.4.	Classification by the Form of Product on The Market	10-11
2.3.4.I	Uncooked wet noodles	10
2.3.4.II	Dried noodles	10
2.3.4.III	Boiled noodles	10
2.3.4.IV	Steamed noodles	11
2.3.4.V	Instant noodles	11
<b>2.4</b>	<b>Noodles Processing Technology</b>	<b>12-17</b>
2.4.1	Mixing	14
2.4.2	Sheeting & Combining	14
2.4.3	Rolling & Cutting	15
2.4.4	Steaming/ Boiling	16
2.4.5	Drying	16
2.4.6	Sterilization & Packing	17
<b>2.5</b>	<b>Ingredients used in Noodle manufacturing</b>	<b>17</b>
2.5.1.	Main Ingredients	18-25
2.5.1.I	Wheat flour ( <i>Triticum vulgare</i> )	22
2.5.1.II	Water	25

2.5.1.III	Salt	25
2.5.2.	Optional Ingredients	26
2.5.2.I	Sodium Bicarbonate	26
2.5.2.II	Sodium Carboxy Methyl Cellulose	26
2.5.2.III	Kohila powder	26-28
2.5.2.IV	Mung bean powder	28
2.4.2.V	Pumpkin powder	29
2.4.2.VI	Karapincha powder	30-31
<b>2.6</b>	<b>Importance of food analysis</b>	<b>32-43</b>
2.6.1	Moisture content of food	33
2.6.2	Ash content of food	34
2.6.3	Carbohydrates and Dietary fibre in food	35
2.6.3.I	Unavailable carbohydrates	36-40
2.6.3.II	Available carbohydrates	40
2.6.3.III	Glycemic Index	40-42
2.6.4	Protein content of food	43
2.6.5	Lipid content of food	44
<b>2.7</b>	<b>Cooking Test- Total Solids in Gruel</b>	<b>44</b>
<b>CHAPTER 3 –</b>	<b>EXPERIMENTAL</b>	<b>45</b>
3.1	Manufacturing Of Fibre Noodle With Kohila Powder	45
3.1.1	Flow Chart of production process	45
3.1.2	Processing Steps	46

3.1.2.I	Mixing and Kneading	46
3.1.2.II	Extruding	46
3.1.2.III	Steaming	47
3.1.2.IV	Drying	48
3.1.2.V	Cooling	48
3.1.2.VI	Weighing & Packing	49
3.1.3	Formulation for the production of Kohila Noodles	49-50
<b>3.2</b>	<b>Proximate Analysis</b>	<b>51</b>
3.2.1	Determination of Moisture content	49-51
3.2.2	Determination of Ash content	52-54
3.2.3	Determination of Carbohydrates & Dietary Fibre in Food	53-54
3.2.4	Determination of Crude Protein	55-56
3.2.5	Determination of Total Fat	57-58
<b>3.3</b>	<b>Microbiological Test for the product</b>	<b>59</b>
3.3.1	Media preparation	59
3.3.1.I	Preparation of PDA	59
3.3.1.II	Preparation of NA	60
3.3.1.III	Serial Dilution Method	60
3.3.2	Plating method	61
3.3.2.I	Pour plate method	61-62
<b>3.4</b>	<b>Sensory Analysis.</b>	<b>63-64</b>
<b>3.5</b>	<b>Cooking Test-Total Solids in Gruel</b>	<b>65</b>



<b>3.6</b>	<b>Cost of Production</b>	<b>66</b>
3.6.1	Variable Cost	66
3.6.2	Fixed Cost	66
3.6.3	Market Survey	66
<b>3.7</b>	<b>Clinical Analysis</b>	<b>67-68</b>
<b>CHAPTER 4 –</b>	<b>RESULTS AND DISCUSSION</b>	<b>69</b>
<b>4.1</b>	<b>Selected Formula</b>	<b>69</b>
<b>4.2</b>	<b>Proximate Analysis</b>	<b>69</b>
4.2.1	Determination of Moisture content	70
4.2.2	Determination of Ash Content	71-72
4.2.3	Determination Carbohydrates and Dietary fiber in food	73
4.2.4	Determination of Crude Protein	74-77
4.2.5	Determination of Total Fat	78
<b>4.3</b>	<b>Microbiological Tests for the Product</b>	<b>79-80</b>
<b>4.4</b>	<b>Cooking Test- Total Solids in Gruel</b>	<b>81</b>
<b>4.5</b>	<b>Cost of The Product</b>	<b>81</b>
4.5.1	Variable cost	81
4.5.1.I	For Raw materials	81
4.5.1.II	For Packaging	82
<b>4.6</b>	<b>Market survey of commercially available Noodle products</b>	<b>82-83</b>
<b>4.7</b>	<b>Sensory Analysis</b>	<b>84-90</b>
<b>4.8</b>	<b>Clinical Analysis</b>	<b>91-98</b>

<b>CHAPTER 5 -</b>	<b>CONCLUSION</b>	<b>99-100</b>
<b>REFERENCE</b>		<b>101-102</b>
<b>APPENDIXES</b>		
<b>Appendix I</b>	<b>Formula evaluation sheet</b>	<b>103</b>
<b>Appendix II</b>	<b>Test Reports</b>	<b>104-107</b>
<b>Appendix III</b>	<b>Sensory Evaluation sheets</b>	<b>108</b>
<b>Appendix IV</b>	<b>t – distribution</b>	<b>109</b>
<b>Appendix V</b>	<b>Request for the Ethical Clearance</b>	<b>110</b>
<b>Appendix VI</b>	<b>Application for the Ethical Clearance</b>	<b>111-112</b>
<b>Appendix VII</b>	<b>Volunteer’s Consent Form</b>	<b>113</b>
<b>Appendix VIII</b>	<b>Ethical Clearance Approval</b>	<b>114</b>

## **List of Tables**

- 2.1: Classification of Japanese noodles due to the size of the strands
- 2.2: Typical percentage composition of starch granules in cereal grains
- 2.3: Nutrient components in Wheat flour
- 2.4: Chemical composition of pumpkin – per 116gs of edible portion
- 2.5: Chemical composition of Curry leaf plant – per 100gs of edible portion
- 3.1 : Formulas used to produce the samples with Pumpkin powder
- 3.2 : Formulas used to produce the samples with out pumpkin powder
- 3.3 : Dilution series of the water samples for microbial growth
- 4.1 : Finally selected formula for the noodle production
- 4.2 : Tabulated results for Moisture content in the developed Noodle product
- 4.3: Tabulated results for Ash content in the developed Noodle product
- 4.4 : Tabulated results for Ash content in Drum dried Kohila powder
- 4.5 : Tabulated results for Crude Fibre content
- 4.6 : Tabulated results for Crude Protein content
- 4.7: Tabulated results for Total Fat
- 4.8: Average of the Total Plate Count
- 4.9 : Prices for raw materials
- 4.10 : Prices for Packing materials
- 4.11 : Market prices of commercially available products
- 4.12: Tabulated category scores for hedonic test
- 4.13: Tabulated category scores for hedonic test
- 4.14: (ANOVA scoring for Colour of two products)

- 4.15: (ANOVA scoring for Shape of the two products)
- 4.16: (ANOVA scoring for Taste of the two products)
- 4.17: (ANOVA scoring for Aroma of the two products)
- 4.18: (ANOVA scoring for Texture of the two products)
- 4.19: (ANOVA scoring for Overall Acceptability of the two products)
- 4.20: (The results of the sensory evaluation)
- 4.21 The physical data of each individual
- 4.22 Clinical analysis of the new product
- 4.23 Clinical analysis of the standard food product
- 4.24 Calculated GI values

### **List of Figures**

- 2.1: Manufacturing process of machine-made noodles
- 2.2: Flour mixing in noodle processing
- 2.3: A typical mixture with rotary shaft
- 2.4: Sheeting and Combining
- 2.5: Rolling & Cutting of noodles
- 2.6: Steaming noodles in a Steaming chamber
- 2.7: Drying in a drying chamber
- 2.8: Molecular structure of Amylose strand
- 2.9: Molecular structure of Amylopectine branched structure
- 2.10: Structure of free amylose molecule
- 2.11: Structure of free amylopectine molecule

- 2.12: Structure of a hybrid of amylose & amylopectine molecule
- 2.13: A General Amylograph (Temperature vs. Viscosity)
- 2.14 Albumin & Globulin
- 2.15 Gliadin
- 2.16: Glutenine
- 2.17: A Kohila plant
- 2.18: A Kohila Flower
- 2.19: Cleaned Kohila Rhizomes
- 2.20: Drum dried Kohila powder
- 2.21: A Drum drying machine
- 2.22: Mung beans
- 2.23: Mung bean powder
- 2.24: Pumpkin
- 2.25: Pumpkin powder
- 2.26: Karapincha (Curry leaf) plant
- 3.1: Components for the Sensory Analysis
- 3.2: Cooked Fibre Noodle product
- 3.3: Cooked Standard Kurakkan Noodle product

### **List of Flow Charts**

- 3.1 Flow Chart of the Production Process

## **List of Diagrams**

2.1 A Section of double Drum Dryer

## **List of graphs**

**4.1 Blood glucose levels of Volunteer No.1**

**4.2 Blood glucose levels of Volunteer No.2**

**4.3 Blood glucose levels of Volunteer No.3**

**4.4 Blood glucose levels of Volunteer No.4**

**4.5 Blood glucose levels of Volunteer No.5**

**4.6 Blood glucose levels of Volunteer No.6**

**4.7 Blood glucose levels of Volunteer No.7**

**4.8 Blood glucose levels of Volunteer No.8**

**4.9 Blood glucose levels of Volunteer No.9**

**4.10 Blood glucose levels of Volunteer No.10**

**4.11 Blood glucose levels of Volunteer No.11**

**4.12 Blood glucose levels of Volunteer No.12**

## Abbreviations

<b>SLS</b>	- Sri Lanka Standards
<b>FN</b>	- Fibre Noodles
<b>PDA</b>	- Potato Dextro Agar
<b>NA</b>	- Nutrient Agar
<b>spp.</b>	- Species
<b>DM</b>	- Diabetes Mellitus
<b>IDDM</b>	- Insulin Dependent Diabetes Mellitus
<b>NIDDM</b>	- Non Insulin Dependent Diabetes Mellitus
<b>DF</b>	- Dietary Fibre
<b>CMC</b>	- Carboxy Methyl Cellulose
<b>CFUs</b>	- Colony Forming Units
<b>MOs</b>	- Micro Organisms
<b>GI</b>	- Glycemic Index
<b>IAUC</b>	- Incremental Area Under Curve
<b>BMI</b>	- Body Mass Index

## ACKNOWLEDGEMENT

First, I wish to express my gratitude to my supervisors; Prof. A. Bamunuarachchi, Co-ordinator of the M.Sc programme in food science and technology, Faculty of Applied Sciences, Sri Jayawardenepura, Nugegoda and Dr. K.K.D.S. Ranaweera, The Head of the Department, Department of Food Science and Technology, Faculty of Applied Sciences, University of Sri Jayawardenepura, Nugegoda, for advising and directing me to conduct my research project for the above M.Sc programme.

Then, my sincere thanks for Dr (Mrs.) Sagarika Ekanayake, Seneior Lecturer, Dept. of Biochemistry, Faculty of Medical Sciences, USJ, for instructing me to conduct the clinical test with Ethical Clearance as a part of the research project. Also I'm very thankful to Dr. (Mrs.) Renu Wickramasinghe and the chairman of the Ethical Clearance Committee, FMS, USJ for providing me the Ethical Clearance for the Clinical Test.

Also, my special thanks for Mrs. Indra Wickramarachchi and Mr. Jagath Wansapala for advising me especially in some situations during the laboratory work.

Specially I am greatly indebted to all the individuals who appeared for the clinical study related testing by giving the consent with a great support and who took part on the tasting panel too.

Further more I make this opportunity to express my deepest appreciation to Mrs. P.R.D. Perera, Mr. W.S.K. Weerasinghe, Miss. Shiluka Perera and to Mr. D.P. Rupasinghe, the



staff members of the Dept. of Food Science & Technology, for giving me a great support on laboratory work. Especially for giving me courage with patience, should be highly appreciated.

Finally I would like to express my thanks with indebtedness to my family members, for encouraging and supporting me during this research project.

## **Development of value added Noodle product with high fibre content**

**By**

**A.A.S. Livera**

### **ABSTRACT**

Diabetes, a non-infectious disease has become a major health hazard in all over the world. Researches have found diabetes has been increasing due to the unfavorable diet habits of the people and due to the lack of exercises. Recently this disease has rapidly increased in Sri Lanka. As a third world country, Sri Lankan people haven't more chance to consume highly nutritious food.

Sri Lankans had been getting a perfect balanced diet from the habits of their ancients. Actually it is still a balanced diet, if the people used to spend the same life style as their ancients. The ancients had had the same balance diet and engaged in an active life style. But the modern Sri Lankans do not engage in an active behavior like the past. Also our ancients release their stress in medication and spending a simple life style. But now we do not have enough exercises and also have heavy diets with more refine food, precooked or ready to eat diets as well as oily food. These food types have high GI values. This life style has lead to increase the percentage of the diabetes patients in the nation.

Now the scientists have found that the dietary fibre content of the food, can affect the health of the people positively.

This attempt was taken to develop the food with higher amount of dietary fibre, but also to provide much balanced diet especially for elders, who are having diabetes or at risk levels. Therefore the research has considered on the other nutrients too.

*Lassia spinosa* (Kohila) which I considered as high fibre food type and used to increase the fibre content in the new product. Fibre content could be further developed by changing the Kohila powdering process. Raw mung bean powder is added to increase the protein content and it also a supplement of less amount of lipids too. Karapincha leaf powder is added due to its medicinal value.

The product has been subjected to chemical, sensory and clinical analyzing for the evaluation. The chemical analysis has compared with SLS of noodles products. Sensory evaluation provided the comparison of the flavour, Appearance and texture of the developed noodle product with compared to Harischandra kurakkan noodles. The texture has to be more developed for the acceptability of consumers. But other sensory properties were much accepted by them.

The cost of the product is much higher due to the cost for the powdering process of Kohila rhizomes. Other wise the raw materials do not cost much higher prices.

The product could be developed more with the requirement of the consumers. More research and development have to be carried out through the product promotional activities in the market.