DEVELOPMENT OF VEGGIE BALLS AS AN ALTERNATIVE PROTEIN SOURCE USING OYSTER MUSHROOM FLOUR INCORPORATED WITH VELVET BEAN SEED (*Mucuna pruriens*) FLOUR

By

K.A.T. VINODYA

Department of Biosystems Technology

Faculty of Technology

Eastern University, Sri Lanka

2025

ABSTRACT

The research focused on creating and assessing a protein product derived from a mixture of oyster mushroom flour (OMF) and velvet bean seed flour. (VBSF). Four different formulations (T_1-Control (100% OMF), T_2-80% OMF and 20% VBSF, T_3- 60% OMF and 40% VBSF and T_4 20% OMF and 80% VBSF) were developed and examined for their sensory characteristics, proximate composition, and microbial stability to identify the most preferable formulation. The sensory analysis indicated that T_3 received the highest overall acceptability score (8.6 ± 0.51), with evaluators praising its balanced umami and nutty flavors, inviting aroma, and smooth consistency.

Proximate analysis indicated that adding 40% VBSF significantly enhanced the protein level (48.00 ± 2.00%) in T_3 compared to the control (31.45%). The moisture content (88.00 ± 1.00%) also showed a significant increase, likely attributable to VBSF's ability to retain water, which improved the texture but could affect shelf life. The fat content in T_3 was lower (10.30 ± 0.20%), making it a nutritionally advantageous choice. The ash content did not change, implying that the mineral content remained largely unaffected by the inclusion of VBSF.

Shelf-life testing revealed that significant microbial spoilage occurred after 10 days of storage, with Total Plate Count (TPC) increased from 50 CFU/g (Day 0) to 20,000,000 CFU/g (Day 14). The pH gradually decreased from 6.2 to 4.3, reflecting microbial activity, while yeast and mold proliferation became noticeable after Day 10, leading to a decline in sensory quality. These results indicate that the veggie balls can ideally be stored for 7-10 days under the given storage conditions.

To prolong shelf life, suggested strategies include refrigeration, vacuum packaging, and incorporating natural preservatives to mitigate microbial growth while preserving sensory and nutritional quality. The research concludes that T_3 is a high-protein, plant-based option with promising potential for commercialization, contingent on enhancing storage and preservation methods.

Keywords- Alternative protein source, plant-based, Velvet bean seeds

TABLE OF CONTENTS

DECLARATION III

ACKNOWLEDGEMENT V

ABSTRACT VI

LIST OF TABLES XI

LIST OF FIGURES XII

CHAPTER 01 INTRODUCTION 1

1.1 Background 1

1.2 Problem statement 2

1.3 Rationale and Justification 2

1.4 Research Gaps 3

1.5 Objectives 3

2.1 Introduction to the plant-based meat alternatives 4

2.2 Overview of plant-based food market trends 5

2.3 The Importance of Meat Substitutes for Addressing Health, ecological, and Ethical Concerns 5

2.4 Familiar alternative vegan protein sources 5

2.5 Benefits of vegetarian diets vegetarian diets 6

2.6 Key Ingredients 7

2.6.1 Velvet bean 7

2.6.1.2 Antinutritional factors 8

2.6.1.3 Detoxification techniques 9

2.6.1.4 Application in the food industry 9
2.6.1.4.1 Bakery products 9
2.6.1.4.5 Production of Mucuna Bean Flour 10

2.6.2 Mushroom 11
Nutritional Composition of *Pleurotus ostreatus* 11

2.6.3 Other ingredients - Spices and additives 12
2.6.3.1 Garlic 12
2.6.3.2 Ginger 12
2.6.3.3 Salt 13
2.6.3.4 Chillie powder 13
2.6.3.5 Turmeric powder 13
2.6.3.6 Curry leaves 14
2.6.3.7 Pepper powder 14

CHAPTER 03 MATERIALS & METHODOLOGY 15

3.1 Research Design 15

3.2 Materials and Equipment 17
3.2.1 Raw materials and equipment needed for the preparation of veggie balls 17
3.2.2 Apparatus and Equipment Required for Analysis 17
3.2.3. Software tools 18

3.3 Methodology 18
3.3.1 Sample Collection and Preparation 18

3.3.2 Formulation of Veggie Balls 18
3.3.3 Preparation of Mushroom flour (Oven drying and grinding) 18
3.3.4 Preparation of Velvet bean seed flour 19
3.3.5 Preparation of Composite Flour 19

3.3.6 Preparation of veggie balls 19

3.5 Proximate Analysis 21
3.5.1. Determination of Moisture Content (Oven Drying Technique) 21
3.5.2. Determination of Fat content 23
3.5.3 Determination of Crude Ash content 24
3.5.4 Crude Protein Determination (Kjeldahl Method) 25
Procedure 26

3.5.4 Determination of Carbohydrate Content (By Difference) 27
3.6.1 Total Plate count: 28
3.6.2 Determination of Yeast and mold count: 29
3.6.3 Determination of pH: 30
3.7 Analysis of Data 30

CHAPTER 04 RESULTS AND DISCUSSION 31

4.1 Sensory Properties of Developed Veggie Balls 31

4.2 Proximate Composition Analysis 38
4.2.1 Protein Content 40
4.2.2 Ash Content 41
4.2.3 Moisture Content 42
4.2.4 Fat Content 42
4.2.5 Carbohydrate Content 42

4.3 Shelf-Life Analysis 43
4.3.1 Organoleptic Changes 43
4.3.2 pH Changes 43
4.3.3 Total Plate Count (TPC) 44
4.3.4 Yeast and Mold Count 47

CHAPTER 05 CONCLUSION AND RECOMMENDATIONS 48

5.1 Conclusion 48

5.5 Future Recommendations: 49

CHAPTER 06 REFERENCE 51

APPENDIX I 59