

TABLE OF CONTENTS

Chapter No	Title	Page Numbers
	Certificate	ii
	Declaration	iii
	Acknowledgement	iv
	Table of contents	vii
	List of tables	xii
	List of figures	xvi
	List of plates	xvii
	Abstract	xviii
1.	Introduction	1
1.1.	Novelty of the study	10
1.2.	Research hypothesis	10
1.3.	Scope of the study	10
2.	Review of Literature	12
2.1.	Triple Burden of Malnutrition-An Overview	12
2.1.1.	Meaning and Concepts	12
2.1.2.	Epidemiology and Prevalence of Triple Burden of Malnutrition	14
2.1.3.	Types of Triple Burden of Malnutrition	21
2.2.	Methods for assessing the nutritional status	28
2.2.1.	Anthropometry easurement	28
2.2.2.	Biochemical Estimation	31
2.2.3.	Clinical Examination	32
2.2.4.	Dietary Survey	33

Chapter No	Title	Page Numbers
2.3.	Effect of Nutrition Interventions-Nutrition Education and Dietary Supplementation on nutritional knowledge and nutritional status of Triple Burden of Malnutrition	34
2.4.	Nutritional significance and health benefits of the formulated Dietary Supplements	40
2.4.1.	Sprouts Tikki	40
2.4.2.	Nutriball	42
2.4.3.	Ragi Brownie	43
3.	Methodology	45
3.1.	PHASE-I: Incidence of Triple Burden of Malnutrition among Young Adult Women (18-21 years)	50
3.1.1.	Selection of the Study Area	50
3.1.2.	Selection and Identification of Subjects with Triple Burden of Malnutrition using the Validated Screening Tools.	50
3.1.3.	Formulation of research tools to conduct the study	51
3.1.4.	Analyze the status of Triple Burden of Malnutrition	51
3.1.5.	Ethical Consideration and Confidentiality	53
3.2.	PHASE -II: Mapping of subjects for Nutrition Interventions	53
3.2.1.	Conduct of the survey	53
3.2.2.	Assessment of nutritional status of the selected subjects	54
3.3.	PHASE - III Formulation and Evaluation of Dietary Supplements and Nutrition Education modules for Triple Burden of Malnutrition	60
3.3.1.	Formulation and Evaluation of the Dietary Supplements for Nutritional Intervention.	61

Chapter No	Title	Page Numbers
3.3.2.	Development and Validation of Nutrition Education Modules for Triple Burden of malnutrition	74
3.4.	PHASE -IV: Effect of Nutrition interventions on nutritional status and nutritional knowledge of Triple Burden of Malnutrition among the selected subjects	82
3.4.1.	Effect of Dietary Intervention on Nutritional Status of the selected subjects	82
3.4.2.	Effect of Nutrition Education on Nutritional Knowledge of the selected subjects in the study groups	85
3.5.	PHASE - V: Statistical Analysis and Interpretation of data	86
4.	Results and Discussion	87
4.1.	Socio- economic and Demographic profile, Life style pattern and Medical History of the selected subjects	87
4.1.1.	Socio-economic and Demographic Profile	87
4.2.	Nutritional status of the selected subjects	95
4.2.1.	Anthropometric Measurements	95
4.2.2.	Biochemical Profile	99
4.2.3.	Clinical Examination	101
4.2.4.	Quantitative Dietary Intake	102
4.2.5.	Triple Burden of Malnutrition among the selected subjects	113
4.3.	Formulation and Evaluation of Dietary supplements and Nutrition Education modules for Nutrition Interventions for Triple Burden of Malnutrition	114
4.3.1.	Formulation and Evaluation of Nutrition Education modules	114
4.3.2.	Formulation and Evaluation of the Dietary Supplements	115

Chapter No	Title	Page Numbers
4.4.	Effect of Nutrition Education on the Nutritional Knowledge of Triple Burden of Malnutrition among the selected subjects	135
4.4.1.	Knowledge, Attitude and Practice (KAP) Study	135
4.4.2.	Effect of Dietary Intervention on Nutritional Status of Triple Burden of Malnutrition among the selected subjects	153
4.5.	Association studies to assess the effect of Nutrition Interventions on Nutritional Status of the selected subjects	169
4.5.1.	Association between type of family and socio-economic status	169
4.5.2.	Association between occupation and socio-economic status	170
4.5.3.	Association between area of residence and type of transport	171
4.5.4.	Association between BMI and Nutrient intake of the selected Over-weight subjects in Experimental Group	171
4.5.5.	Association between BMI and Nutrient intake of selected Over-weight subjects in Control group	173
4.5.6.	Association between BMI and Nutrient intake of selected Under-weight subjects in Experimental Group	175
4.5.7.	Association between BMI and Nutrient intake of selected Under-weight subjects in Control Group	176
4.5.8.	Association between WHR and Nutrient intake of selected Over-weight subjects in Experimental group	178
4.5.9.	Association between WHR and Nutrient intake of selected Over-weight subjects in Control Group	179
4.5.10.	Association between WHR and Nutrient intake of selected Under-weight subjects in Experimental Group	179
4.5.11.	Association between WHR and Nutrient intake of selected Under-weight subjects in Control Group	181

Chapter No	Title	Page Numbers
4.5.12.	Association between Biochemical Profile and Nutrient Intake of selected subjects in Experimental Group before Nutrition Interventions	182
4.5.13.	Association between Biochemical Profile and Nutrient intake of the selected subjects in Experimental Group after Nutrition Intervention	183
4.5.14.	Association between Biochemical profile and Nutrient Intake of selected subjects in Control Group before Nutrition Intervention	185
4.5.15.	Association between Biochemical Profile and Nutrient intake of the selected subjects in Control Group after Nutrition Intervention	186
5.	Summary and Conclusion	187
5.1.	Objectives	187
5.2.	Salient Features of the research study	189
5.3.	Recommendations of the study	203
5.4.	Limitations of the research study	204
5.5.	Scope of the study	204
	Bibliography	206
	Annexure	
	Publication	
	Plagiarism Report	

LIST OF TABLES

Table No	Title	Page Numbers
I	Criteria for Selection of the Subjects	51
II	Grade of malnutrition based on BMI	55
III	Waist to Hip Ratio	57
IV	ABCD Techniques used to Assess Nutritional Status	60
V	Quantity of ingredients used in the three variations of Ragi Brownie	64
VI	Nutritional contribution and Health benefits of Ingredients used in Ragi Brownie	65
VII	Quantity of ingredients used in the three variations of Sprouts Tikki	66
VIII	Nutritional contribution and Health benefits of Ingredients used in Sprouts Tikki	67
IX	Quantity of Ingredients used in Variations of Nutri Ball	69
X	Nutritional contribution and Health Benefits of Ingredients used in Nutri Ball	70
XI	Procedures/Methods followed in Nutrient Analysis	73
XII	Socio –Economic and Demographic Profile of the selected subjects	88
XIII	Medical history of selected subjects	91
XIV	Lifestyle Pattern of the selected subjects	92
XV	Height Distribution of the selected subjects	96
XVI	Weight Distribution of the selected subjects	96
XVII	BMI Distribution of the selected subjects	97
XVIII	WHR Distribution of the selected subjects	99
XIX	Biochemical Profile of the selected subjects	100
XX	Clinical Profile of the selected subjects	101
XXI	Dietary Intake of selected subjects	103
XXII	Nutrient Calculation based on 24-hour recall of the selected subjects	106

Table No	Title	Page Numbers
XXIII	Frequency of food consumption pattern of the selected subjects	107
XXIV	Profile of Triple Burden of Malnutrition among the selected subjects	113
XXV	Dietary Supplements to meet the nutritional requirements	115
XXVI	Statistical Analysis of Sensory Evaluation of Sprouts Tikki	116
XXVII	Statistical Analysis of Sensory Evaluation of Ragi Brownie	118
XXVIII	Statistical Analysis of Sensory Evaluation of Nutri Ball	119
XXIX	Cost Calculation of Sprouts Tikki (ST1)	122
XXX	Cost Calculation of Ragi Brownie (RB1)	123
XXXI	Cost Calculation of Nutri Ball (NB3)	124
XXXII	Cost Comparison of dietary supplements and commercially available similar products	125
XXXIII	ICMR RDA for Sedentary working Woman	126
XXXIV	Nutrient content of Sprouts Tikki, Ragi Brownie and Nutri Ball	126
XXXV	Anti-Nutrient Analysis (Phytic Acid) of dietary supplements	128
XXXVI	Shelf-life analysis of Sprouts Tikki (ST1)	130
XXXVII	Shelf-life analysis of Ragi Brownie (RB1)	132
XXXVIII	Shelf-life analysis of Nutri ball (NB3)	133
XXXIX	Effect of Nutrition education on Knowledge of the selected subjects in Experimental Group	136
XL	Effect of Nutrition education on Knowledge of the selected subjects in Control Group	139
XLI	Effect of Nutrition education on Attitude of the selected subjects in Experimental Group	141
XLII	Effect of Nutrition education on Attitude of the selected subjects in Control Group	144
XLIII	Effect of Nutrition education on Practice adopted by selected subjects in Experimental Group	146
XLIV	Effect of Nutrition education on Practice adopted by selected subjects in Control Group	149

Table No	Title	Page Numbers
XLV	Effect of Nutrition Intervention on KAP study among the study groups	151
XLVI	Effect of Dietary Intervention on BMI of selected subjects in Experimental and Control groups	154
XLVII	Effect of Dietary Intervention on WHR of selected subjects in Experimental and Control groups	157
XLVIII	Effect of Dietary Intervention on Biochemical profile of selected subjects in Experimental and Control groups	161
XLIX	Effect of Dietary Intervention on incidence of Signs and Symptoms for various health problems among the selected subjects in Experimental and Control groups	165
L	Effect of Dietary Intervention on Clinical Profile and Health problems of selected subjects in Experimental and Control groups	166
LI	Effect of Dietary Intervention on 24 hour recall of selected subjects in Experimental and Control groups	168
LII	Association between type of family and socio economic status	170
LIII	Association between occupation and socio economic status	170
LIV	Association between area of residence and type of transport	171
LV	Association between BMI and Nutrient intake of Over-weight subjects in Experimental Group	172
LVI	Association between BMI and Nutrient intake of Over-weight subjects in Control Group	174
LVII	Association between BMI and Nutrient intake of Under-weight subjects Experimental Group	175
LVIII	Association between BMI and Nutrient intake of Under-weight subjects in Control group	177
LIX	Association between WHR and Nutrient intake of Over-weight subjects in Experimental Group	178
LX	Association between WHR and Nutrient intake of Over-weight subjects in Control group	179

Table No	Title	Page Numbers
LXI	Association between WHR and Nutrient intake of Under-weight subjects in Experimental Group	180
LXII	Association between WHR and Nutrient intake of Under-weight subjects in Control group	181
LXIII	Association between Biochemical Profile and Nutrient intake of selected subjects in Experimental Group before nutrition intervention	182
LXIV	Association between Biochemical Profile and Nutrient intake for Experimental Group after nutrition intervention	184
LXV	Association between Biochemical Profile and Nutrient intake of selected subjects in Control group before nutrition intervention	185
LXVI	Association between Biochemical Profile and Nutrient intake for Control group after nutrition intervention	186

LIST OF FIGURES

Figure No	Title	Page Numbers
1	Formulation of Dietary Supplements	62
2	Steps involved in developing Ragi Brownie	63
3	Steps involved in formulation Sprouts Tikki	67
4	Steps involved in preparation of Nutri Ball	69
5	Radar graph for Sensory Evaluation of Sprouts Tikki	117
6	Radar graph for Sensory Evaluation of Ragi Brownie	118
7	Radar graph for Sensory Evaluation of Nutri Ball	120
8	Level of Knowledge of the selected subjects in Experimental Group	138
9	Level of Knowledge of the selected subjects in Control Group	140
10	Level of Attitude among the selected subjects in Experimental Group	143
11	Level of Attitude among the selected subjects in Control Group	145
12	Level of Practice among the selected subjects in Experimental Group	148
13	Level of Practice among the selected subjects in Control Group	150

LIST OF PLATES

Plate No	Title	Page Numbers
1	Collection of Blood Sample	57
2	Ragi Brownie in three Variations (RB1, RB2 and RB3) with Standard	64
3	Different variations of Sprouts Tikki	66
4	Different variations of Nutri Ball	68
5	Sensory Evaluation	72
6	Booklet and Bookmarks for Nutritional Education	77
7	Subjects actively involved in healthy diet preparation as part of nutrition education	77
8	Online Exam for the Experimental Group Subjects (n= 250)	78
9	Sample of WhatsApp page used for Nutritional Education	79
10	Sample of WhatsApp used for Diet Counselling	80
11	Website Home page and Visits	81
12	Subjects involved in Supplementation Study	83
13	TPC Analysis of Sprouts Tikki for 4 th and 7 th day	131
14	TFC Analysis of Sprouts Tikki for 4 th and 7 th day	131
15	TPC Analysis of Ragi Brownie (RB1) for 7 th and 10 th day	132
16	TFC Analysis of Ragi Brownie (RB1) for 7 th and 10 th day	133
17	TPC Analysis of Nutri Ball (NB3) for 7 th and 10 th day	134
18	TFC Analysis of Nutri Ball (NB3) for 7 th and 10 th day	134