M.Sc. PROJECT AND DISSERTATION

ON

DEVELOPMENT OF LOW COST NUTRITIOUS PANJIRI FOR LACTATING WOMEN

DEPARTMENT OF FOOD TECHNOLOGY AND NUTRITION

SCHOOL OF AGRICULTURE

LOVELY PROFESSIONAL UNIVERSITY

INDIA

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PROJECT AND DISSERTATION PLAN PROPOSAL

Of the proposed Research Project for the degree of

MASTER'S OF SCIENCE

IN

NUTRITION AND DIETITICS

Name of the Research Scholar: Sandeep Kaur Parmar

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Name of the Supervisor: Dr. Vikas Kumar

Title of Research**: Development of low cost nutritious panjiri for lactating women.**

Signature of the Research Scholar**:**

Approved by Coordinator

CERTIFICATE

This is to certify that Sandeep Kaur Parmar (Registration $N_{O.}$ 11715292) has personally completed M.Sc. Pre-dissertation entitled 'DEVELOPMENT OF LOW COST NUTRITIOUS PANJIRI FOR LACTATING WOMEN' under my guidance and supervision. To the best of my knowledge, the present work is the result of hid original investigation and study. No part of per-dissertation has ever been submitted for any other purpose at the university.

The project report is appropriate for the submission and the partial fulfillment of the conditions for evaluation leading to the award of Master of Nutrition and Dietetics.

Date: May, 2018 Signature of Supervisor

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Table of Content

TOPIC: Development of low cost nutritious Panjeeri for lactating women.

CHAPTER 1: INTRODUCTION

According to WHO, malnutrition refers to deficiencies, excesses or imbalances in a person's intake of energy or nutrients. It contains two conditions .One is 'under nutrition' – which includes stunting (low height for age), wasting (low weight for height), underweight (low weight for age) and micronutrient deficiencies or insufficiencies (a lack of important vitamins and minerals).The other is overweight, obesity and diet related non-communicable diseases (such as heart diseases, stroke, diabetes and cancer).

Malnutrition is the leading risk factor to nearly 12% of all deaths and 16% of all disability-adjusted life years lost globally and one-third of all disability-adjusted life years lost in low – income countries .Various problems are associated with malnutrition like nutritional anemia ,failure to breastfeed ,suppressed immune system ,underweight and risk of death in women .This review focuses on the special considerations ,during the development of low cost panjeeri viz ,finding alternate sources of ingredients ,ensuring nutrition and sensory quality characteristics ,compliance with the regulatory guidelines ,economics and product.

Panjiri is a nutritious food product formed from the locally available flours of cereal grains and legumes such as wheat flour, soya flour, chickpea flour using household technologies like blending and roasting(Salve et al;2011).The cereals commonly used are wheat, rice, maize etc .Cereals usually provide energy 350 calories per 100g.Although they are relatively poor source of protein. Pulses are good source of protein (17%-24%) they provide vitamins, minerals and fibers as well. Pulses being rich in lysine and threonine, they complement the amino acid of cereal based diet(Kadam et al;2011).Soya multigrain panjiri contain a good source of essential amino acids and minerals like iron, calcium etc.(Gurwara et al;2016).The dietary supplementation in the form of soya multigrain panjiri proved to be useful in the improvement of cardiovascular efficiency(Agarwal et al;2016).This panjiri is also helpful in increasing the hemoglobin level among the women(Gurwara et al;2016).Supplementary foods like panjiri fortified with iron, vitamin A, iodine etc.helps to combat malnutrition and protein energy malnutrition in small children especially in developing countries(Prasad et

al;2015).Traditionally, panjiri can be modified so as to increase its micronutrient quality and to reduce the fat content with the aim of reducing the risk of obesity in mothers but benefitting the growth of infant(Kajale et al;2014).

CHAPTER 2. PROBLEM BACKGROUND

1. Lack of awareness among the rural and illiterate population regarding the necessity of nutritious foods during pregnancy and lactation.

2. Supplementary foods and fortified products are costly that cannot be afforded by poor people on daily basis.

3. Despite of high calorie diet, there may be deficiency of essential nutrients that enhance milk production during lactation.

4. Importance of nutrition and nourishment is usually misunderstood by ignorant people.

CHAPTER 3. PROPOSED RESEARCH OBJECTIVES

1. To conduct the survey regarding consumption of different foods during the lactating period.

2. To prepare a low cost product.

3. To study the storage stability of developed food product.

CHAPTER 4. REVIEW OF LITERATURE

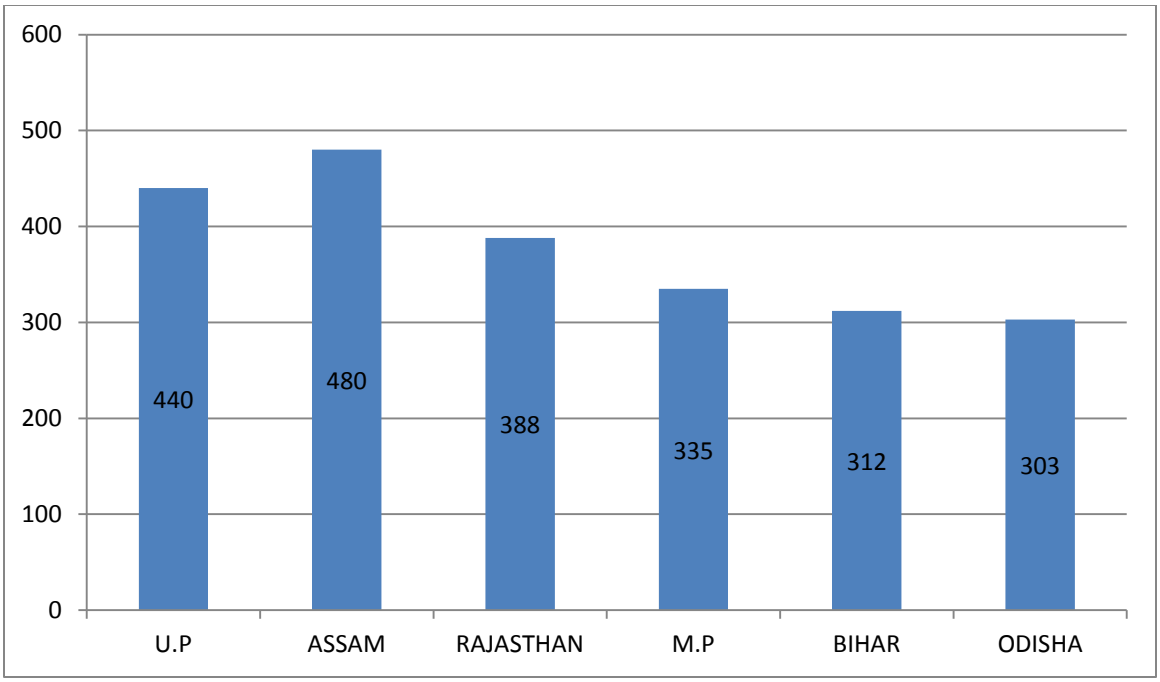
4.1 PREVALENCE

Malnourishment is more prevalent in poor and developing countries as compared to developed countries. In India, it occurs more in backward regions with low social economic status such as Bihar, Jharkhand, U.P .etc .Here the low living standard, illiteracy, ignorance leads to high infant and mother mortality and morbidity rates.

- Malnutrition results in various diseases such as anemia, osteoporosis, vitamin deficiency, jaundice in newborns etc .Hence there is need to develop more nutritious products that could nourish pregnant and lactating women.

Traditionally there are various health foods that are commonly eaten during pregnancy and lactation example methi dana, panjeeri, gond ke laddoo, ginger powder etc. Basically these are galactogogues. .Galactogogues are those food substances/products that enhance the milk production.

Maternal milk is considered the optimal feeding for the all babies. Breast milk is considered the best nutritious food as compared to formula feeding even in the case of pre-term birth .Poor breast milk production is the most frequent cause of the breast feeding failure. Pre-term birth, illness of mother, child mother baby separation, anxiety, fatigue and emotional stress are powerful inhibitors of lactation (Zuppa et al., 2010).



MMR: Maternal deaths per 1, 00,000 live births. SOURCE :(Registrar General of India, Survey Report 2006)

4. 2 EFFECTS OF MALNUTRITION

Anemia is the risk factor in number of health outcomes, including poor brain development, low immunity, against infection, maternal morality and endocrine malfunctioning.

Nutritional anemia occurs from inadequate availability of micronutrients required for hemoglobin synthesis, resulting in 841,000 deaths and 35,057,000 disability adjusted life years lost annually, predominantly in low-income countries .Underweight due to energy deficiency. Another form of chronic malnutrition is associated with poor birth outcomes ,inability or failure to breastfeed ,suppressed immune system , and increased risk of death in women .Underweight in children annually accounts for 3,748,000 deaths and 9.5% of all disability adjusted life years lost worldwide .The burden of chronic malnutrition falls disproportionately on the developing countries ,including India ;In 1998-1999 ,anemia afflicted 74% of children and 52% of women of child bearing age in India while 47% of children and 36% of women of child bearing were underweight . Recent studies show that prevalence of underweight remain unchanged that is 46% of children and 33% for women of child bearing age .While anemia increased 79% for children ,57% for women of child bearing age .(Ackerson et at .,2008)

CAUSES OF MATERNAL MORTALITY:

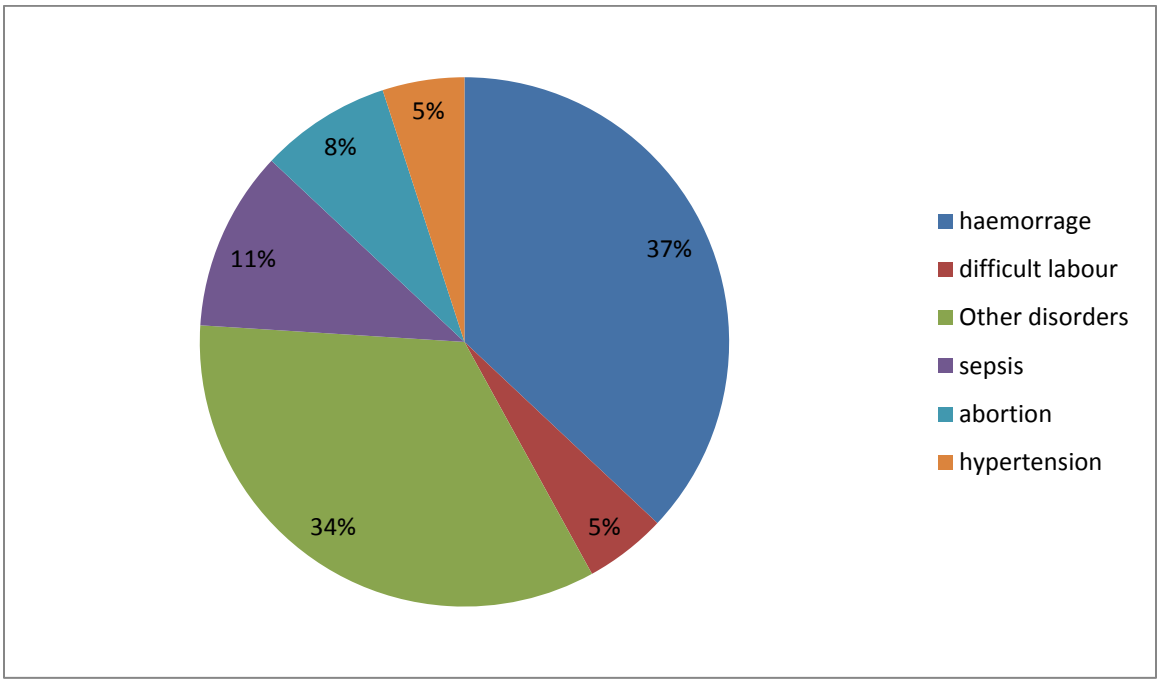


Figure: RESEARCH GATE (1997-2003)

4.3 IMPORTANCE OF DEVELOPING LOW-COST NUTRITIOUS PRODUCTS FOR PREGNANT AND LACTATING WOMEN

Different societies have different traditional belief regarding harmful and beneficial food for women during pregnancy .There are beliefs regarding amount of food taken during pregnancy for a successful reproductive outcome .These beliefs may or may not confirm adequate maternal nutrition and adequate growth of fetus along with safe delivery . Many studies have shown that the food taken by large section of pregnant women in India is deficient in caloric content ,protein, and nutrients-a leading cause of maternal and child mortality.

Three well known reasons for low nutritional status of pregnant women in India:

1. Widespread poverty

2. Discrimination against women and female children in household food distribution and health care.

3. Lack of poor quality of antenatal care (Andersen et al., 2007)

The belief of " eating down"- The belief that pregnant women should eat less or should not increase their diet during pregnancy so as to limit baby size and to avoid difficult a delivery ; is known to be common in India (Brems and Berg 1989).There is another concept of 'Hot' and 'Cold' foods.(Nag et al.,1994).In Indian society food items described as 'Hot' are often believed to be harmful for pregnant women and those perceived as 'Cold' believed to beneficial ; although in few communities effects are believed to vary in different stages of pregnancy and individual mindset. It is a common myth that there should be a balance maintained between hot and cold foods items consumed for proper well-being of the body.Since pregnancy generates a state of 'hotness' so only cold foods should be taken (Nichter 1989;Pool 1987; Ramanamurthy 1969).

Hot foods - Animal foods for example egg, fish, meat are called hot foods .They are bad because they make babies too large.

Cold foods- milk, yoghurt and butter milk are cold foods.

But in UP ghee is hot food still it is good for pregnant women as it produces blood and gives strength .Most fruits are called 'cold' in Gujarat ,Karnataka and U.P. but not in every state . For example in Karnataka, banana, papaya, jackfruit, pineapple and all unripe fruits are perceived as 'hot'. In Andhra Pradesh- banana, papaya and mango are perceived as 'hot'; only fruit 'cold' is coconut.

4.4 COMMON NUTRITIOUS PRODUCT AVAILABLE IN THE MARKET:

- 1.Sweet potato based nutritious food product(Salama et al., 2005)
- 2.Ready to eat nutritious snacks(Brennam et al., 2013)
- 3.Cow milk products(Snijders et al.,2008)
- 4.Fortified food and beverage products for pregnant and lactating women(Yang et al.,2011)
- 5.PUFA rich food products(Kolanowski et al.,2006)

- 6.Soya multigrain panjiri(Gurwara et al.,2016)
- 7. Fortified beverages to prevent maternal anemia and iron deficiency[Yang et al;2011]

There is strong need to introduce more and more nutritious product which could help to raise the nutritional status of pregnant and lactating women.

4.5 SIGNIFICANCE OF DEVELOPING LOW COST PANJEERI:

The nutritious food products available in the market are mostly costly, consumer unacceptable or beyond approach. Hence, my aim is to make low cost panjeeri which is nutritious food product of Punjab (India) origin for the pregnant and lactating women. It contains various ingredients like almonds, cashew, raisins, ghee, wheat flour, chickpea flour, sugar, gums, dried coconut etc. which are very expensive in market. Therefore it is extremely difficult for a poor man to afford such a nutritious product at convenient price tag. As during the development of product, these costly ingredients will be replaced by cheap, affordable, locally available alternate sources which contain approximately same nutritional composition as the original ones. This helps to reduce the overall cost and availability of the product.

4.6 COMMON DRAWBACKS ON NATIONAL NOURISHMENT SCHEMES:-

1. A big challenge is to eliminate leakages and corruption and ensure stringent monitoring in public distribution system.

2. The challenge is to ensure the sustained availability of food grains with public authorities in wake of the legal rights guaranteed to entitled beneficiaries.

3.Then is the long term challenge of qualitative improvement in food absorption, especially for women and children , by creating synergies between public health and sanitation ,education and agricultural intervention.

4. There is related key issue regarding the efficiency of food grain procurement and transportation, distribution.

5. Above all lay the problem of lack of awareness among the rural poor. Many ignorant people are not conscious about the various nutritional schemes of the government.

6. Till now, there has been difficulty in providing health facilities to the grass root level i.e. Villages, tribal areas, slums etc.

SPECIFIC CONSIDERATIONS:-

Preparation of low cost nutritional products for the pregnant and lactating women is a big challenge to the manufacturers as it has to take care of the affordability (cost), consumer acceptance, availability to general public etc. It has to stand along the guidelines approved by FDA (Food and Drug Administration).

To meet the Recommended Dietary Allowance (RDA) requirements:-

RDA is defined as "the average daily dietary nutrient intake level sufficient to meet the nutrient requirement of nearly 97%-98% healthy individuals in a particular life age". Indian Council of Medical Research (ICMR) has provided the RDA for different nutrients for each age group of Indian population.

RDA FOR PREGNANT AND LACTATING WOMEN IS AS FOLLOWS:

Group	Particulars	Body wt (kg).	Net energy(kcal/d)	Protein(g/d)	Visible Fat(g/d)	Calcium(mg/d)	Iron(mg/d)	Vit. A(µg/d)	B-carotene(µg/d)	Thiamine(mg/d)	Riboflavin(mg/d)	Niacin(mg/d)	Pyridoxine(mg/d)	Vit. C(mg/d)	Folate(µg/d)	Vit B12(µg/d)	Magnesium (µg/d)	Zinc(mg/d)
Woman	sedentary	55	1900	55	20	600	21	600	4800	1.0	1.1	12	2.0	40	200	1.0	310	10
	moderate	55	2230	55	25	600	21	600	4800	1.1	1.3	14	2.0	40	200	1.0	310	10
	heavy	55	2850	55	30	600	21	600	4800	1.4	1.7	16	2.0	40	200	1.0	310	10
	pregnant	55	+350	82.2	30	1200	35	800	6400	+0.2	+0.3	+2	2.5	60	500	1.2	310	12
	Lactating(0-6)	55	+600	77.9	30	1200	25	950	7600	+0.3	+0.4	+4	2.5	80	300	1.5	310	12

	(6-12) months	55	+520	70.2	30	1200	25	950	7600	+0.2	+0.3	+3	2.5	80	300	1.5	310	12

SOURCE: BOOK OF DIETETICS BY B.SRILAKSHMI; Edition 7; 2014

ECONOMICAL STATUS/COST OF THE PRODUCT

The ingredients used in the preparation of panjeeri are individually costly. So a person economically of low status cannot afford to have food items like almonds, cashew nuts etc. Thus there is a strong need to develop low cost nutritious product which should contain all the food items that enhance lactation/breast milk in lactating women. Hence, addition of these beneficial ingredients will further boost the health and immunity of the mother as well as the child.

COMPOSITION CHART

INGREDIENTS	POSITIVE EFFECTS	ALTERNATE SOURCES
1. Wheat flour	Easy to digest	Ragi
2. Dry fruits and nuts	Enhance lactation	Groundnut
3. Ghee	Source of saturated fat	Vegetable oil or refined
4. sugar	Increase calories and give sweet taste	Jaggery
5. Dry ginger(saunth)	Has anti-bacterial properties	Ginger peel
6. Butter	For increase in palatability	Refined oil
7. cumin	Rich source of calcium and iron	-
8. edible gums	Increase body heat and promotes milk production	-
9. fennel (saunf)	Increase lactation and digestion	-
10. carom seeds (ajwain)	Cleanse stomach and uterus	-
11.basil (tulsi)	Stimulate milk flow	-

CUMIN COMPOSITION: (Jassir et al, 1992)

PROTEIN	20.85%
FAT	38.20%
MOISTURE	4.64%
ASH	4.37%
CRUDE FIBRE	7.94%
CARBOHYDRATE	31.94%

ALMOND :(Venkatachalam et al; 2006) values per 100 g

Moisture	9.51±0.08gm
Fat	43.36±0.62gm

Protein	19.48±0.51gm
Ash	2.48±0.05gm
Carbohydrates	2.11±0.11gm

SUGAR/ SUGARCANE: (Kim et al, 2011)

Cellulose	42%
Hemi cellulose	25%
Lignin	20%

CAROM SEEDS: (Javed et al, 2012)

Carbohydrates	24.6%
Protein	17.1%
Fat	21.1%

BUTTER: (Sawaya et al; 1985)

Protein	24.7%
Fat	58.9%
Fiber	2.3%
Ash	3.0%
Moisture	<1.0%

EDIBLE GUMS FROM FRUIT PULP: (Leakey et al; 1999)

Protein	8.8%
Lipid	15.1%
Ash	3.4%
Carbohydrate	68.7%
Crude fiber	4.0%

COMPOSITION TABLE 1: (in %)

		Carbohydrates	Protein	Fat	Crude fiber	Ash	Dietary fiber	Dry matter	Moisture	Starch	Ref.
1.	Wheat flour	60-70	6.33-18.6	1.35-10.77	1.54	0.40-	33.4-63.0		8.1-12.7	9.10-	Curti et al;(2013

		69.4	12.1	1.7		1.48	1.9		12.2	38.9	) Laukova et al;(2016) National Institute of Nutrition
2.	Almond	10.5-54.87	11.52-20.8	21.76-58.9	5.09	6.76	1.7	97.70	5.2		Agunbiade et al;(2006) National Institute of Nutrition
3.	Ghee			100							
4.	Sugar	99.4	0.1	0					0.4		National Institute of Nutrition
5.	Cumin	31.94-36.6	18.7-20.85	15-38.20	7.94	4.37	59%; 12		4.64-11.9		Jassir et al;(1992) Sowbhagya et al;(2007) National Institute of Nutrition
6.	Butter	0	0-24.7	58.9-81.1	2.3	3.0	0		<1%-19.0		Sawaya et al;(1985) National Institute of Nutrition

7.	Carom seeds	24.6-38.6	17.1	21.1-21.8	11.9		21.2		7.4		Javed et al;(2012) Mishra et al;(2012) Dhiman et al;(2014)
8.	Edible gums	68.7	8.8	15.1	4.0	3.4					Leakey et al;(1999)
9.	Dry ginger	72.4	5.08-8.5	3.72-6.4		3.85-5.7					Prakash et al;(2010) Vasala et al;(2012)
10.	Dried dates	81-83.1; 75.8	2.5;5.17-5.56	10.19-12.67; 0.4		1.12-1.15	3.9		15.3		Berbes et al;(2004) National Institute of Nutrition
11	Dried coconut	18.4	6.8	62.3			6.6		4.3		National institute of Nutrition
12	Raisins	65.86-76.62;74.6	1.8	0.3			25-32; 1.1		20.2	32.37-37.33	Camire et al;(2003) Ghrairi et al;(2013) National

											Institute of Nutrition
13	Chick pea flour		22.5-24.1	4.8%							Sreerama et al;(2012)
14	Fennel (saunf)			68-135.7					7%		Gupta et al;(1995) Daset et al;(2013)
15	Green Gram	56.7	24.0	1.3			4.1		10.4		National Institute of Nutrition

TABLE NO.2

	CARBOHYDRATES	PROTEIN	FAT	CRUDE FIBRE	ASH	DRY MATTER	MOISTURE	STARCH	COST	REFERENCE
Corn		8.43-8.87	3-3.19	2.10-2.20	0.93-1.02		11.62-12.13			Brake et al;1997
Groundnut	1.81+_0.02	38.61+_0.07	47+_0.03	3.7+_0.03	3.8+_0.06		5.8+_0.04			Atasie et al;2009
Jaggery(molasses)	9.6(sucrose)	Crude 16.3 True-5	0.3-1.4	Nil	38.9	Organic matter=36	28.3			Waliszewski et al;1997
Lotus stem(seed)	81.74+_0.78	3.09+_0.08	6.67+_0.58	6.17+_0.58	2.33+_0.29		48.66+_0.29			Musa et al;2012
carrot	6-10.6	0.7-0.9	0.2-0.5	1.2-2.4	1.1		86			Sharma et al;2012

Carrot pomace	Ca-80mg/100g	Fe-2.2mg	Vit.c-4mg							
Ficus racemosa	15.84	1.475	Crude 1.079	0.544	11.86 (pulok et al 1999)		80.20			Bhogaonkerpy et al;2014
pomegranade peel	31.38+_0.30	8.719+_0.10	9.4+_0.1	21+_0.6	0.5+_0.14		4+_0.22			Ullah et al;2012
citrus peel		3.12-8.42	0.89-4.46	Dietary 44.2-89.2						Figuerola et al;2005

TABLE NO.3

PRODUCT NAME:	Supplementary food(panjiri)	Weaning food(panjiri)	Soya-based(panjiri)	Low cost food(infants)	Weaning foods using malted cereals for infants (panjiri)
REFERENCES:	Salve et al.;2011 Hussain et al;2012	Dubey et al.;2012 Masoodi et al;2012	Sadana et al.;2008 Rosset et al;2012	Puri et al.;1984	Srivastava et al.;2015
COMPOSITION:		(containing wheat flour 100g)			
Fat	1.9-4.5%	-	23.1 g	-	5.89-6.42 g
Protein	16.2-21.1%	10.4 g	11.6 g	12.5 g	13.5-20.35 g
Carbohydrates	67.66-77.2%	86.4 g	62.4 g	-	75.8-82.98 g
Ash	0.7-1.40%	0.85±0.03%	4.36±0.05%	-	-
Moisture	8.63±0.37%	5.2 g	7.17±0.04%	2 mg	-
Fibre	1.28-1.78%	2.8 g(crude)	-	-	-
Calcium	AverageMean 115mg/100g	56 mg	108 mg	-	46.2-96.4mg
Iron	Average Mean	7.2 mg	4.42 mg	4 mg	5.23-7.21mg

	4mg/100g				
Vit.c	-	-	-	-	-
SENSORY EVALUATION:					
Texture	8.6	7.76-8.64	4.05±0.08	7.30-7.40	7.76-8.64
Colour	8.2	7.8-8.84	4.33±0.15	7.10-7.80	7.8-8.84
Taste	8.2	7.64-8.6	4.38±0.12	7.20-8.10	7.32-7.72
Appearance	-	-	4.05±0.08	7.30±0.15	-
Overall acceptability	8.6	7.77-8.64	4.19±0.11	7.23-7.65	7.77-8.64

CHAPTER 5: RESEARCH METHODOLOGY

EXPERIMENT 1:

Development of questionnaire: A questionnaire will be prepared consisting of 15- 20 questions including the general or personal information of the respondents.

Conduction of survey: The questionnaire will be developed and offline survey will be conducted by visiting various residential colonies of slum dwellers and daily laborers in Jalandhar and adampur cities of Punjab. Questionnaires will be filled by the respondents to obtain information regarding the various aspects. A total number of 100 randomly chosen respondents will be chosen to participate in the study and to complete the form.

List of locations selected for conducting offline survey:

S.NO.	CITY/TOWN	LOCATION
1.	Jalandhar	Cantt.
2.	Adampur	Dana Mandi
3.	Phagwara	LPU campus

QUESTIONNAIRE:

1. NAME-
2. AGE-
3. SEX/GENDER-
4. BODY WEIGHT-
5. HEIGHT-
6. BMI-
7. FOOD HABITS-
8. INCOME(FROM ALL SOURCES)-
9. WHAT ARE YOUR DIETARY HABITS?
   A) VEG
   B) NON-VEG
10. DO YOU CONSUME ANY SPECIAL LACTATING FOOD?
    A) YES
    B) NO
11. DO YOU HAVE ANY DEFICIENCY DISORDER?
    A) YES
    B) NO
12. DO YOU HAVE ANEMIA/BLEEDING PROBLEMS?
    A) YES
    B) NO

13. HOW IS YOUR BREASTFEEDING PATTERN?
    A) NORMAL
    B) ABNORMAL
14. WHAT IS YOUR BABY'S HEALTH STATUS?
    A) GOOD
    B) NOT GOOD
15. HOW IS THE MOTHER'S PHYSICAL CONDITION?
    A) HEALTHY
    B) WEAK

EXPERIMENT 2:

OPTIMIZATION OF . PROCESS FOR THE PREPARATION OF NUTRITIOUS PANJIRI

Different blends would be prepared using corn flour, peanuts, lotus stem, refined oil; jaggery etc.The concentrations will be prepared using response surface methodology.

PARAMETERS TO BE OBSERVED:

1. Energy content (Bomb calorimeter)

2. TSS (Ranganna, 2007)

3. Titratable acidity (AOAC, 2004)

4. pH (pH meter)

5. Antioxidant (Brand and Williams, 1995)

6. Tannin (AOAC, 2004)

7. Carbohydrate (Sadasivam, 1991)

8. Protein (Lowry method)

9. Flavonoid (Sadasivam, 1991)

10. Sodium (Flame photometer)

11. Potassium (Flame photometer)

12. Calcium (Flame photometer)

13. Viscosity (Viscometer)

14. Sensory analysis (Amerine et al.; 1965)

EXPERIMENT 3:

Shelf life estimation of the developed product. Storage study will be performed on the best treatment obtained from the above experiment2.

Sr. No	Packaging material	Storage conditions	Storage duration (Month)
1	Laminated aluminum pouch	Ambient	0
2	Poly labs	Refrigerated	1
3			2
4			3

Total number of treatments = 2X2X4= 16

Number of replication = 3

EXPERIMENT 4:

To study the consumer acceptance of the developed product.

CHAPTER 6: EXPECTED OUTCOMES

1. Trend of food consumption in lactating women.

2. Low cost food for lactating women.

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