# Development of instant health mix from sesame oil cake and spent malted finger millet and oats grains

**Dissertation 2 Report**

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**May, 2018**

# CERTIFICATE

This is to certify that **Manisha Gautam** (Registration No. 11719778) has personally completed M.Sc. dissertation 2 entitled **"Development of instant health mix from sesame oil cake and spent malted finger millet and oats grains"** under my guidance and supervision. To the best of my knowledge, the present work is the result of her original investigation and study. No part of dissertation has ever been submitted for any other purpose at any University.

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

Date: 14 May, 2018

Signature of Supervisor

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## DECLARATION

I hereby declare that the work presented in the pre-dissertation report entitled **"Development of instant health mix from sesame oil cake and spent malted finger millet and oats grains"** is my own and original. I have carried out the work at School of Agriculture, Lovely Professional University, Phagwara, Punjab, India under the guidance of **Dr. Ashwani Kumar,** Assistant Professor (Food Technology) of School of Agriculture, Lovely Professional University, Phagwara, Punjab, India, for the award of the degree of Master of Science in Food Technology.

**Date:** 14 MAY, 2018 **Manisha Gautam**

**Place:** Phagwara, Punjab (India) **Registration No. :** 11719778

I certified that the above statement made by the student is correct to the best of my knowledge and belief.

**Place:** Phagwara, Punjab (India) **Dr. Ashwani Kumar**

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## CONTENT:

## 1 . INTRODUCTION

Food waste is produced in several periods agricultural production and processing , manufacturing and distribution. From household activities 40-42% ,in food industries 35-39%, and in food service sector 12-14% and 5% during distribution. of waste is produced. Till 2020, it is expected that food waste will increase upto 126Mt (Mirabella *et al*.,2014).

Food waste has been identified as the major challenge faced by humanity today. To alleviate the increasing demand for production it is necessary to significantly reduce food waste. (Derek *et al*.,2016). Food waste or by-products mostly refers to palatable sustenance items which is proposed for the motivations behind human utilization. A country like India with huge population cannot afford to waste food at such a high rate. The wastes and by products obtained from the food industries are rich in several nutrients dietary fat-products and co-products of fruits and vegetables industries. (Helkar *et al*.,2016). Grains handling by items are enhanced with wellsprings of vitamins, minerals, cancer prevention agent mixes like polyphenols, vitamin E , tocotrienols and carotenoids (Helkar *et al*.,2016). The results obtained from the marine business are an incredible source of nutraceuticals and bioactives, and these can be separated/confined and added to a scope of sustenances in this manner redesigning helpfulness of the nourishments regarding human wellbeing (Helkar *et al*.,2016).

Sesame (*Sesamum indicum L.)* being the most ancient crops and oilseeds known , it belongs to the Pedaliaceae family. It is also known as til, gingelly, simsim, benniseed, sesame and ajonjoli Bedigian and Van der Maesen, 2003). Sesame is enriched with both medicinal and nutritional benefits. After the extraction of oil, the by-product obtained is the sesame oilcake (Onsaard *et al* 2012). The composition of the nutrient constituent obtained from sesame meal are carbohydrate 28.17%, 7.92% moisture, 27.83% fat, 6.22% fiber, 30.56% protein and 5.27% ash content . (De Padua, 1983; Onsaard *et al*., 2010) . This meal can be utilized as a rich wellspring of the protein ingredient in the sustenance business.

Finger Millet(*Eleusine Coracana*) is commonly known as Ragi which is one of the important millet in India. In finger millet the nutrient content is very much higher to major cereals grains like Wheat, Rice and Maize. (Fao, 2005).

Ragi is higher in content of minerals and dietary fiber than wheat, rice and is balanced with adequate protein. Finger Millet is also enriched with calcium and other minerals. (Thapliyal and Singh, 2015).

Within cereals, oat ranks sixth in world production. Annual world production of oats was 23.82 million MT in 2013 (FAO 2014). Russia had the highest oat production in the world at 4.93 million MT followed by Canada (3.88 million MT) and Australia (1.12 million MT). In India, almost 1.0 lakh hectares of land is under oats cultivation as a fodder crop (ICAR 2006).

Healthfully oats are an incredible wellspring of solvent fiber as beta-glucans, alpha-tocopherols, B vitamins, minerals, proteins and plant fats. Around 80 percent of aggregate oat lipids are unsaturated fat lipids. Oats contain one of a kind cancer prevention agents(antioxidants), called avenanthramides, and in addition with tocotrienols and tocopherols (Young 1986).

## 2 . PROBLEM BACKGROUND

A large chunk of Indian population is experiencing ailing health problems such as malnutrition. Among these protein, calcium and iron deficiency are most prevalent. In the present scenario it is not possible to meet the prerequisites from milk and other staple cereals. In this manner, there is a need to create affordable instant nutrient dense health foods by utilizing alternative crops. In this regard sesame oilcake and finger millet represents huge scope due to richness in protein, calcium and iron.

## 3. REVIEW OF LITERATURE:

In India to alleviate the demand of food production it is necessary to reduce the food waste. This decrease can enhance the general effectiveness of the nourishment supply chains to meet the developing demands of the population. The waste of food simultaneously result in loss of time and efforts, fertilizers, pesticides , soil and water resources and several other resources that went into production of that food. (Derrek *et al*.,2016). Every food product goes through a life cycle, which starts from the farm and progess through the processing, its distributuion, retailing and finally the consumption and dumping or the wastage, this reveals that food waste occuring throughout the entire food supply chain.

**Table 1.** The major food processing industry in India their production and wastage:

| **Food Crops** | **Total Production** | **Processing (%)** | **Wastage** | **Loss in rupees (crores)** |
|---|---|---|---|---|
| Grains | 270.10MT | 34% | 6% | 24,575 |
| Milk | 146.3 MT | 16% | 0.8% | 4,409 |
| Fruits and vegetables | 282.5 MT | 4% | 18% | 4,0811 |
| Meat and Poultry | Buffalo meat-1.4MT<br>Goat meat- 0.91MT<br>Broiler meat- 4.2MT<br>78.4 billions | 10% | 2.3%<br>3.9% | 6,497 |
| Marine products | 13 MT | 4% | 2.9% | 8,081 |
| References: | Indiabusiness.nic.in, Ministry of Agriculture, Directorate of Statistics, APEDA, Indiastat , Meat & Poultry Processing Board, FAOSTAT, Assocham , Department of Animal Husbandry, Dairying & Fisheries, Economic Times (US Department of Agriculture) | Source:Indiainfoline; Bloomberg | Source : (CIPHET) | Source: (CIPHET), Ludhiana (2014-2016) |

Abbreviation : MT( Million tonnes) ; CIPHET - Central Institute of Post Harvest Engineering and Technology (CIPHET), Ludhiana

### 3.1. SESAME SEED OILCAKE:

One of the most essential oil seed crop in the world is Sesame (*Sesamum indicm L.*)seed crop. Aside from being an imperative oilseed source, sesame seed is a potential wellspring of proteins (Onsaaard et al). Sesame seed contains 40-50% oil, 20-25% protein, 20-25% carbohydrate and 5-6% ash (Salunkhe *et al*., 1992). While after the extraction of the oil from the seeds the oilcake has a sythesis of 7.92% moisture, 27.84% fat, 30.55% protein, 6.21% fiber, 5.28% ash and 28.15% sugar. The defatted sesame oilcake constitutes protein (41.15-49.59%) (De Padua 1983; Onsaard *et al*., 2010). The crude protein content in ghani cake is extended from 35 to 39.10% which was bring down when compared to solvent extracted oilcake (41 – 45%) and expeller cake (39.10 – 47.10%). The content of crude fibre in ghani cake ranged from 2.4 to 4.2%, which was likewise lower when compared to the solvent extracted sesame oilcake (7 – 7.2%) and expeller cake (4.7 – 9.97%). Though there is no distinction in calcium and phosphorus in any three sorts of cake

**Table 2. NUTRITIONAL COMPOSITION OF SESAME SEED:**

| **Nutrient** | **Quantitiy(%)** |
|---|---|
| Moisture | 04.0- 05.2% |
| Protein | 18.2-25.4% |
| Oil | 43.0- 44.3% |
| SaturatedFattyAcids (% inoil)<br>Monounsaturated Fatty Acids<br>Polyunsaturated fatty acids<br>Ash<br>Glucose<br>Fructose<br>Sucrose<br>Phytosterols | 14.0%<br>39.0%<br>46.0%<br>05.2-06.2%<br>03.2%<br>02.6%<br>0.2%<br>0.4% |

(Bawa et al.,2010)

### 3.2. FINGER MILLET

Nutritionally, finger millet stands unique among cereals because of its enriched nutritional qualities. It is a high-quality source of calcium (344mg/100g), phosphorus (283mg/100g), other minerals and fibre (Singh and Raghuvanshi 2012). The content of finger millet ranged from 72-79.5% of carbohydrate, protein content 5.6-12.70% (Bhatt *et al.*,2003) and fat content is between 1.2-1.4% (Seetharam 2001). The starch content in finger millet up to 60-90% (Mittal 2002) and the essential amino acid content of the total amino acid is 44.7 (Mbithi *et al.*, 2000). Though finger millet is lower in fat content, it is higher in content of poly unsaturated fatty acids such as oleic acid , palmitic acid and linoleic acid (Antony *et al* .,1996).

### 3.3. OATS- MULTIFUNCTIONAL GRAIN

Oats are recognized as functional grains as they possess several phytochemicals, notably, β-glucan. Most of the product development work on oats has been focused on utilizing their functionality due to β-glucan. These are found to occur naturally in cereals such as oats, barley, rye, wheat, mushrooms, yeasts (baker's yeast *Saccharomyces cerevisiae),* algae and phytoplankton, Islandic moss (lichen), Brown seaweed (*Laminaria spp*) and gram negative bacteria (Izydorczyk and Biliaderis 2000). β-glucan has excellent cholesterol lowering properties.

## 4. PROPOSED RESEARCH OBJECTIVE

1. Quality evaluation of the raw materials.
2. Process parameters will be optimized to reduce the anti-nutrients content of sesame oil cake.
3. Process optimization for the development of instant health mix.
4. Quality evaluation of the prepared product.
5. Shelf life of the final product.

## 5 . PROPOSED RESEARCH METHODOLOGY

### 5.1. Experiment 1: Quality evaluation of the raw materials

**A. Raw Materials to be used**

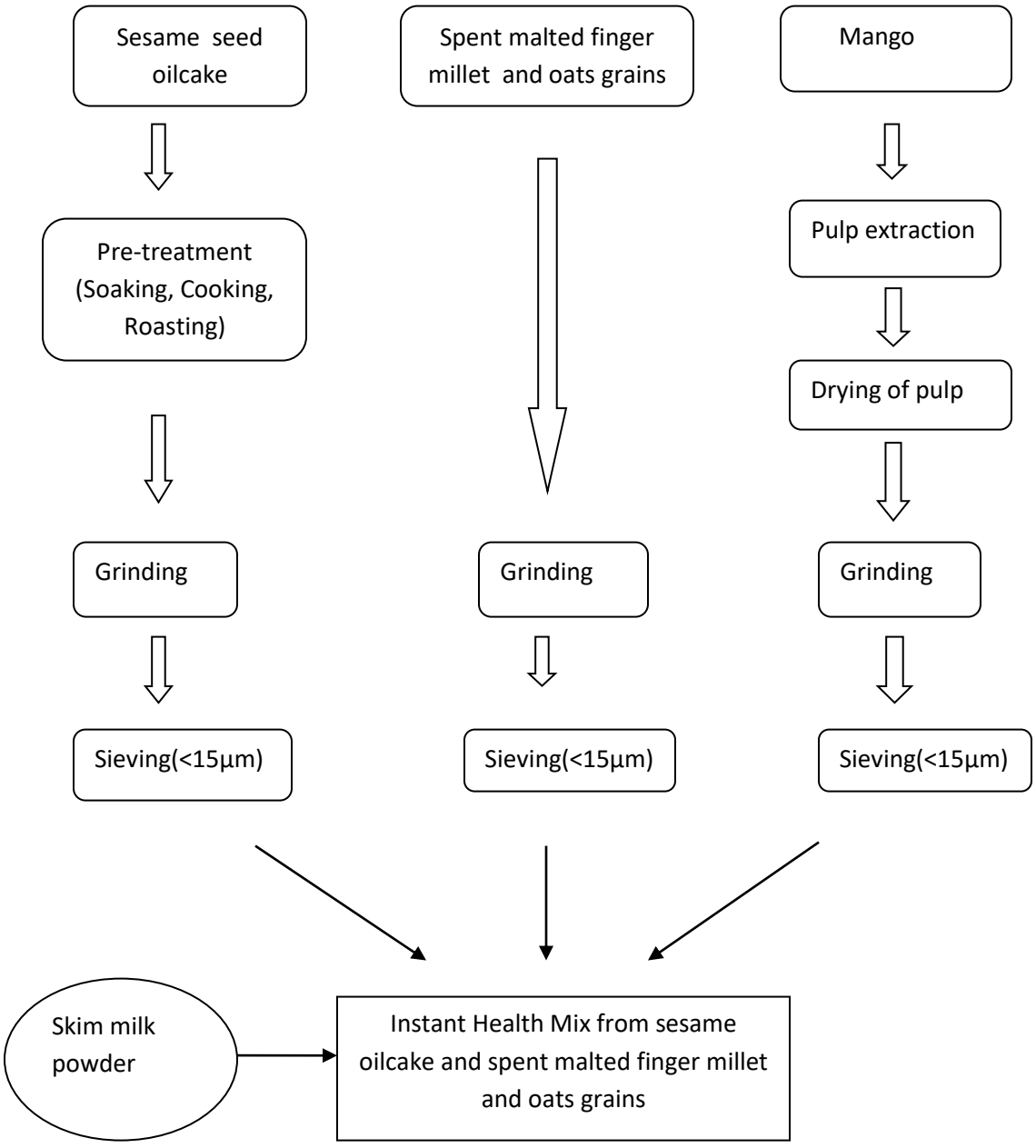
a. Sesame oilcake

b. Spent finger millet and oat malt

**B. Flavourant**

a. Mango

Fig. P



**C. Tests to be performed**

a. Moisture content ( Olawuni et al. 2013)
b. Protein ( *AOAC 2000* (Mundi et al. 2012)
c. Fats (*Soxhlet extraction method)*
d. Ash ( Elezabeth and Subhramnian, 2013)
e. Crude fiber (*AOAC 2000)*
f. Dietary fiber ( Van Soest and Wine (1967), AOAC 991.43)

**Bioactive compounds**

a. Total phenols (Sakakibara et al. 2003)
b. Flavonoids ( Elizabeth and Subhramnian, 2013 )
c. Anthocyanins ( Elizabeth and Subhramnian ,2013)
d. Phytates (AOAC 98611-1988)
e. Oxalates (Moureau & Savage 2009)
f. Tannins (Ricci et al. 2015)
g. Mycotoxins ( Elizabeth and Subhramnian, 2013)

## 5.3 Experiment 3: To reduce the antinutrient content of Sesame Oilcake

### 5.3.1. Bioactive compounds

a. Total phenols (Sakakibara et al. 2003)
b. Flavonoids ( Elizabeth and Subhramnian, 2013 )
c. Anthocyanins ( Elezabeth and Subhramnian ,2013)
d. Phytates (AOAC 98611-1988)
e. Oxalates (Moureau & Savage 2009)
f. Tannins (Ricci et al. 2015)
g. Mycotoxins ( Elizabeth and Subhramnian, 2013)

### 5.2. Experiment 2: Development of instant health mix

Treatments will be selected on the basis of RSM design and the best treatment will be selected for further studies.

| | Factor 1 | Factor 2 | Factor 3 | Factor 4 | Response 1 | Response 2 | Response 3 | Response 4 | Response 5 | Response 6 | Response 7 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Run | A:Skim Milk | B:Sesame oil Cake | C:Malt Residue | D:Mango Pulp powder | Viscosity | Sedimentation | Flowability | Colour | Taste | Aroma | Overall acceptability | |
| | g | g | g | G | | | | | | | | |
| 1 | 50 | 30 | 30 | 3.5 | | | | | | | | |
| 2 | 40 | 20 | 20 | 5 | | | | | | | | |
| 3 | 50 | 50 | 30 | 3.5 | | | | | | | | |
| 4 | 60 | 20 | 40 | 5 | | | | | | | | |
| 5 | 50 | 30 | 30 | 3.5 | | | | | | | | |
| 6 | 40 | 40 | 20 | 2 | | | | | | | | |
| 7 | 40 | 20 | 40 | 5 | | | | | | | | |
| 8 | 50 | 30 | 30 | 3.5 | | | | | | | | |
| 9 | 60 | 20 | 40 | 2 | | | | | | | | |
| 10 | 50 | 30 | 30 | 3.5 | | | | | | | | |
| 11 | 40 | 20 | 20 | 2 | | | | | | | | |
| 12 | 60 | 20 | 20 | 2 | | | | | | | | |
| 13 | 60 | 40 | 20 | 2 | | | | | | | | |
| 14 | 50 | 10 | 30 | 3.5 | | | | | | | | |
| 15 | 50 | 30 | 30 | 6.5 | | | | | | | | |
| 16 | 50 | 30 | 50 | 3.5 | | | | | | | | |
| 17 | 50 | 30 | 30 | 3.5 | | | | | | | | |
| 18 | 40 | 40 | 40 | 5 | | | | | | | | |
| 19 | 50 | 30 | 30 | 0.5 | | | | | | | | |
| 20 | 50 | 30 | 10 | 3.5 | | | | | | | | |
| 21 | 60 | 40 | 40 | 5 | | | | | | | | |
| 22 | 30 | 30 | 30 | 3.5 | | | | | | | | |
| 23 | 50 | 30 | 30 | 3.5 | | | | | | | | |
| 24 | 40 | 20 | 40 | 2 | | | | | | | | |
| 25 | 60 | 40 | 20 | 5 | | | | | | | | |
| 26 | 60 | 20 | 20 | 5 | | | | | | | | |
| 27 | 40 | 40 | 20 | 5 | | | | | | | | |
| 28 | 40 | 40 | 40 | 2 | | | | | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 29 | 70 | 30 | 30 | 3.5 | | | | | | | | |
| 30 | 60 | 40 | 40 | 2 | | | | | | | | |

## 5.4.Experiment 4 : Quality Evaluation of Prepared Product

### 5.4.1. Proximate composition

a. Moisture ( Olawuni et al. 2013)
b. Protein *AOAC 2000* (Mundi et al. 2012)
c. Fats (*Soxhlet extraction method)*
d. Ash ( Elezabeth and Subhramnian ,2013)
e. Crude fiber (*AOAC 2000)*
f. Dietary fiber ( Van Soest and Wine (1967), AOAC 991.43)

### 5.4.2. Bioactive compounds

h. Total phenols (Sakakibara et al. 2003)
i. Flavonoids ( Elizabeth and Subhramnian, 2013 )
j. Anthocyanins ( Elezabeth and Subhramnian ,2013)
k. Phytates (AOAC 98611-1988)
l. Oxalates (Moureau & Savage 2009)
m. Tannins (Ricci et al. 2015)
n. Mycotoxins ( Elizabeth and Subhramnian, 2013)

### 5.4.3. Sensory Evaluation

Final product will be evaluated for the sensory characteristics on the basis of 9 Point hedonic scale and composite sensory scale.

**A. Sensory analysis:**

A 9 point hedonic scale will be used to evaluate the experimental samples using 100 semi trained panelists. Healthy male and female of suitable age will be selected for the evaluation.

a. Color and appearance
b. Flavor and sweetness
c. Body and texture
d. Mouthfeel
e. Overall acceptability

| Expression | Points to be assigned |
|---|---|
| Liked extremely | 9 |
| Liked very much | 8 |
| Liked moderately | 7 |
| Liked slightly | 6 |
| Neither liked nor disliked | 5 |
| Disliked slightly | 4 |
| Disliked moderately | 3 |
| Disliked very much | 2 |
| Disliked extremely | 1 |

| Sample code | Color and appearance | Flavor and sweetness | Body and texture | Mouth feel | Overall acceptability | Remarks (if any) |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |

Optimized product will be obtained using the above experimental setup.

**B. Mean Sensory score on composite sensory scale for the Health Drink:**

| Sensory attributes | Possible score | Mean Score ± SD | Number of Judges |
|---|---|---|---|
| Appearance | | | |
| Consistency | | | |
| Flavor | | | |
| Absence of defects | | | |
| Total Score | | | |

## 5.5. Experiment 4: Microbiological Study

a. TPC (Total Plate Count)

b. Yeast Count

c. Mould Count

## 6 . EXPECTED RESEARCH OUTCOME

1. Value added products from sesame oilcake and spent malted finger millet and oats grains with acceptable sensory, physical and chemical parameters is obtained.
2. It will be adequately beneficial as there is utilization of waste from the sesame oilcake and spent malted finger millet and oats grains as the food wastage has been identified as the major challenge faced by humanity today. To alleviate the increasing demand for production it is necessary to significantly reduce food waste and utilize their by-products which can be a good economic source for the food industries .

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