Ministry of Food Processing Industries
Government of India

NIFTEM
KNOWLEDGE • INNOVATION • OUTREACH

PM Formalisation of

Micro Food Processing Enterprises Scheme

HANDBOOK OF PREPARATION OF PULSES

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ABBREVIATIONS & ACRONYMS

Sr:No.	Abbreviations &Acronyms	Full Forms
1.	PM FME	Prime Minister's Formalization of Micro Food Processing Enterprises Scheme
2.	HACCP	Hazard Analysis and Critical Control Point
3.	RDA	Recommended Dietary Allowance
4.	MUFA	Mono Unsaturated Fatty Acids
5.	USD	United States dollar
6.	FSSAI	Food Safety and Standards Authority of India
7.	FBO	Food Business Operator
8.	FLRS	Food Licensing and Registration System
9.	PFA	Prevention of Food Adulteration
10.	MoFPI	Ministry of Food Processing Industries
11.	FPOs	Farmer Producer Organizations
12.	SHGs	Self Help Groups

CHAPTER -1

INTRODUCTION

Pulses are one of the extensively consume crop across the world because of availability and low cost. On tracing the consumption pattern, it is very next to cereals. Pulses belong to "*Leguminoseae*" family. According to FAO, Pulses are merely defined as dry edible seeds harvested from crop belonging to *leguminoseae* family. Most common variety of pulses grown in India is chickpea, mung bean, black gram and pigeon pea. India also imports pulses from Canada, USA, Myanmar and Australia (Khandelwal, Udipi, & Ghugre, 2010).

Three type of protein is present in pulses viz, Albumin, Globulin and Glutenin. Globulin is the major protein constituent (70%) soluble in salt water solution. It exists in rigid form because of the presence of disulphide bonds and thus digested slowly. On the basis of sedimentation co-efficient, Globulin is further classified into 7S and 11S. Albumin constitutes 10-20% of pulse protein. They are readily soluble in water and digested easily. Glutenin are soluble in acidic or basic solutions and are of high nutritional importance as they are abundant in cysteine and methionine. Recent studies have shown pulse protein to contain Prolamins in trace amount. These are alcohol soluble (Bessada, Barreira, & Oliveira, 2019).

1.1 IMPORTANCE OF PULSES

Pulses are known widely as the cheapest source of protein present on earth. Nutritional aspect of pulses will be further discussed in the paper. Each and every legume crop has an additional responsibility of fixing nitrogen to meet their necessity. Many a times, when crops like cereals, which lack the ability of fixing nitrogen, are planted alongside pulses they harbor nitrogen from the adjacent plant for growth and development. Pulses supports sustainable agriculture as it decreases carbon footprint and water footprint as well by restricting the release of greenhouse

gases. Other parts of pulse plant are used animal feed. They also possess great potential to emerge as a substitute to ethanol used in fuel(Lal, 2007).

1.2 NUTRITIONAL BENEFITS OF PULSES

Pulses also have carbohydrate (50-55%) but these are digested at slow rate so has low Glycemic Index. GI of pulse can be altered by the method of processing opted. Pulses are storehouse of dietary fibre. In about half serving of pulses, 7g of fibre is present. In country like India, pulses are consumed alongside cereals this is because an essential amino acid lysine is deficient in cereal but abundant in pulses. Similarly, pulses are low on amino acids tryptophan, methionine and cysteine but cereals have high concentration of these amino acids. So consuming pulses and cereals together help consumer to balance their nutrition profile and ingest high quality protein. Pulses are abundant source of micronutrients such as selenium, zinc, niacin, folate and riboflavin. Pulses are also known to be rich in Iron usually the pulses which are white in color but absorption of iron is low because of the presence of phytate complex. Pulses are dense in vitamin A and E. Germinated legumes are rich in vitamin C and have enhanced absorption of all minerals. Pulses are free from cholesterol, gluten and are not famously known as food allergen (Mudryj, Yu, & Aukema, 2014). These also exhibits anti-oxidant activity and scavenges free radical (Pal, Bhartiya, Kant, & Aditya, 2020).

Nutritional composition of common pulses is depicted in the following table:

TABLE 2: NUTRITIONAL COMPOSITION OF PULSES (Meda, Orsat, Shirhatti, Mcrae, & Dubé, 2018)

Pulses	Energy	Carb.	Fibre	Protein	Fat	Calcium	Iron
Black bean	298	39	22	22	1.5	113	8.1
Yellow pea	307	45	20	18	1.45	62	5.33

Chick pea	340	49	19	22	5.96	150	9.4
Cow pea	332	48	11.5	20	9.5	128	6.2
Mung bean	322	41	18	20	1.45	98	4.98
Mungo bean	312	45	19	24	1.66	118	8.11
Lentil	320	40	15	25	3.55	75	9.22

1.3 IMPORTANT FUNCTIONAL ATTRIBUTES OF PULSES

Functional properties are of prime importance as these properties determine the behavior of a substance in food system during processing, storage and ingestion. Emulsifying, solubility, gelation, water holding capacity, foaming ability are few of the functional properties which explains proteins collaboration with other important molecules like carbohydrates, fats, protein and water present in food system. Factors like polarity, size of molecule, conformation and sequence of amino acids have critical effect on functional attribute of pulse protein. These properties are efficiently exploited by food industry for development of many more novel food products. Some of the important functional properties are discussed below:

1.3.1 SOLUBILITY

Solubility is a critical parameter and sometime a pre-requisite for other properties which are used in food industry. Solubility of protein is compromised at pH near to isoelectric point. At Isoelectric point, protein gets precipitated as total charge on protein becomes zero. Solubility of protein should be very high to be used in food preparation. Studies have proven that thermal treatment of protein can result in enhanced solubility (Bessada et al., 2019).

1.3.2 WATER ABSORPTION CAPACITY (WAC) & FAT ABSORPTION CAPACITY (FAC)

WAC refers to the amount of water that 1g of protein can take up. Similarly, FAC of protein is the amount of fat that 1g of protein flour can absorb. Both these properties are of prime importance as these significantly affect the organoleptic quality of food. Polar amino acids are related to WAC and Non polar amino acids related to FAC. Generally pulse protein is found to have high FAC value (desirable as it increases palatability of food) and WAC value ranging from 1.3 -3.5g/g (Bessada et al., 2019).

1.3.4 EMULSIFYING PROPERTY

Due to the amphiphilic nature of protein, they make for an excellent emulsifier in many food formulations. Emulsifier is used to keep two immiscible liquids as an emulsion. Studies have reported to have found pulse protein has a great potential to be used as emulsifier in industry. Protein at low pH (near pI) has low solubility and low emulsifying activity. Recent studies have proved that protein from pea, chickpea and lupin possess emulsifying property (Bessada et al., 2019).

1.3.5 FOAMING PROPERTY

Foaming properties cover both Foaming ability and foaming stability. Foaming capacity is the amount of air that can be incorporated into protein and foaming stability is the ability of protein to hold stable foam over time. Albumin rich fraction of pulse protein is found to be an excellent foaming agent (pea and lupin) almost a suitable counterpart for egg and soy.

1.3.6 GELLING PROPERTY

Gelation refers to the ability of protein to form gel. The ability of gel to hold water, lipid, sugar and many more components is the index of a good gel. The strength of gel depends upon the amount of protein used. Soy protein is always considered as reference protein because of its gelling ability. Protein obtained from lupin has weak gelling property but possess excellent thermal stability.

Functional properties can be altered depending on drying and extraction conditions, application of processing techniques, storage and handling environment.

1.3.7 POST HARVEST LOSSES

It is always a delight for farmers to see a field ready to harvest. But it is upsetting after harvesting, if farmers are unable to protect their produce and it gets spoiled before delivering to consumers. Pulses are also not exempted from this loss. Pulses are non-perishable crop but because of high protein content they are susceptible to attack by insects and pests if not stored properly.

Post-harvest system of pulses includes harvesting, threshing, processing, milling and storage. In each stage, some losses keep happening. Improper handling and management of crop after harvest is the leading culprit of huge post- harvest loss.

Some of the most common losses are mentioned in the table below :

LOSSES AT DIFFERENT STAGES OF POST HARVEST SYSTEM

STAGE	**TYPE OF LOSS**
AFTER HARVESTING	Pest or rodent attacks

DRYING	Insufficient drying leads to microbial attacks (mould growth)
THRESHING	Inappropriate threshing leads to shattered grains and broken pulse grain attracts more insect infestation.
STORAGE	Improper storage conditions are thriving place of insects, rodents, pests and microbes
MILLING	Increased broken grains and powdered pulses
TRANSPORTATION	Loss in weight of product
PACKAGING	Defective packing leads to loss in quantity and quality of crop

In pulses, post- harvest loss is about 25%. About 15 % losseshappen during milling and storage stage. Post- harvest losses occurring in pulse production and handling can be broadly divided into three categories:

1.3.8 WEIGHT LOSS

This loss in weight may happen due to changes occurring in physical conditions of commodity because of absorption of moisture, reduction of moisture content, pest infestation and improper packaging (leaks, spillage) (Lal, 2007).

1.3.9 QUALITY LOSSES

Clean and wholesome pulses have high demand in market. These parameters are taken as quality criteria to standardize the quality of pulses. Changes in color or odor can be detected easily. Following criteria can be assessed to check the quality of grain:

a) Free from impurities or debris
b) Uniform acceptable color
c) Appropriate moisture content
d) No odor
e) Absence of pests and micro-organisms.

1.3.10 PHYSICAL DEFORMITIES

Changes in shape and size of pulse grain, presence of broken, damaged, foreign grains, stones, excreta, debris or pebble in the produce are the common deformities present.

1.3.11 ORGANOLEPTIC LOSSES

Organoleptic properties play an important role in consumer acceptance and consumption. Change in aroma or taste can hamper the sale of grain in market. Other factors that compromise the sensory and nutritional aspect of pulse grain are presence of pesticides, herbicides and microbial toxins.

1.3.12 ECONOMIC LOSSES

If the produce does not sell well then all the energy which was put into their production goes waste, example, production cost, infrastructure, labor cost, transportation cost and storage facilities charges all have to be paid by the farmers. Thus, huge loss is incurred due to spoiled pulse grains.

1.3.13 WAYS TO CURB POST-HARVEST LOSSES IN PULSES

Depending upon the grain selected the loss percentage differs or changes. Many factors such as climate, processing methods, variety of pulses affects the extent of loss. In post-harvest system, losses can be minimized by modifying threshing, storage, handling and transportation processes.

I. Threshing

In this stage, there is about 0.5 – 0.6 % losses. To eliminate these losses, these operations should be completed in limited time span with help of improved technology.

II. Transportation

In this stage, 0.5% loss is incurred during travel from field to market. Efficient and fast transportation and effective packaging helps to curb losses.

III. Processing losses

Losses in this process are 1%. Improved techniques should be adopted to reduce losses and increase output. Proper training of personnel's can also solve the issue at hand.

IV. Storage losses

Major losses in India happen during storage phase. About 10-15 % loss happens, this loss is attributed to inefficient storage. Huge losses are incurred due to microbial spoilage and infestation by pests, insects and rodents. Proper scientific storage facilities should be provided to preserve pulses in proper and acceptable form.

Few preventive measures can be adopted by pulse farmers to curb these losses:

1. Harvesting should be done when crop reaches maturity
2. Harvesting method employed should be appropriate.
3. Improved technology and equipment should be used.
4. Modern processing techniques should be used.

5. To save money, cleaning and grading should be done at low price.

6. Excellent packaging technology should be used.

7. Proper storage conditions.

8. Proper and efficient transportation and handling system

CHAPTER -2

PROCESS AND MACHINERY REQUIREMENT

2.1 PROCESSING OF PULSE

In spite of all the goodness pulses have, there is also another side to story i.e. pulses is slow to cook, has low digestibility and possess many anti-nutritional factors which hinders the absorption of nutrients. To overcome these cons of pulses, processing is done to improve texture, taste, and flavor, bio-availability of nutrients, decrease anti-nutritional compounds, enhanced anti-oxidant activity and decreased microbial activity. Few processing techniques generally undertaken are splitting, soaking, germination, drying, roasting, fermentation and cooking.

Processing affects the physical, chemical and nutritional makeup of pulses and a good understanding on the changes brought about through processing can help use processing techniques to their fullest potential.

2.1.1ROASTING

In roasting, heat from a hot surface is given to food and simultaneously moisture from food is let out into air and then moist air is exhausted out from roaster. After moisture removal, series of browning and caramelisation reactions follows. Different roasting methods are available – sand roasting, microwave roasting, micronization/ infrared roasting and continuous spiral roasting.

2.1.2 SOAKING

In soaking, simply the pulse grains are soaked in tap water in ratio 1:5 v/v for 12 hours at room temperature. After 12 hours, grains are washed properly and drained (Khandelwal et al., 2010).

2.1.3 COOKING

Raw pulses are never consumed. Most of the time, they are cooked using thermal processing techniques to bring in changes in texture, aroma, taste, flavor and nutritional availability. In this review, main focus would be on steaming, boiling and autoclaving or pressure cooking of pulses.

2.1.4 GERMINATION

This is a very simple and cheap method of processing. Bioactive compounds availability is increased when pulse is germinated. A safe and better alternative to conventional thermal cooking of pulses which results in loss of many heat labile nutrients. The germination process is initiated when seed breaks out from its inactive state when it comes in contact of water. When out of dormant stage bioactive compound becomes alive and starts synthesizing more phytochemicals and phenolic. These compounds enhances the bioavailability of nutrients and also have numerous health promoting benefits (López-martínez et al., 2017).

2.1.5 FERMENTATION

Fermentation is a process which has been used by humans since time immemorial but it is only recently that the process has gained attention for food processors because of the ability of this process to enhance digestibility of protein. Fermented pulses has reduced level of ANFs, improved flavor, texture, taste, aroma, increased synthesis of amino acids and bioactive compounds.

2.2 MACHINERIES

Steps	Machine Name	Description	Machine Image.
Gram Delivery	Unloading Bins	These are large bins designed for unloading of Grams & similar product; they are equipped with large rod mess to prevent big impurities from entering system.	
Storage	Storage Tank	These Equipments are class of storage Equipments which are specifically designed for dry Dal or similar products (Raw material) of small granule composition. Usually used to store grains but can also be used to store cement & aggregate.	
Pre-Cleaning	Vibrating Pre-Cleaner	It's used to remove various foreign agents like dust, sticks etc; from required gram so as to reduce load on successive machinery.	
Cleaning	Aspirator	It's a more fine-tuned separator designed to remove finer impurities like remaining dirt, similar sized impurities, leaves etc.	
De-stoning	De-stoner	Remove the pebbles and another small foreign particle from the Gram seed.	

Grinding	Heavy-duty Pulverizer	It's a grinding class Machine, used for grinding grams to a fine powder.	
Sifting	Sifter	This machine used for screening, sieving, grading Besan flour.	
Packaging	Automatic packaging machine	It's a simple packaging machine, designed to fill the given food grade plastic material's continuous pouch with required product after sealing one end & after filling sealing the other end also to generate packet of product.	

2.3 ADDITIONAL MACHINE & EQUIPMENT

Machine	Definition	Image
Disc Separator	It's a separator class machine, generally used to remove foreign grains from required grain efficiently	
Magnetic Separator	It's a type of separator which is used to magnetic impurities from given product using powerful electromagnets, used in wide range of industries for separation.	
Food Grade Conveyor	These are conveyors with food grade belt to maintain food safety standards set by monitoring authorities.	

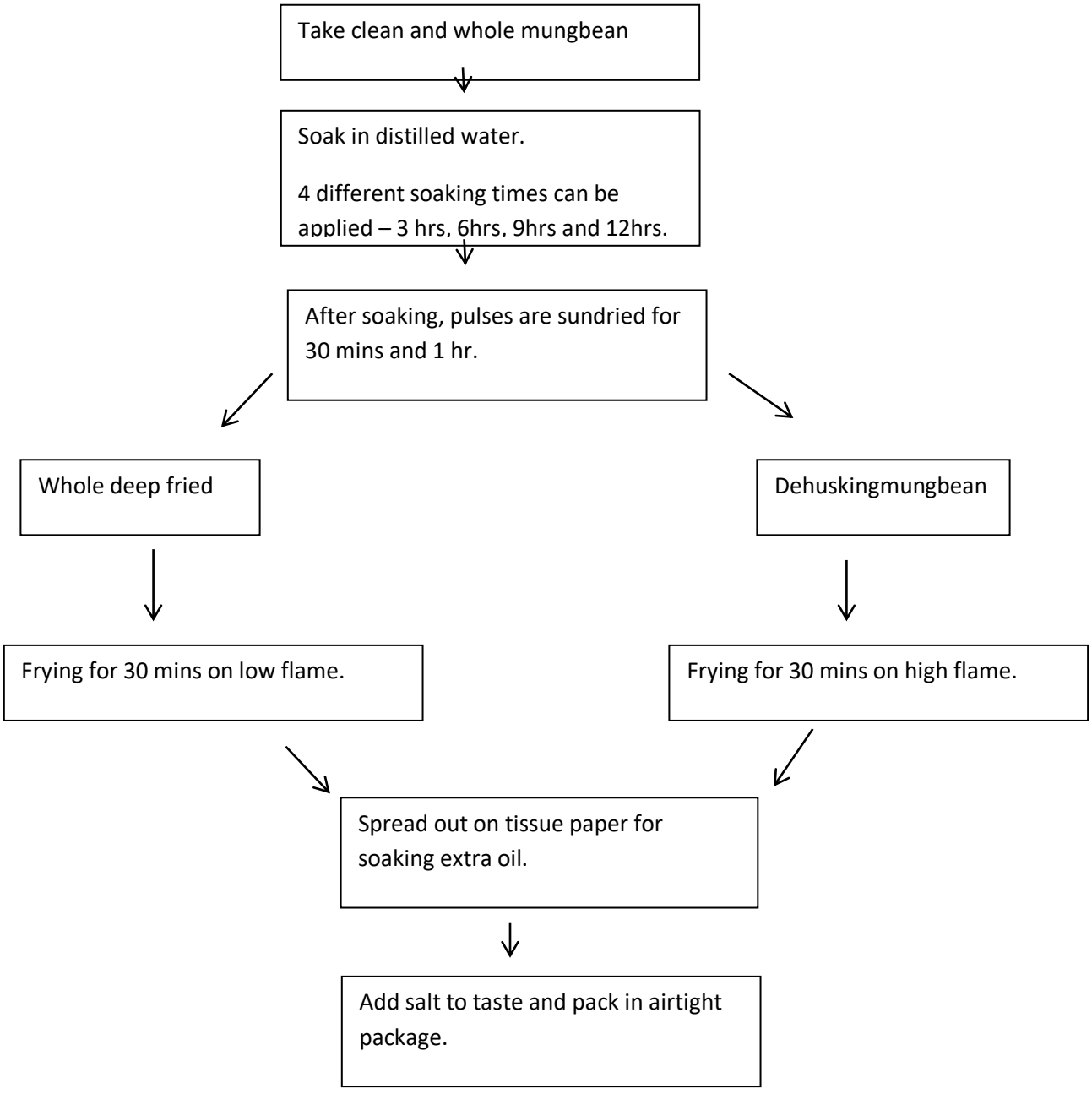
2.4 GENERAL FAILURES & REMEDIES

S. No.	General Failures	Remedies
1.	Ball bearing failure of various machine	1. Proper periodic lubrication of all bearings in various machines. 2. Regular replacement of all bearing to prevent critical failures.
2.	Power Drive Overload	1. Ensure proper weighing & metering specially in case of semi-automatic plant. 2. Install warning sensor in buffer region of loading capacity to ensure efficient operation.
3.	Mechanical Key Failure	1. Ensure that mechanical keys are replaced as per there pre-defined operational life. 2. Prevent Overloading.
4.	Loss of Interface	1. This problem is dominant in newly established automatic plant, one must learn to maintain rules in plant & ensure no employee goes near transmission lines, unless authorised. 2. Provide proper physical shielding for the connections.
5.	Hulling	Gram has the whole- hull intact. Extra cleaning required for Gramm flour milling to sift out the impurities (dirt, chaff, etc.)

2.5 MUNG BEAN BASED SNACKS

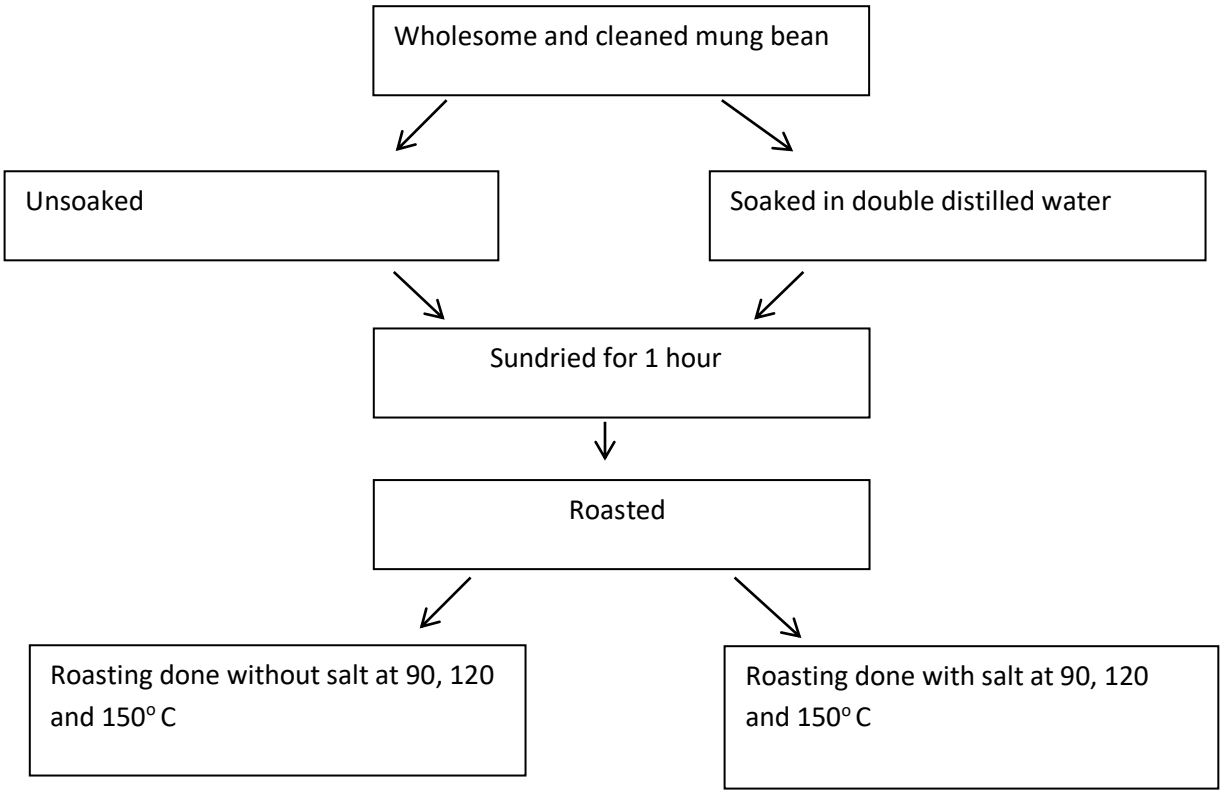
- **WHOLE FRIED NAMKEEN AND DEHUSKED NAMKEEN**

FLOWCHART (Raghuvanshi, Singh, Bisht, & Singh, 2011)



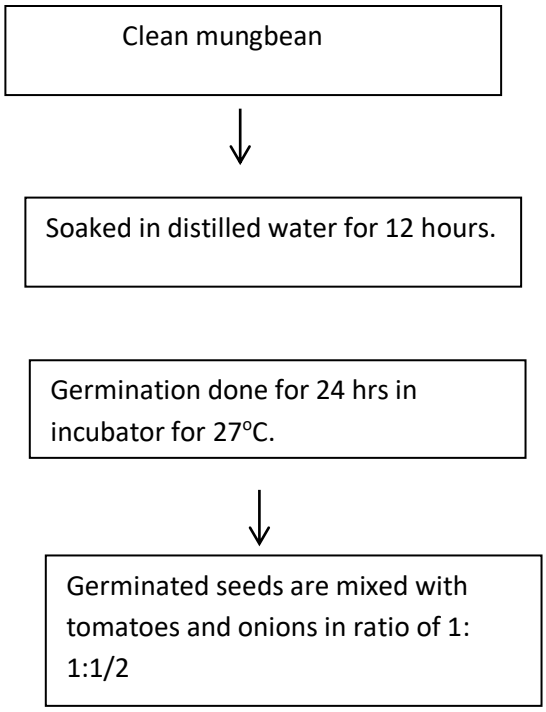
- **ROASTED NAMKEEN**

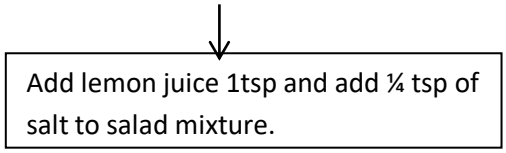
FLOWCHART (Raghuvanshi, Singh, Bisht, & Singh, 2011)



- **SPROUTED MUNGBEAN SALAD**

FLOWCHART (Raghuvanshi, Singh, Bisht, & Singh, 2011)





Dehusked fried namkeen showed greater reduction in moisture. Total ash content represents mineral content and it was highest in roasted and whole namkeen. This is because husk was not removed. Germinated sample used for salad exhibited low mineral content of 3.97 % because mineral was leached into water and this water was later drained off. Thermal processing reduced calcium content but germination resulted in enhanced calcium content. Iron content was seen to reduce in fried namkeen but increased in roasted namkeen.

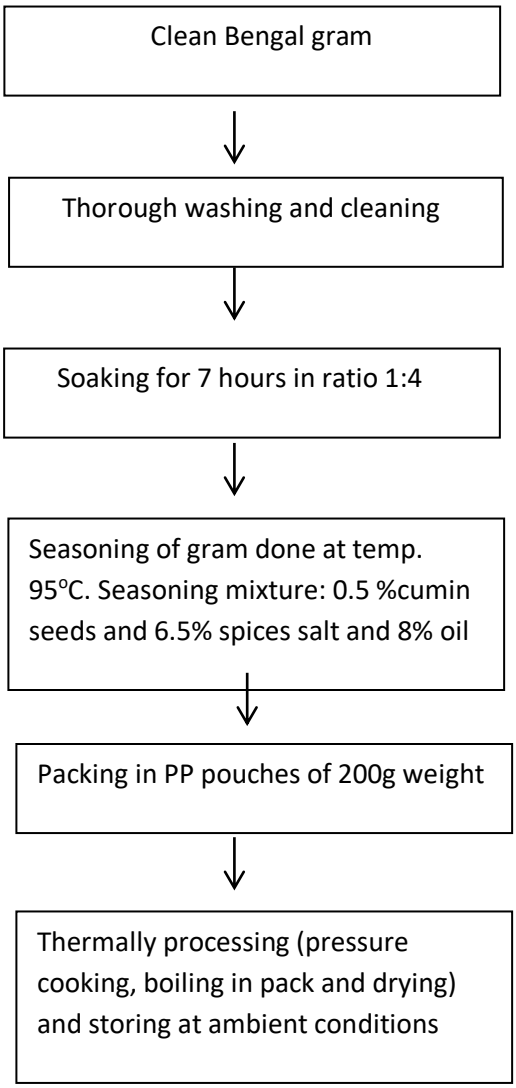
Proximate composition of processed mung bean samples

Product	Parameter	PANT – 5 VARIETY	UPM-98	PANT – 2 VARIETY
WHOLE FRIED NAMKEEN				
	MOISTURE (%)	7.68	7.66	6.85
	ASH (%)	4.08	4.09	3.37
	PROTEIN (%)	23.88	23.49	21.69
	FAT (%)	14.08	14.08	13.06
	IRON (mg/g)	4.01	4.09	3.89
	CALCIUM(mg/g)	149	189	179
DEHUSKED NAMKEEN				

	MOISTURE (%)	6.53	6.63	6.01
	ASH (%)	3.30	3.35	2.21
	PROTEIN (%)	22.45	23.45	20.53
	FAT (%)	14.02	14.05	13.91
	IRON (mg/g)	3.79	3.72	3.56
	CALCIUM(mg/g)	144	144	178
ROASTED NAMKEEN				
	MOISTURE (%)	7.69	7.68	6.85
	ASH (%)	4.23	4.20	3.46
	PROTEIN (%)	23.33	23.37	21.56
	FAT (%)	1.71	1.63	1.51
	IRON (mg/g)	4.12	4.17	3.88
	CALCIUM(mg/g)	217	145	178
SPROUTED SALAD				
	MOISTURE (%)	63.39	63.41	63.22
	ASH (%)	4.24	4.21	3.47
	PROTEIN (%)	1.60	1.63	1.47
	FAT (%)	16.89	17.01	16.71
	IRON (mg/g)	3.21	3.09	3.08
	CALCIUM(mg/g)	153	153	113

2.6 CHANNA NIBBLE

A benegal gram based READY TO EAT snack was developed called channa nibble.

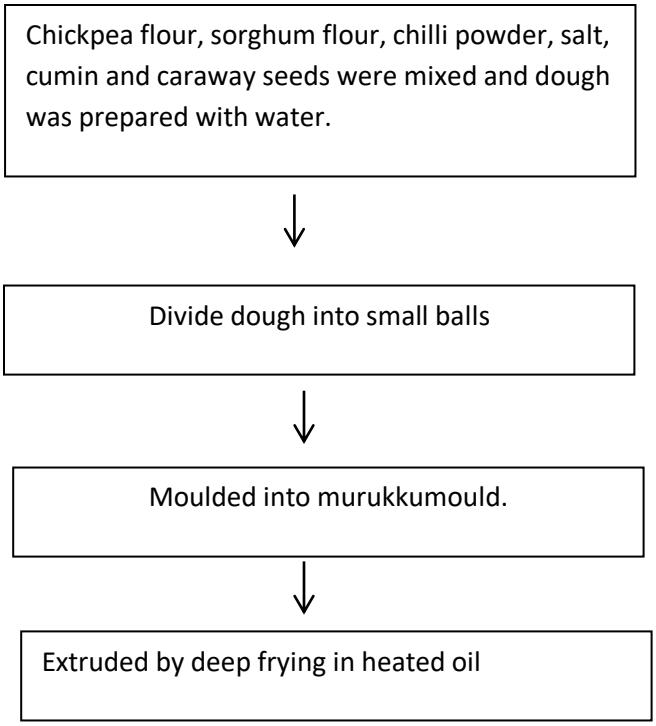


Preparation of RTE channa nibble involved soaking, pressure cooking and seasoning. Different heat treatments were used like boiling water, microwave oven and cabinet heat dryer to thermally stabilize product inside pack. Better shelf life of about 112 days without preservative

was seen in pack thermal stabilization offered by pressure cooking (Preservation, Division, & Food, 2016).

2.7 CHICK PEA-SORGHUM MURUKKU

Murukku is an extruded deep fried product(ICRISAT, 1991)(Boye, Zare, & Pletch, 2010). Chips and biscuits were also prepared from chickpea-sorghum flour.



2.8 FEW OTHER PRODUCTS AND THEIR PROCESSING CONDITIONS:

PRODUCT	STATE	METHOD OF PROCESSING
CURRY	**RAW GREEN SEEDS**	Mix with vegetable and meat and cook
PILAU		Mix with rice and cook
HOLAN		Roasted seeds eaten as snack
CURRY		Mix with vegetable and meat and cook.

	WHOLE DRY SEEDS	Soak before cooking
CHAAT		Soak and later mix with potatoes and other fruits.
ROASTED		Soak and extrude at 240 ^{o}C for 2-3 mins results in puffed products.
SWEET CHANA		Extrude and coat with sugars.
CURRY	**DHAL**	Mix with vegetable and meat and cook.
KHICHDI		Soak and steam rice and pulses
SHAMI KABAB		Minced meat is mixed with dal and shaped as cutlet and fried in oil
HALEEM		Soak and mash a mixture of wheat, rice, millet and dhal followed by boiling of mixture.
NAMKEEN	**DHAL**	Soak and fry
HALWA		Soak and boil in milk. Add sugar and cook.
MISSI ROTI	**CHICKPEA FLOUR**	Mix with wheat flour and cook bread
PAKODA		Make batter and fry
SAWAYAN		Make batter and extrude it out in shape of noodle and fry.

CHAPTER- 3

PACKAGING

3.1 SHELF LIFE OF PRODUCT

Flour infestation is a common problem that both traders and flour millers face. Maintaining the consistency of the grain and its flour is a difficult task. With due treatment & managed conditioned climate, flour can be stored without any signs of damage for up to 6 months. Like other types of pulses should be stored in a sealed container to keep out moisture in a cool place. It stays fresh for upto 6 months and longer if refrigerated. Pulses from Indian stores sometimes is already a few months old and has been stored in hot conditions should be refrigerated.

The moisture content of the Pulses flour

- Storage Conditions
- Storage –Temperature & Humidity
- Cross Contamination
- Unhygienic Conditions
- Cracks on the floors & walls
- Standing water near the stores
- Spillage & bird faeces in the stores/stairs & floors
- Presence of grains germs in the flour.

In order to improve the shelf life of the flour, the following additional precautions should be taken by millers -:

- Use clean & fumigated pulses for milling
- Use scouring machines in the cleaning line
- Set cleaning machines with optimum efficiency to separate out all the impurities from the pulses
- Clean the dead pockets of the cleaning line frequently, to get rid of non-moving pulses at the elevator bottom & outlets, grains conveyor troughs, and tempered grain conveyors.
- Fumigate empty pulses bag.
- Before milling, use scourers to remove dirt in tempered pulses
- Regularly clean the milling equipment like roller mills, feed hoppers, flour conveyors, gravity spouts, plan shifters purifiers, bran finishers, flour bins, flour elevators, pulses packing hoppers, bran elevators line, etc.

- Fumigate packing materials before every use.
- Frequently fumigate bins & conveyors.
- Always keep the parking area & the flour storage area clean.
- Type of packaging materials used.

3.2 PULSES FLOUR PACKAGING

Packaging refers to the act of designing and producing the container or wrapper of a product. It is one of the most important parts of marketing.

There are many factors that need to consider while selecting a suitable type of pack for the product:

- The product contents.
- The application of the product.
- Content stability.
- Protection from any environmental factors
- Acceptability of the pack to the customer.
- Regulatory, legal, and quality issues.

Characteristics of packaging material

- The material selected must have the following characteristics:
- Must meet tamper-resistance requirements
- Must not reactive with the product
- They must protect the preparation from environmental conditions
- Must be non-toxic
- Must not impart odour/taste to the product
- Must be FDA approved.

Flour is packed directly in gunny bags, gunny poly-line bags for bulk sale, and for retail sale in laminated pouches or poly-bags.

- **Hanging Bags-** Hanging bags in grocery stores and other shopping outlets are commonly used. They are a type of plastic bag that is also sealed with a back-middle seam on both ends

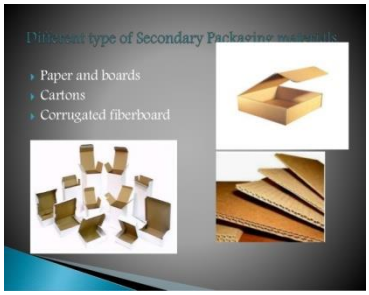
as well.Hanging bags have a pre-cut hole that makes it easier for them to hang from hooks so that they can be seen in an attractive way.

- **Pillow bags -** A pillow bag is another typical type of package. The bags are named for their shape, which is like a cushion. They are found lying flat on grocery store shelves in the grocery store and were known to carry the items.
- **Gusseted Poly Bags-** Gusseted bags are often called flat-bottom bags because they feature a tucked in pleat that's been pressed flat. It allows the bag to expand for greater carrying capacity and to keep the shape of a box if necessary. These types of poly bags can be heat sealed, tied, stapled, or taped shut. They're the perfect poly bag for anyone looking to get more flour in a single bag.
- **Flexible Pouches-** Flexible pouches are a perfect way to carry most packaged items. They can be made with zipper-seal closures, which tend to keep the inside contents fresh for use. Flexible pouches offer amazing printing capabilities, so you can add your attractive product branding to the pouch itself. Many pouches stand up on their own, which helps you improve your shelf appearance.

3.3 TYPES OF PACKAGING

- **Primary packaging**: Primary packaging is packaging which is in close association with the product itself and is often referred to as a consumer unit. The main purpose of the primary packaging is to contain, protect and/or conserve the final product, in particular against contamination.

- **Secondary packaging:** Secondary packaging is the outer packaging of the main packaging, which connects packages and further covers or marks the prescription component.
- **Tertiary packaging:**Tertiary packaging is used for the handling, transportation, and delivery of bulk products.



3.4 MATERIAL OF PACKAGING

In addition to cellulose and Aluminium foil, a very large amount of polymeric materials is used for packaging products. Paper boards and metal containers are also used for such purposes.

While a range of packaging materials are available, the ultimate option of the packaging depends on the appropriate shelf life, the efficiency of the packaging machine, and the cost that is purely based on the market segment targeted by the manufacturer. The most common choice of packaging medium is plastic (usually flexible) as it offers the requisite safety and preservation, resistance to grease, physical strength, machinability, and printability.

Plastics that are lighter in weight are also the most preferred material for the packaging of flour. There are changing trends in the packaging of Flour. Plastic films and their laminates are increasingly used due to better properties and aluminium laminates due to price and better flex crack properties. Plastic packaging products that can be used are described below.

Polypropylene- Polypropylene films have better clarity than polyethylene and enjoy superior machinability due to stiffness. Lack of good salability has been a problem; however, PVDC and vinyl coating have been used to overcome this problem. Some varieties of PP have been specially developed for twist-wrap applications as they have the ability to lock in position after twisting.

Poly Vinyl Chloride (PVC)- PVC is a stiff and clear film having a low gas transmission rate. PVC can be used as small wraps, bags, and pouches. PVC when co-polymerized with polyvinylidene chloride is known as Saran. Since it is a costly material, it is only used as a coating to obtain barrier properties and heat salability. PVC film is also used for twist wraps, as it has twist retention properties and is excellent on high-speed machines.

Polyesters (PET) and Polyamide (PA) -Polyethylene terephthalate film has high tensile strength, gloss, and stiffness as well as puncture resistance. It has moderate WVTR but is a good barrier to volatiles and gases. To provide heat seal property, PET is normally laminated to other substrates. Nylons or polyamides are similar to PET but have high WVTR.

CHAPTER- 4

FOODSAFETYREGULATIONSANDSTANDARDSOFBESAN

4.1 INTRODUCTION TO FSSAI

The Food Safety and Standards Authority of India (FSSAI) has been established under Food Safety and Standards, 2006 which consolidates various acts & orders that have hitherto handled food-related issues in various Departments. The FSSAI is responsible for setting standards for food so that there is one body to deal with and no confusion in the minds of consumers, traders, manufacturers, and investors. The Act aims to establish a single reference point for all matters relating to food safety and standards, by moving from multi-level, multi-departmental control to a single line of command.

Highlights of the Food Safety and Standard Act, 2006-

Various central Acts like Prevention of Food Adulteration Act, 1954 , Fruit Products Order , 1955, Meat Food Products Order , 1973, Vegetable Oil Products (Control) Order, 1947,Edible Oils Packaging (Regulation)Order 1988, Solvent Extracted Oil, De- Oiled Meal and Edible Flour (Control) Order, 1967, Milk and Milk Products Order, 1992 etc will be repealed after commencement of FSS Act, 2006.

The Act also aims to establish a single reference point for all matters relating to food safety and standards, by moving from multi- level, multi- departmental control to a single line of command. To this effect, the Act establishes an independent statutory Authority – the Food Safety and Standards Authority of India with head office at Delhi. Food Safety and Standards Authority of India (FSSAI) and the State Food Safety Authorities shall enforce various provisions of the Act.

Establishment of the Authority-

Ministry of Health & Family Welfare, Government of India is the Administrative Ministry for the implementation of FSSAI. The Chairperson and Chief Executive Officer of Food Safety and Standards Authority of India (FSSAI) have already been appointed by Government of India. The Chairperson is in the rank of Secretary to Government of India.

4.2 FSSAI REGISTRATION & LICENSING PROCESS

According to Section 31(1) of Food Safety and Standards (FSS) Act, 2006,Every Food Business Operator (FBO) in the country is required to be licensed under the Food Safety & Standards Authority of India (FSSAI).

As per FSS (Licensing & Registration) Regulations, 2011, Licenses and Registrations are granted to FBOs in a 3 tier system

- Registration - for petty FBOs with annual turnover less than Rs 12 lakhs
- State license - for medium-scale food manufacturers, processor and transporters
- Central License - for large-scale food manufacturers, processor and transporters

FSSAI registration is done online on the FSSAI website through Food Safety Compliance System (FoSCoS)

- FoSCoS has replaced the Food Licensing and Registration System (FLRS).
- Petty food business operators are required to obtain FSSAI Registration Certificate
- "Petty Food Manufacturer" means any food manufacturer, who manufactures or sells any article of food himself or a petty retailer, hawker, itinerant vendor or temporary stall holder (or) distributes foods including in any religious or social gathering except a caterer;

or

- Other food businesses including small scale or cottage or such other industries relating to food business or tiny food businesses with an annual turnover not exceeding Rs. 12lakhs and/or whose production capacity of food (other than milk and milk products and meat and meat products) does not exceed 100 kg/ltr per day

Any person or entity that does not classify as a petty food business operator is required to obtain an FSSAI license for operating a food business in India.

FSSAI License - two types - State FSSAI License and central FSSAI License

Based on the size and nature of the business, the licensing authority would change.

- Large food manufacturer/processors/transporters and importers of food products require central FSSAI license
- Medium-sized food manufacturers, processor and transporters requires state FSSAI license.
- License period: 1 to 5 years as requested by the FBO.

- A higher fee for obtaining FSSAI license for more years.
- If a FBO has obtained the license for one or two years, renewal may be done, no later than 30 days prior to the expiry date of the license.

Food Category System

The food category system is a tool for assigning food additive uses in this Standard. The food category system applies to all foodstuffs. The food category descriptors are not to be legal product designations nor are they intended for labelling purposes.

The food category system is based on the following principles:

a) The food category system is hierarchical, meaning that when an additive is recognized for use in a general category, it is recognized for use in all its sub-categories, unless otherwise stated. Similarly, when an additive is recognized for use in a sub-category, its use is recognized in any further subcategories or individual foodstuffs mentioned in a sub-category.

b) b) The food category system is based on product descriptors of foodstuffs as marketed, unless otherwise stated.

c) The food category system takes into consideration the carry-over principle. By doing so, the food category system does not need to specifically mention compound foodstuffs

d) The food category system is used to simplify the reporting of food additive uses for assembling and constructing this Standard.

4.3 FOOD SAFETY & FSSAI STANDARDS & REGULATIONS

"2.4 CEREALS AND CEREAL PRODUCTS; 2.4.4 BESAN:" Besan means the product obtained by grinding dehusked Bengal gram (*Cicer arietinum*) and shall not contain any added colouring matter or any other foreign ingredient. Besan shall conform to the following standards:—

1. **Total ash – Not more than 5.0%.**
2. **Ash insoluble in dilute hydrochloric acid – Not more than 0.5%.**

"2.4.6 Food grains; 2.4.6.13 Channa whole"

Channa whole shall be the dried grains of gram (*cicerarietinumLinn.)* It shall be sound, clean, sweet, wholesome and free from unwholesome substances. It shall also conform to the following standards, namely:—

(i) Moisture	Not more than 16 per cent by wight (obtained by heating the pulverised grains at 130oC-133oC for two hours).
(ii) Foreign matter - (Extraneous matter)	Not more than 1 per cent. by weight of which not more than 0.25 per cent. by weight shall be mineral matter and not more than 0.10 per cent. by weight shall be impurities of animal origin
Other edible grains -	Not more than 4 per cent by weight.
Damaged grains-	Not more than 5 per cent by weight
Weevilled grains-	Not more than 10 per cent by count.
(vi) Uric acid-	Not more than 100 mg. per kg
Aflatoxin	Not more than 30 micrograms per kilogram.
Provided that the total of foreign matter, other edible grains and damaged grains shall not exceed 9 per cent by weight.	

Standards of pulses are notified in the sub-regulation 2.4.5.22 of the Food Safety and Standards (Food Product Standards and Food Additives) Regulations, 2011. These standards apply to whole, shelled (de-husked) and split variants of 12 types of pulses, namely: lentil (masur) Black gram (urd) green gram (moong) Bengal gram (chana or chick pea or Kabuli chana or Chole or (green chick pea), harachana, Red gram (arhar) Horse gram (kulthi) Field bean (Black, Brown, White), Peas dry (matra) Soybean, Rajmah or Double beans or Broad beans or Black beans, Lobia or black-eyed beans or black eyed white lobia, Moth bean (matki). Limit of moisture, extraneous matter, defects, uric acid, etc. are important parameters in standards.

Standards of Besan are prescribed under sub-regulation 2.4.4 of the Food Safety and Standards (Food Products and Food Additives) Regulations, 2011. The sub-regulation “2.2.1: restriction of use of certain ingredient relating to Kesari dal” of the Food Safety and Standards (Prohibition

and Restriction on Sales) Regulations, 2011 prohibits sale of Kesari dal (*lathyrussativus*) and its products.

Food Safety

Part I - General Hygienic and Sanitary practices to be followed by Petty Food Business Operators applying for Registration.

Sanitary and hygienic requirements for food manufacturer/ processor/handler

The place where food is manufactured, processed or handled shall comply with the following requirements:

1. The premises shall be located in a sanitary place and free from filthy surroundings and shall maintain overall hygienic environment. All new units shall set up away from environmentally polluted areas.

2. The premises to conduct food business for manufacturing should have adequate space for manufacturing and storage to maintain overall hygienic environment.

3. The premises shall be clean, adequately lighted and ventilated and sufficient free space for movement.

4. Floors, Ceilings and walls must be maintained in a sound condition. They should be smooth and easy to clean with no flaking paint or plaster.

5. The floor and skirted walls shall be washed as per requirement with an effective disinfectant the premises shall be kept free from all insects. No spraying shall be done during the conduct of business, but instead fly swats/ flaps should be used to kill spray flies getting into the premises. Windows, doors and other openings shall be fitted with net or screen, as appropriate to make the premise insect free The water used in the manufacturing shall be potable and if required chemical and bacteriological examination of the water shall be done at regular intervals at any recognized laboratory.

6. Continuous supply of potable water shall be ensured in the premises. In case of intermittent water supply, adequate storage arrangement for water used in food or washing shall be made.

7. Equipment and machinery when employed shall be of such design which will permit easy cleaning. Arrangements for cleaning of containers, tables, working parts of machinery, etc. shall be provided.

8. No vessel, container or other equipment, the use of which is likely to cause metallic contamination injurious to health shall be employed in the preparation, packing or storage of food. (Copper or brass vessels shall have proper lining).

9. All equipments shall be kept clean, washed, dried and stacked at the close of business to ensure freedom from growth of mould/ fungi and infestation.

10. All equipments shall be placed well away from the walls to allow proper inspection.

11. There should be efficient drainage system and there shall be adequate provisions for disposal of refuse.

12. The workers working in processing and preparation shall use clean aprons, hand gloves, and head wears.

13. Persons suffering from infectious diseases shall not be permitted to work. Any cuts or wounds shall remain covered at all time and the person should not be allowed to come in direct contact with food.

14. All food handlers shall keep their finger nails trimmed, clean and wash their hands with soap, or detergent and water before commencing work and every time after using toilet. Scratching of body parts, hair shall be avoided during food handling processes.

15. All food handlers should avoid wearing, false nails or other items or loose jewellery that might fall into food and also avoid touching their face or hair.

16. Eating, chewing, smoking, spitting and nose blowing shall be prohibited within the premises especially while handling food.

17. All articles that are stored or are intended for sale shall be fit for consumption and have proper cover to avoid contamination.

18. The vehicles used to transport foods must be maintained in good repair and kept clean.

19. Foods while in transport in packaged form or in containers shall maintain the required temperature.

20. Insecticides / disinfectants shall be kept and stored separately and `away from food manufacturing / storing/ handling areas.

4.4. LABELLING STANDARDS (REGULATION 2.5 OF FSS)

Labelling requirements for packaged food products as laid down in the Part 2.4 of the Prevention of Food Adulteration (PFA) Rules, 1955, and the Standards of Weights and Measures (Packaged Commodities) Rules of 1977, require that the labels contain the following information:

1. Name, trade name or description
2. Name of ingredients used in the product in descending order of their composition by weight or volume
3. Name and complete address of manufacturer/packer, importer, country of origin of the imported food (if the food article is manufactured outside India, but packed in India)
4. Nutritional Information
5. Information Relating to Food Additives, Colors and Flavors
6. Instructions for Use
7. Veg or Non-Veg Symbol
8. Net weight, number or volume of contents
9. Distinctive batch, lot or code number
10. Month and year of manufacture and packaging
11. Month and year by which the product is best consumed
12. Maximum retail price

Provided that — (i) the nutritional information may not be necessary, in case of foods such as raw agricultural commodities, like, wheat, rice, cereals, flour, spice mixes, herbs, condiments, table salt, sugar, jaggery, or non –nutritive products, like, soluble tea, coffee, soluble coffee, coffee-chicory mixture, packaged drinking water, packaged mineral water, alcoholic beverages or flour and vegetables, processed and pre- packaged assorted vegetables, flours, vegetables and products that comprise of single ingredient, pickles, papad, or foods served for immediate consumption such as served in hospitals, hotels or by food services vendors or halwais, or food shipped in bulk which is not for sale in that form to consumers.

Wherever applicable, the product label also must contains the following

The purpose of irradiation and license number in case of irradiated food. Extraneous addition of coloring material.

Non-vegetarian food – any food which contains whole or part of any animal including birds, fresh water or marine animals, eggs or product of any animal origin as an ingredient, not including milk or milk products – must have a symbol of a brown color-filled circle inside a brown square outline prominently displayed on the package, contrasting against the background on the display label in close proximity to the name or brand name of the food.

Vegetarian food must have a similar symbol of green color-filled circle inside a square with a green outline prominently displayed.

All declarations may be: Printed in English or Hindi on a label securely affixed to the package, or Made on an additional wrapper containing the imported package, or Printed on the package itself, or May be made on a card or tape affixed firmly to the package and bearing the required information prior to customs clearance.

Exporters should review the Chapter 2 of the "FSS (Packaging and Labeling) Regulation 2011" and the Compendium of Food Safety and Standards (Packaging and Labeling) Regulation before designing labels for products to be exported to India. FSSAI revised the labelling Regulation and a draft notification to that effect was published on April 11, 2018, inviting comments from WTO member countries and the comments received are under review and the publication date remains unknown.

According to the FSS Packaging and Labeling Regulation 2011, "prepackaged" or "pre packed food" including multi-piece packages, should carry mandatory information on the label.

CHAPTER- 5

OPPORTUNITIES FOR MICRO/UNORGANIZED ENTERPRISES

5.1.PM-FME Scheme:

Ministry of Food Processing Industries (MoFPI), in partnership with the States, has launched an all India centrally sponsored "PM Formalisation of Micro Food Processing Enterprises Scheme (PM FME Scheme)" for providing financial, technical and business support for up-gradation of existing micro food processing enterprises. The objectives of the scheme are :

I. Support for capital investment for up-gradation and formalization with registration for GST, FSSAI hygiene standards and Udyog Aadhar;

II. Capacity building through skill training, imparting technical knowledge on food safety, standards & hygiene and quality improvement;

III. Hand holding support for preparation of DPR, availing bank loan and up-gradation;

IV. Support to Farmer Producer Organizations (FPOs), Self Help Groups (SHGs), producers cooperatives for capital investment, common infrastructure and support branding and marketing.[i]