Draft Study Material

Job Role

MILLET PRODUCT PROCESSOR

QUALIFICATION PACK: Ref. Id. FIC/Q1011
SECTOR: Food Processing

NSQF Level: 3

Grade: 10

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NCERT

PSS Central Institute of Vocational Education, Bhopal
(A constituent Module of National Council of Educational Research and Training, Ministry of Education, Government of India)
Shyamla Hills, Bhopal-462 013, Madhya Pradesh, India, Website : www.psscive.ac.in

FOREWORD

India has a rich tradition of cultivating and consuming millets, which are now being recognized worldwide as "nutri-cereals" for their nutritional value and resilience to climate change. In line with the Government of India's efforts to revive and promote millets, the vocational course on Millet Product Processor (Qualification Pack: Ref. Id. FIC/Q1011) has been developed for students of Grade 10 under the Food Processing sector.

This Module has been designed to equip learners with the knowledge and practical skills required to process, prepare, and package millet-based products. The curriculum aligns with NSQF Level 3, focusing on hands-on training, entrepreneurial orientation, and employability skills. Through this, students will not only understand the importance of millets in nutrition and food security but also gain competencies for future career opportunities in the growing food processing industry.

We hope that this Module will inspire young learners to take pride in India's millet heritage, develop innovative millet-based products, and contribute to building a healthier nation. Teachers, trainers, and students are encouraged to make full use of this resource to promote both skill development and sustainable food practices.

Dinesh Prasad Saklani
Director
National Council of Educational Research and Training

New Delhi
September 2025

About The Module

This Module, "Millet Product Processor," is a comprehensive guide designed to introduce Grade 10 students to the fundamentals and practical skills required to develop, process, and market millet-based food products. Structured into four main units, the book provides a step-by-step journey from basic baking techniques to advanced extrusion technology, with a strong emphasis on hygiene, quality control, and entrepreneurship.

Module 1, *Millet-Based Bakery Products*, introduces students to the essentials of baking with millets, including understanding structure in baked goods, recipe formulation, actual baking practices, and sensory evaluation. It also emphasizes packaging and labelling requirements to ensure safety and shelf stability.

Module 2 focuses on *Ready-to-Cook (RTC) Millet Foods*, offering insights into the formulation and production of convenience foods such as dosa mix, upma, and khichdi using millets. This Module reflects the growing demand for nutritious, time-saving food options.

In Module 3, learners are introduced to the world of *Millet-Based Extruded Products*. They explore the principles of extrusion, ingredients used, recipe balance, machine operation, and post-processing techniques, equipping them with skills to produce snacks like puffed millets and millet noodles.

Finally, Module 4, *Marketing and Sales of Millet Products*, equips students with basic marketing knowledge, customer analysis, branding, pricing, and promotional strategies. It culminates in planning a millet sales event, encouraging hands-on business exposure.

Designed for vocational students, millet entrepreneurs, women's groups, and food processing trainees, this Module combines technical know-how with entrepreneurial insights. With simple language, practical sessions, and real-world applications, it empowers learners to not only make high-quality millet products but also to successfully bring them to market.

Dr. R. Ravichandran
Professor
Department of Humanities, Science, Education and Research,
PSS Central Institute of Vocational Education Bhopal

Module Development Team

1. Dr. R. Ravichandran, Professor, Department of Humanities, Sciences, Education and Research (DHSER), PSS Central Institute of Vocational Education, Bhopal (Member Coordinator)
2. Dr. Dipika Agrahar Murugkar, Principal Scientist, ICAR-Central Institute of Agriculture Engineering, Bhopal, Madhya Pradesh
3. Dr. Preeti Dixit, Consultant, Madhya Pradesh Council of Science and Technology, Bhopal, Madhya Pradesh.
4. Alka Sharma, Director, Khadyot Naturals Pvt. Ltd., Bhopal, Madhya Pradesh

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PSSCIVE Team

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Module 1 Millet-Based Bakery Products

About the Module

This module introduces learners to the art and science of baking with millets. It explains the essentials of measuring ingredients, the role of tools and equipment, and the functional properties of millet flours in baked products. Students will study recipe formulation, baking techniques, and quality evaluation through sensory parameters like taste, aroma, and texture. The module also emphasizes packaging and labelling in line with food safety standards, enabling students to prepare market-ready bakery products such as cookies, cakes, breads, muffins, and buns.

Learning Outcomes

- Demonstrate the use of baking tools, equipment, and techniques for millet-based bakery products.
- Formulate recipes and prepare millet bakery items by applying appropriate ingredient ratios and baking methods.
- Assess quality parameters and apply packaging and labelling standards to ensure safety and shelf life.

Once a staple of Indian kitchens, millets are now enjoying a well-deserved revival. These ancient grains, long associated with rural porridge and traditional fare, are re-entering the culinary spotlight—not only in their original forms but also as key ingredients in contemporary baked goods like cookies, cakes, muffins, and breads. This revival is not just about nostalgia. It reflects a growing global movement toward healthier, climate-resilient, and culturally rooted food systems.

In today's evolving food landscape, consumers are increasingly health-conscious, environmentally aware, and interested in reconnecting with indigenous food traditions.

As a result, millets are often referred to as "nutri-cereals," which are gaining traction for their high nutritional density, low environmental footprint, and naturally gluten-free properties. Their appeal lies in a unique combination of health benefits and adaptability, making them ideal for innovative baking.

Trend	Insight

Growth in Millet Production	Up 40% in the last 5 years
Rise in Urban Millet Consumption	Up 35% due to health awareness
Market Share in Bakery Products	Millets now make up 30% of India's bakery market
Startup and RandD Investments	500+ Startups in millet value chain, ₹6.2+ crore disbursed through govt schemes

SESSION 1: ESSENTIALS OF BAKING

1. Measuring Ingredients Accurately

Baking is not like regular cooking, where you can add "a little bit of this and a pinch of that." It's more like science—you need to be precise! Even a small mistake in measurement can change the outcome of your baked product. You must take care while measuring the ingredients. Various tools used for measuring are shown below in Fig. 1.1.

Fig. 1.1: Measuring Tools

2. Tools, Appliances and Equipment Used in Baking

From mixing bowls and measuring cups to hand beaters and ovens, baking needs the right tools. You should be able to identify various tools and equipment used for baking millet products, and how to use them safely and efficiently.

3. Ingredients Used in Baking

Flour, sugar, eggs, butter, baking powder… sounds familiar? Each ingredient plays a special role. Understanding how each ingredients have a specific function and interacts with other ingredients is crucial to give your product the desired texture, rise, flavour and taste.

4. Techniques Used in Baking

Ever heard of creaming or whisking? What about icing or glazing? These are techniques that bakers use to mix ingredients or decorate their creations. Different product requires different techniques for the outcome.

2.1 Weight and Measure Equivalents

In baking and food preparation, measurement accuracy is very important. Just as in science, where exact quantities ensure correct results, in cooking too, proper measurements help maintain consistency in taste, texture, and quality.

The following chart provides common equivalents used in the kitchen. It will help you convert between cups, tablespoons, ounces, and grams while following or adjusting recipes.

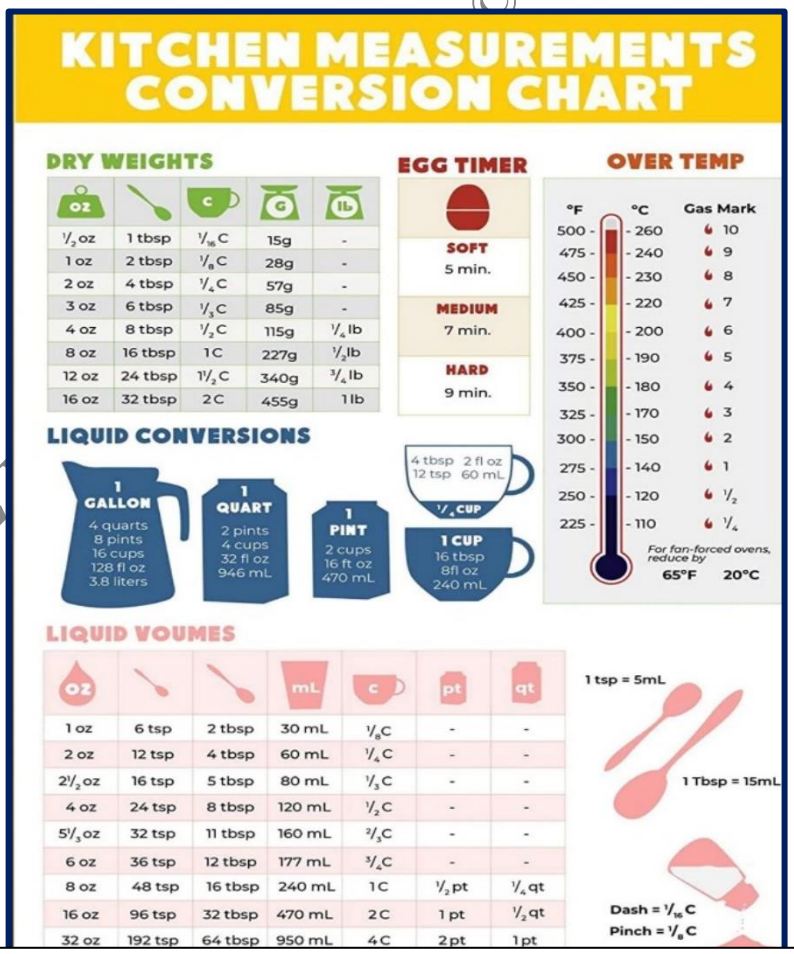

Fig. 1.2: Kitchen Measurements and Conversion Chart

Terms commonly used in baking:

When learning baking, you will often come across some special terms. Understanding them will make it easier to follow recipes and develop confidence in practical work. A few commonly used terms are explained below:

Term	Meaning
Bake	To cook food using dry heat, typically in an oven.
Preheat	To heat the oven to the required temperature before placing food inside.
Creaming	Beating butter and sugar together until light and fluffy.
Knead	To work dough with hands or a mixer to develop gluten.
Proof/Prove	Letting dough rise before baking, usually until doubled in size.
Whisk	To beat ingredients (like eggs or cream) to incorporate air.
Fold	Gently mixing a light ingredient (like whipped cream) into a heavier one.
Sift	Passing dry ingredients through a sieve to remove lumps and add air.
Beat	To mix ingredients vigorously using a whisk, spoon, or mixer.
Chill	To cool an ingredient or dough in the fridge before using or baking.
Grease	To coat a pan with oil, butter, or spray to prevent sticking.
Crumb	The interior texture of a baked product (e.g., fine, open, dense).
Glaze	A shiny coating (like egg wash, icing, or syrup) is brushed on baked goods.
Leavening	Agents (like yeast, baking soda, or baking powder) that make dough rise.
Zest	The outer coloured part of the citrus fruit peel, used for flavouring.
Room Temperature	Ingredients like butter or eggs that are not cold and easier to mix.
Stiff Peaks	Whipped egg whites or cream that hold their shape firmly when lifted.

Baking Product Comparison Table

Baked products may look similar, but each has its own unique texture, taste, and method of preparation. Cookies, biscuits, muffins, cakes, breads, pav, buns, and pizza bases differ in ingredients, softness, sweetness, and usage. Comparing them side by side helps us understand how small changes in recipe or technique create very different products.

Product	Texture	Sweetness	Ingredients	Shape/Form	Common Uses
Cookies	Chewy or soft, sometimes crispy	High	Flour, butter, sugar, eggs, chocolate chips	Small, round or irregular	Snacks, desserts
Biscuits	Crisp and crunchy	Low to medium	Flour, baking powder, butter, milk/water	Flat, round or square	Tea-time snack, crackers
Muffins	Dense, moist, bread-like	Moderate	Flour, oil/butter, sugar, eggs, fruits	Individual cup shape	Breakfast, quick snacks
Cakes	Light, airy, fluffy	High	Flour, butter, sugar, eggs, baking powder	Round, square, layered	Birthdays, celebrations
Bread	Firm crust, soft or chewy crumb	Not sweet	Flour, yeast, water, salt	Loaf, sliced	Toast, sandwiches
Pav	Very soft, fluffy	Not sweet	Refined flour, yeast, milk, butter	Small, square buns	Vada pav, pav bhaji
Buns	Soft, sometimes rich and sweet	Low to moderate	Flour, milk, sugar, butter, sometimes eggs	Round, slightly puffy	Burgers, sweet or savory buns
Pizza Base	Chewy, firm, sometimes crisp edge	Not sweet	Flour, yeast, olive oil, water, salt	Flat, round disc	Pizza (topped and baked)

Core Machinery for Millet-Based Bakery Products Production

Preparing bakery items with millets on a larger scale requires specialized machines. These machines save time, maintain quality, and ensure uniformity in products. From mixing the flour to baking and packaging, each step depends on reliable equipment. Below are some of the core machineries commonly used in millet-based bakery production:

1.1 Planetary Mixer

At the heart of ingredient preparation lies the planetary mixer, whose rotating bowl and orbiting agitator mimic planetary motion to blend millet flours, fats, liquids, and leavening agents into uniform doughs and batters.

Interchangeable attachments include a flat beater for cookie and pastry doughs, a whisk for aerated cake and muffin batters, and a dough hook for yeasted breads. Variable-speed controls allow a gentle slow start to prevent flour clouds before ramping up for thorough mixing, and optional air-injection systems fold in microscopic air bubbles to produce lighter crumbs. Built-in scraper blades traverse the bowl walls to eliminate dry pockets of flour, ensuring consistent texture even in large batches. Models range from compact 8 kg units for small-scale kitchens to industrial 175 kg machines for high-volume bakeries, all designed to meet rigorous food-safety and hygiene standards.

Fig. 1.3: Planetary Mixer

1.2 Spiral Mixer

For denser doughs—such as those used in pav, buns, or rolls—spiral mixers offer superior gluten development when millet is blended with small proportions of wheat flour. A rotating spiral hook kneads the dough gently but effectively, strengthening the gluten network and improving dough elasticity. This results in better oven spring, fine crumb structure, and a soft, evenly risen loaf or bun.

Fig. 1.4: Spiral Mixer

1.3 Dough Sheeter and Cutter

This versatile Module combines dough sheeting and precision cutting for a variety of laminated and flat products. The adjustable rollers thin puff pastry, Danish dough, or paratha-style layers to the exact thickness required, while an integrated conveyor carries the sheet directly to programmable cutting dies or rotary blades. Whether producing wire-cut cookies, rectangle turnovers, spiral rolls, or layered puffs, digital recipe selec tion enables rapid changeovers.

Fig. 1.5: Dough Sheeter

Built-in sensors maintain proper do ugh tension and alignment, and the stainless-steel frame disassembles easily for thorough cleaning between gluten-free runs.

1.4 Cookie Cutting Machine

Automating the shaping process for cookies, this machine features a dough hopper, sheeting rollers, and interchangeable cutting dies controlled by digital commands. As dough is flattened, sensors detect tray placement and initiate the cutting sequence, stamping out perfectly uniform shapes—from straight drops to twists and wire-cut patterns—without manual effort. The result is consistent cookie size, uniform bake times, and enhanced productivity, all of which free bakery staff to focus on recipe development and flavour innovation.

1.5 Dough Divider and Rounder

When producing buns, pav, or rolls, a combined dough divider and rounder streamlines portioning and shaping. First, the divider slices a bulk dough piece into equal-weight portions—whether 50 g dinner rolls or 120 g burger buns—then the rounder gently shapes each piece into a smooth ball. This two-step process not only reduces labour but also ensures uniform surface tension on each dough piece, leading to even oven spring and consistent crumb structure, which is particularly important when working with millet's low-gluten formulations.

1.6 Proofing Cabinet

Before baking yeast-leavened products, proper fermentation is crucial to develop flavour, volume, and structure. A proofing cabinet provides a controlled environment of precise temperature and humidity, allowing millet-wheat hybrid doughs to rise predictably. This results in loaves and buns with optimal volume, even crumb, and a light, airy texture.

Fig. 1.6: Proofing Cabinet

1.7 Rotary Convection Oven

Ideal for high-volume baking of cookies, puffs, and small pastries, the rotary convection oven unites forced hot-air circulation with slowly rotating racks. Every tray receives identical airflow and radiant heat, preventing hot spots and uneven browning. Digital controls fine-tune temperature and fan speed, and the gentle rotation ensures uniform moisture migration, allowing lower bake temperatures and shorter times that preserve the delicate flavour of millet.

Fig. 1.7: Rotary Convection Oven

1.8 Deck Oven

For artisan breads, pav, and rustic loaves, deck ovens offer one or more flat baking decks, each with independent temperature settings. Radiant heat from above and below can be adjusted deck by deck to achieve a soft interior crumb and a crisp, golden crust.

1.9 Rack Oven

When production demands scale up, rack ovens accept entire mobile trolley racks filled with pans of buns, rolls, or pastries. Multi-zone heating and steam injection guarantee identical baking conditions for every tray, top to bottom. Programmable baking profiles store settings for different products, enabling quick transitions between cookies one day and pav the next, and ensuring consistent results across high-volume batches.

Fig. 1.8: Rack oven

2. Supporting Equipment

Apart from the three main machines, several additional tools are required for a smooth baking process:

Fig. 1.9: Kitchen Weighing Scale

a. Weighing Machine

Essential for accurately measuring ingredients, maintaining batch consistency, and ensuring standardization.

b. Baking Trays

Flat trays to hold cookie dough during baking. Preferably non-stick and durable—hold dough during baking and withstand repeated wash cycles

c. Cooling Racks

Once baked, products are transferred to cooling racks, where open airflow prevents moisture buildup and preserves crisp textures.

d. Packaging Equipment

Finally, carefully chosen packaging materials—such as food-grade pouches, eco-friendly boxes, grease-proof wraps, or reusable glass jars—are used to protect products from air, moisture, and contamination while conveying brand identity and regulatory details. These includes:

- **Sealing Machines** – For airtight packaging
- **Labelling Machines** – For applying labels with product details

Tool	Purpose
Mixing bowls	For combining ingredients
Blender	For smoothies, purees
Measuring cups (dry and liquid)	Precise ingredient measuring
Sieve	For sifting flour or powdered sugar

Timer clock	Perfect timing every time
Rolling pin	Flattening dough
Wire racks	Cooling baked goods evenly
Pastry brushes	Glazing, buttering pans
Spatulas	Mixing and scraping bowls
Dough cutter/scraper	Cutting dough, cleaning surfaces
Wire whisk	Whipping eggs and cream
Measuring spoons	Measuring small amounts
Grater	Grating zest or cheese
Pastry blender	Cutting fat into flour for doughs
Pastry bag and tips	Decorating cakes and pastries
Cake turn table	For decorating cakes

Common Baking Ingredients

Behind every soft cake, crisp cookie, or fluffy bread lies a perfect balance of ingredients—each with a specific role to play. In baking, ingredients are not just mixed; they interact through heat, moisture, and time to create textures, flavours, and aromas that delight us. From flour that gives structure, to fats that add richness, to leavening agents that make dough rise—every component is a building block. With growing awareness about health and nutrition, millets are now gaining popularity as wholesome, gluten-free alternatives to refined flour. Understanding the function of each ingredient—including millet-based substitutes—is key to creating nutritious and delicious baked goods. Let's explore how these ingredients work together like a team in every successful bake!

Ingredient Type	Name	Primary Function(s)
1. Flour	• Refined Wheat flour (maida) • Whole wheat flour (Atta) • Millet flours: Ragi, Bajra, Jowar, Foxtail, Little Millet etc.	• Provides structure Forms the base of dough or batter • Gluten in wheat helps trap gases and gives elasticity • Millets provide nutritional benefits but lack gluten, leading to no elasticity in dough.
2. Sweeteners	• White sugar • Brown sugar • Jaggery powder • Date paste, honey, coconut sugar	• Adds sweetness • Aids browning (Maillard reaction) • Helps in fermentation (feeds yeast)

3. Fats	• Butter • Ghee • Edible oil	• Adds richness and flavour • Tenderizes baked goods • Improves shelf life • Helps in creaming (for aeration)
4. Liquids	• Water • Milk • Buttermilk • Almond milk • Coconut milk	• Activates gluten and leaveners • Provides moisture • Aids in batter consistency
5. Eggs (or substitutes)	• Whole egg • Egg whites • Egg replacer: • Flaxseed or chia gel • banana puree (as egg replacers) • Buttermilk	• Binds ingredients • Traps air (aeration) • Adds colour and moisture • Gives volume to cakes
6. Leavening Agents	• Baking soda (sodium bicarbonate) • Baking powder • Yeast • Eno (in quick bakes)	• Produces gas (CO_2) to make baked items rise • Makes texture light and fluffy
7. Salt	• Table salt • Rock salt	• Enhances and balances flavour • Strengthens gluten in dough • Controls yeast fermentation
8. Flavouring Agents	• Vanilla essence • Cardamom, nutmeg, cinnamon • Cocoa powder • Lemon zest	• Adds aroma and taste • Creates product identity (e.g., chocolate, vanilla, masala cookies)
9. Thickeners / Stabilizers	• Cornflour • Arrowroot	• Provides smooth texture • Used in fillings or to bind mixtures
10. Add-ons / Enrichments	• Nuts and seeds • Dried fruits • Chocolate chips • Coconut flakes	• Add texture and flavour • Improve nutritional value • Create product variety

Fig. 1.10: Ingredients and Their Basic Functions in Baking

SESSION 2: UNDERSTANDING STRUCTURE IN BAKED PRODUCTS

Baked products achieve their texture, shape, and flavour through a delicate interaction of ingredients, each playing a specific functional role. Whether it's the fluffiness of a sponge cake, the crispness of a cookie, or the chewiness of a freshly baked bread, the outcome depends on how structure-forming and tenderizing agents work together during mixing and baking.

At the heart of this process are ingredients that contribute to the structural framework: flour provides the foundational body of the dough or batter; liquids activate proteins and starches; eggs contribute moisture, richness, and binding; fats shorten gluten strands to create tenderness; and leavening agents like baking soda or yeast produce gases that make the mixture rise and lighten.

Activity: Guess the Grain!

Display flour samples of wheat, rice, ragi, bajra and jowar.

Touch, observe, and try to identify the grain based on texture, colour, and feel.

Can you share:
Why do we mostly use wheat for bread and cakes? What could be the benefits of switching to millet flours?"

The Role of Gluten: Nature's Elastic Network

One of the most critical components in traditional baking is gluten, a protein found in wheat and some other cereal grains. When wheat flour is mixed with water and kneaded, gluten forms a stretchy, elastic network that traps gases released during fermentation or chemical leavening. This network allows dough to expand and retain its shape, contributing to the chewiness in breads and the crumb structure in cakes and cookies. Flours like all-purpose flour (10-12% gluten), whole wheat flour (13 % protein) make them suitable for elastic and chewy baked goods. In contrast, pastry and cake flours, with a lower protein range of 7–9%, are preferred for tender and delicate items. Millets offer a range of health benefits, as already discussed in Module 1 of the Grade 10th Module.

However, millets are naturally gluten-free. While this makes them suitable for individuals with celiac disease or gluten intolerance, it also presents challenges in terms of structure, elasticity, and moisture retention. Millet-based doughs do not develop the same stretchy network as wheat-based doughs, often resulting in denser or more crumbly final products. Therefore, it may be combined with other gluten-rich ingredients as per the needs of the product.

Gluten Stretch Comparison

Activity: *Stretch Test – Wheat vs. Ragi Dough*
Form two dough balls: one from wheat flour, another from finger millet flour.

Observe and record:
- How does each dough feel?
- Does it stretch or tear?
- Try rolling out a chapati of each dough, which one was easier to roll and why?
- Which one is more elastic—and why?
- What would be the main difficulty in making soft, airy bread using only millet flour?

Millets in Baking: Opportunities and Challenges

- Suitable for people with celiac disease or gluten intolerance
- Offer better nutrition with high fibre, iron, and magnesium
- Add unique nutty, earthy flavours
- Their climate resilience and low water requirements make them an environmentally sustainable choice.

Challenges of Gluten-Free Baking with Millets

- Baking with millets demands thoughtful formulation and technique.
- Without gluten, achieving structure and texture requires alternative strategies such as combining flours, incorporating binders, or adjusting moisture levels.
- Dough lacks stretch and elasticity
- Final products may be denser or crumbly
- Moisture retention and shelf life may be reduced

Best Practices for Making Millet-Based Bakery Products: Although millets lack gluten, but with the right techniques and combinations, millets can create delicious, nutritious, and marketable baked products.

- Blend millet flour with other flours (e.g., rice, tapioca, chickpea)
- Use binders like xanthan gum, flaxseed gel, or eggs
- Modify techniques like creaming, whisking, and hydration timing
- Use moisture-retention strategies (e.g., using yogurt or oil)
- Adapt baking techniques like creaming or pre-gelatinization of starch
- Develop recipes through experimentation and testing

Activity: Let's Compare Wheat Cookies vs. Millet Cookies

To understand the practical differences between wheat and millet in baking, students can compare cookies made with wheat flour and those made with finger millet (ragi) flour. Through sensory observation and texture analysis, students will examine the impact of different flours on cookie characteristics.

Materials Required

- Small samples of both cookie types
- Magnifying glasses
- Sensory evaluation sheets

Observation Task

- Use a magnifier to examine crumb structure
- Break the cookie to assess texture
- Taste and record differences in aroma and flavour
- Discuss: What contributes to crispness or spread?

Criteria	Wheat Cookie	Millet Cookie (e.g., Ragi)
Texture	Chewy or soft (gluten effect)	Crumbly or dense
Aroma	Mild, buttery	Nutty, earthy
Taste	Neutral to sweet	Slightly bitter, rich
Crumb Structure	Uniform, elastic	Slightly coarse or grainy

Functional Roles of Millets in Different Bakery Products

Different types of millets offer varying textures and applications in baking. For instance:

- **Finger millet (Ragi)** yields dense, crumbly textures ideal for brownies or cookies, with a strong earthy flavour.
- **Pearl millet (Bajra)** has a coarse feel suitable for biscuits but usually requires some binders.
- **Foxtail millet** produces a light, dry crumb that works well in cakes and muffins when blended.
- **Sorghum (Jowar)** delivers a soft crumb, making it suitable for bread loaves when structural enhancers like wheat flour are added.

Each millet type brings its own sensory characteristics and functional properties, influencing both formulation and final quality.

SESSION 3: RECIPE FORMULATION AND RATIOS

Crafting millet-based bakery products requires adapting traditional baking ratios and techniques to accommodate the absence of gluten. Several core principles guide this process. The "Core Principles of Millet-Based Baking" are:

1. Selecting the Right Millet

Choose a millet type suited for baking applications. Foxtail, pearl, and finger millet are commonly used. Ensure the grains are finely ground into flour for a smoother texture and better integration in doughs and batters.

- **Flour Blending and Percentage Use**

  For cookies and cakes, millet flours can often replace wheat flour in different ratios in combination with other ingredients, especially if supported by adequate binding and moisture. However, for yeast-leavened products like bread, it is advisable to limit millet content to around 10-15 % to preserve gluten structure and allow for adequate oven rise. Muffins may tolerate higher quantities of millet flour, especially when higher hydration and eggs are included.

- **Hydration Adjustments**

  Millets tend to absorb more water than wheat, so bakers should increase hydration by 10–15%. A useful technique is pre-soaking millet flour for 10–15 minutes before mixing, which improves batter consistency and reduces dryness.

- **Binding and Structure**

  In cakes and cookies without gluten, structural cohesion must be supported through binders like eggs, xanthan or guar gum. In case of breads, natural fermentation or autolyse period, where flour and water rest together before other ingredients are added, can improve hydration and structure.

- **Flavour and Sweetness**

  Millets have a naturally earthy and nutty taste. To enhance their appeal, bakers can pair them with warming spices like cinnamon and cardamom, or citrus elements like lemon zest. Sweeteners like jaggery or date paste complement the millet's flavour profile while adding nutrition.

- **Leavening**

  Millet-based quick breads, cakes, and muffins benefit from a combination of baking powder or soda and acidic ingredients such as buttermilk, yogurt, or jaggery to activate leavening. For yeast-leavened breads, using a starter or short fermentation helps develop flavour and compensate for reduced gluten elasticity.

- **Temperature and Baking Time Adjustments**

  Millet products often bake faster and may brown quickly. Lower baking temperatures or shorter baking durations may be required. Monitor the oven closely to avoid burning or dryness.

- **Proper Cooling and Storage**

  Allow baked goods to cool completely on a wire rack to avoid moisture retention. Store them in airtight containers at room temperature. Refrigeration can help extend freshness, especially in humid conditions.

Activity: "Mix, Observe and Compare – Exploring Millet Doughs & Batters"

Objective:
Students will prepare different millet-based dough or batter mixtures using varied ingredient ratios and observe how changes affect consistency, texture, and usability.

Materials (for 4–5 small group stations):

Flours: Ragi, Jowar, Bajra, Whole Wheat, Maida
Liquids: Water, Milk, Yogurt
Other: Oil or melted butter, Baking powder, Salt, Measuring cups/spoons, Mixing bowls, Spoons

Instructions:

Step 1: Select One Product Type per Group
Each group chooses one of the following to work with:
Cookie dough
Muffin batter
Bread dough
Cake batter

Step 2: Follow Standard Recipe Ratio (Base Recipe Sheet Provided by Teacher)
Example for cookies (Group A):
50% millet flour + 50% wheat flour
1 part flour: 0.5 part fat: 0.5 part sugar: 0.25 part liquid

Step 3: Prepare 3 Small Variations

Make three small 100g flour batches of the same product with different flour ratios:

Version	Millet: Wheat	Notes
A	30: 70	Balanced gluten
B	50: 50	Moderate millet
C	70: 30	High millet

Keep other ingredients constant across all 3 samples.

Step 4: Record Observations in Table

Sample	Dough/Batter Texture	Stickiness	Spread ability	Moisture Feel	Prediction on Final Product
A					
B					
C					

Step 5: Wrap-Up Discussion

Each group shares:

- Which ratio worked best and why?
- How did millet affect the consistency?

SESSION 4: LET'S BAKE!

1. Millet Muffins

Ingredients	Instructions
1. 1/2 cup millet flour 2. 1 cup refined wheat flour 3. 1/4 cup honey 4. 1/2 cup milk (or non-dairy) 5. flax gel (made up of 2 tbsp ground flaxseed + 6 tbsp water and kept for 30 min) 6. 1 tsp baking powder 7. 1/2 tsp vanilla extract 8. Pinch of salt	• Preheat oven to 350°F (175°C); line muffin tin. • Mix dry ingredients in a bowl. • Add wet ingredients; mix until just combined. • Divide batter in muffin cups. • Bake 20–25 min or until toothpick comes out clean. • Cool in tin briefly, then on rack.

2. Ragi Chocolate Chip Cookies

Ingredients	Instructions
1. 1 cup ragi flour 2. 1 cup wheat flour 3. 1/4 cup butter, softened 4. 1/2 cup sugar 5. 1/2 tsp baking soda 6. 1/2 tsp vanilla extract 7. 1/4 cup dark chocolate chips	• Preheat oven to 375°F (190°C); line baking sheet. • Cream butter and sugar, vanilla; mix well. • Mix dry ingredients separately, then combine. • Fold in chocolate chips. • Shape dough balls, flatten slightly. • Bake 10–12 min. Cool on tray, then rack.

3. Ragi Cake

Ingredients	Instructions
1. 1 cup fine ragi flour 2. 1 cup refined wheat flour 3. 2 tbsp cocoa powder 4. 1 tsp baking powder	• Grease and line the cake pan. • Preheat oven to 180°C (350°F). • Sieve dry ingredients 3 times.

5. ½ tsp baking soda 6. 100 g butter 7. 3 eggs or flaxseed gel 8. 1 cup sugar/jaggery powder 9. ½ cup curd 10. 1 cup milk 11. 1 tbsp vanilla extract 12. 1/8 tsp salt (optional)	• Beat the eggs and add sugar/jaggery. • Add milk, vanilla, curd, butter; mix gently. • Pour into the pan, tap to release air. • Bake 25–30 mins. • Cool 15 mins in pan, then on rack. • Slice when fully cool.

SESSION 5: QUALITY CHECK AND SENSORY EVALUATION

In bakery products, quality is not just a technical term—it's a sensory experience. Whether it's the golden-brown colour of a cookie, the rich aroma of roasted millets, or the satisfying crunch of a freshly baked bite, these elements form the foundation of consumer appeal. Evaluating and improving these sensory attributes helps young bakers refine their craft and better understand customer preferences.

Activity:
Visit a local bakery or millet processing unit. Interview the owner or technician about the machines they use. Prepare a short report and share your findings in class.

Understanding Quality in Millet Bakery Products

The quality of any bakery product can be assessed through five key parameters: appearance, aroma, taste, texture, and shelf life.

Quality Parameter	What to Check
Appearance	Colour, shape, evenness, browning
Aroma	Freshness, natural smell of ingredients
Taste	Balance of sweetness, saltiness, or spiciness
Texture	Crunchy, soft, dry, or chewy
Shelf Life	How long does it stay fresh without spoiling

Sensory Evaluation

Sensory evaluation means using our senses (eyes, nose, mouth, hands) to judge a food product. It includes observing colour and shape, smelling for freshness or off-odours, tasting for flavour balance, and feeling for texture.

Sight → Colour and shape
Smell → Aroma
Taste → Sweetness, bitterness, saltiness
Touch → Crumb texture, softness, crispiness

Balancing Taste and Texture

Challenge	Solutions
Moisture vs. Crumbliness	Increase liquid (milk, yogurt) or fat to soften the crumb. Decrease the millet ratio if the dough feels too dry (target 10- 20 % millet). Add yogurt, oil, eggs, or banana; use softer millet
Density vs. Lift	Use adequate leaveners (2–3% baking powder/soda). Incorporate aeration (creaming or adding whipped eggs). Whipped eggs, creaming, baking powder/soda
Dense Mouthfeel	Add seeds/nuts (10–15%) for crunch. Use emulsifiers (egg yolks) for a smoother texture. Aeration (folding/whipping)
Flavour Flatness	Add spices (1–2%) to complement nutty millets, jaggery, or citrus zest

Monitoring Shelf Life Through Observation

In addition to sensory testing, students can study how different storage conditions affect product quality over time. By storing millet-based product samples in various conditions—airtight boxes, foil wraps, or open trays. You can observe and record daily changes in aroma and texture. This simply gives you an idea of how many days you can store your products safely or how slowly/quickly the product can go stale if not packaged properly, reinforcing the importance of airtight and hygienic packaging.

Activity: Blind Tasting & Peer Evaluation

Objective: Evaluate and give feedback on millet-based bakery items like cookies or muffins.

Steps:

1. Prepare or procure 2–3 versions of the millet-based cookie (change ingredient, baking time, or sweetener).
2. Label samples as A, B, C.
3. Form a panel of food testing judges comprising 10 members. Ask the panel to taste without knowing which sample belongs to whom.
4. Each student uses a sensory score sheet to rate each sample on:
   - Taste
   - Appearance
   - Aroma
   - Texture

Sample Score Sheet (Out of 5 per parameter):

Sample	Appearance	Aroma	Texture	Taste	Total
A	4	3	4	5	16
B	5	5	3	4	17
C	3	2	4	3	12

Answer following question:

- Which sample did most people like?
- What made one cookie better than another?
- How could the lower-rated cookie be improved?

Write a short paragraph on "What I learned from the blind tasting exercise."

Shelf-Life Check (Over 15 Days)

Objective: Observe how shelf life changes texture and aroma.

- Store 2–3 cookie samples in different conditions (airtight box, open plate, wrapped in foil).
- Observe and record changes daily in a table:

Day	Airtight Box	Foil Wrap	Open Plate
1	Fresh	Fresh	Fresh
3	Still crisp	Slightly soft	Stale
5	Soft, chewy	Mild odour	Very stale

SESSION 6: PACKAGING AND LABELLING

Packaging is the final, but perhaps most visible, step in the baking process. In millet-based bakery products, where freshness and texture can deteriorate quickly, packaging plays a crucial role in preserving quality. A good package doesn't just look attractive but also:

- Protects the product from air, moisture, dust, and insects.
- Extends its shelf life, and
- It also maintains hygiene by preventing contamination during handling and transport.
- Beyond protection, packaging is essential for product branding and communication. Labels share critical information like ingredients, nutrition, and shelf life, helping customers make informed choices and comply with food safety regulations.

Types of Packaging Materials Used in Bakeries

Packaging Material	Best For	Features
Food-grade plastic pouches	Cookies, small snacks	Seals freshness, allow visibility
Zip-lock pouches	Premium cookie packs	Resealable
Paperboard boxes	Cakes, muffins	Good for branding, eco-friendly,
Butter paper wraps	Muffins, brownies	Greaseproof
Glass jars	Dry cookies, luxury packs	Reusable, visually appealing
Aluminium foil containers	Brownies, bread slices	Moisture barrier, food-safe

When selecting materials, it is important to prioritize recyclability and food-grade certification. Eco-friendly options are increasingly preferred by conscious consumers.

Shelf-Life Considerations while Choosing Packaging Materials

Several factors affect how long a millet-based bakery product remains fresh. High-moisture ingredients like milk or ghee can shorten shelf life, while low-moisture, well-baked products tend to last longer. Airtight packaging and proper storage—cool, dry, and away from sunlight—can preserve texture and prevent spoilage. For instance, millet cookies in a sealed jar may remain fresh for up to 10 days, while those exposed to air may turn stale within three.

Several factors affect how long millet bakery products stay fresh:

Factor	Impact
Ingredients used	Use of jaggery, ghee, or milk can reduce shelf life
Moisture content	Higher moisture = faster spoilage
Packaging quality	Airtight packaging increases shelf life
Storage conditions	Cool, dry, and dark storage is ideal

4. FSSAI Labelling Requirements for Baked Products

In India, all packaged food items must comply with the Food Safety and Standards Authority of India (FSSAI) guidelines. Labels must be clear, legible, and securely affixed to the product. A basic label must include:

- Product Name (e.g., Ragi Choco Cookies)
- Ingredients List (in descending order)
- Net Quantity (e.g., 150 g)
- Manufacturing Date (MFD)
- Best Before Date
- FSSAI License Number

- Nutritional Information (energy, fat, protein, sugar, etc.)
- Allergen Info (e.g., contains wheat, nuts, lactose etc.)
- Veg/Non-Veg Symbol: Use the green dot for vegetarian and brown triangle for non-vegetarian products.

Fig. 1.11: Veg/non-Veg Symbol

Packaging, labelling, and sensory evaluation are as critical to baking success as ingredients and ovens. They ensure customer satisfaction, brand trust, and product safety. By understanding and practicing these steps, students not only develop better millet-based products but also learn the basics of running a bakery enterprise with professionalism and care.

Millets are not just traditional; they are timely. As India and the world lean toward more sustainable, nutritious, and inclusive food systems, millet-based bakery products present a powerful opportunity for innovation. With the right understanding of ingredient roles, baking techniques, and formulation adjustments, these ancient grains can deliver modern, healthful, and appealing baked goods that meet the demands of today's conscious consumers. The art and science of millet baking lie not in replicating wheat-based outcomes, but in embracing and enhancing what these grains uniquely offer.

CHECK YOUR PROGRESS

Practical Activity

1. Pack, Label, and Display!

Materials Needed:

- Food-grade pouches, paper boxes, or jars
- Printed or hand-made FSSAI-style labels
- Sealing tape/stapler
- Permanent markers, stickers, ribbon (for decoration)

Steps:

1. Bake and cool your millet cookies/muffins.
2. Choose appropriate packaging material (explain why).
3. Label your package using the FSSAI template.
4. Seal hygienically and decorate for display.
5. Display all student products on a presentation table for peer review.

Make a short note explaining:

- Which packaging did you choose and why?
- How did you make your product stand out?
- What would you change next time for better shelf life or presentation?

Paste a photo of their labelled package and write a short paragraph: "How packaging and labelling help build trust and freshness."

A. Multiple Choice Questions (MCQs)

1. Which machine is primarily used to mix ingredients like millet flour, fats, and liquids in large batches?
   A. Dough Blender
   B. Planetary Mixer
   C. Dough Divider
   D. Proofing Cabinet
2. Which of the following is NOT a millet?
   A. Ragi
   B. Bajra
   C. Corn
   D. Foxtail
3. Which of the following flours has the highest gluten content?
   A. Sorghum flour
   B. Whole wheat flour
   C. Refined wheat flour
   D. Corn flour
4. What is a key reason millet-based baked goods may have a dense or crumbly texture?
   A. Low protein content
   B. Lack of sugar
   C. Absence of gluten
   D. Excess fat
5. What is the typical hydration adjustment required when baking with millet flour?
   A. Decrease water by 10%
   B. Increase water by 10–15%
   C. Use no water at all
   D. Add milk instead of water

B. Fill in the Blanks

1. Millets are often referred to as _____ because of their high nutritional value and health benefits.
2. The process of beating butter and sugar together until light and fluffy is called _____.
3. The outer-coloured part of citrus fruit peel used for flavouring is known as _____.
4. A "_____ oven uses rotating racks and hot air circulation for even baking at scale.
5. _____ is the elastic protein network in wheat flour that gives structure and chewiness to baked goods.

C. True or False

1. Millets contain high amounts of gluten.
2. Sensory evaluation involves all five senses.
3. Using airtight packaging helps extend the shelf life of baked goods.
4. All millet flours perform equally well in bread baking without any binding agents.
5. Labels must display allergen information and the veg/non-veg symbol to indicate vegetarian or non-vegetarian content.

D. Short Answer Type Questions

1. Why are millets considered a good alternative to refined flour in baking?
2. What is the main difference between a planetary mixer and a spiral mixer?
3. List any two tools used in baking and mention their functions.
4. What roles do eggs or egg substitutes play in baking?
5. Why is gluten important in traditional wheat-based baking?

E. Long Answer Questions

1. Describe five practices that can improve the quality of millet-based bakery products.
2. What is the significance of packaging in millet-based baking, and how can shelf life be enhanced?
3. Compare the textural and sensory properties of cookies made with wheat and finger millet.
4. Millets are nutritionally rich but pose baking challenges. How can a baker innovate while using millets?
5. Discuss common challenges faced when baking with millet flours and possible solutions to overcome these challenges.

Module 2 Millet-Based Ready-to-Cook (RTC) and Ready-to-Eat (RTE) Foods

About the Module

This module focuses on the preparation of millet-based RTC and RTE foods that meet the growing demand for convenience and nutrition. Students will learn about cleaning, dehusking, grading, and milling, followed by the formulation of products such as dosa mix, idli mix, upma mix, pongal mix, laddoos, energy bars, and millet-based snacks. The content emphasizes hygiene, quality standards, and safe handling practices, while also highlighting market trends and consumer preferences. Practical exposure enables students to prepare RTC/RTE mixes, operate relevant machinery, and package products for extended shelf life.

Learning Outcomes

- Operate processing equipment to produce millet-based RTC and RTE food products.
- Prepare RTC/RTE mixes and fermented millet-based foods while ensuring nutritional value and safety.
- Apply packaging, storage, and labelling practices to enhance shelf life and consumer appeal.

SESSION 1: INTRODUCTION TO READY-TO-COOK (RTC) AND READY-TO-EAT (RTE) FOODS

Ready-to-Cook (RTC) foods are semi-processed or pre-processed food products that require minimal preparation before consumption. These include items such as instant mixes, dehydrated meals, and parboiled staples. RTC foods help save time and effort while ensuring taste and nutrition.

Indian Market Scenario of RTC and RTE Products

India has witnessed rapid growth in the RTC and Ready-to-Eat (RTE) segments due to urbanization, changing food habits, and increased working population. The market value of RTE/RTC foods is expanding with increasing demand for health-centric and traditional grain-based products, especially millets.

Opting Millets for RTC and RTE Products

- Nutritional Superiority: Millets are rich in fibre, proteins, essential minerals, and antioxidants.
- Gluten-Free: Suitable for gluten-intolerant individuals.
- Climate-Resilient Crop: Promotes sustainability.
- Traditional Value: Millets are part of Indian culinary heritage.

RTC products made from millets

Product Name	Millet(s) Used	Description
Millet Dosa Mix	Ragi, Jowar, Little Millet	Just add water to make dosa batter for a quick and healthy breakfast.
Millet Idli Mix	Ragi, Foxtail, Barnyard	Instant fermented idli mix; steam-cooked after preparation.
Millet Upma Mix	Kodo, Foxtail	Seasoned pre-mix for quick cooking with hot water or light sautéing.
Millet Pongal Mix	Little Millet, Barnyard	Spiced millet mixes to cook a South Indian-style savory dish.
Multigrain Millet Atta	Ragi, Bajra, Jowar, Little Millet	Flour blend used for rotis, parathas, or baking.
Millet Pulao Mix	Little Millet, Barnyard	Pre-spiced rice alternative made with millets and dehydrated veggies.
Millet Instant Noodles	Foxtail, Kodo, Little Millet	Healthier noodles alternative, usually steamed and sun-dried, not fried.
Millet Pasta	Ragi, Sorghum, Jowar	RTC pasta made from millet flours; cooks like regular pasta.

RTE products made from millets

Product Name	Millet(s) Used	Description
Millet Cookies	Ragi, Jowar, Foxtail, Kodo	Healthy baked cookies, often sweetened with jaggery; ideal for snacks or kids.
Millet Muesli	Foxtail, Bajra, Ragi	Breakfast cereal with mixed millets, seeds, and dried fruits.
Millet-Based Snacks (e.g., puffs)	Jowar, Bajra, Ragi	Crunchy snacks made from puffed or roasted millets, often lightly salted/spiced.
Millet Laddoos	Ragi, Bajra	Traditional sweet balls made from millets, jaggery, and ghee.
Millet Energy Bars	Mixed Millets	Nutrition bars combining millets with nuts, seeds, and natural sweeteners.
Millet Breakfast Flakes	Foxtail, Sorghum	Dry flakes are to be eaten with milk or yogurt.

Millet-Based Nankhatai or Biscuits	Ragi, Kodo, Little Millet	Traditional Indian biscuits are made with millet flour and ghee.

Future Market Trends in RTC and RTE Millet-Based Foods in India

The market for ready-to-cook (RTC) and ready-to-eat (RTE) millet-based foods in India is expanding quickly due to health awareness, government support, and changing lifestyles.

- ***Growing Demand for Health-Conscious Products*:** Consumers are becoming more health-conscious. Millets are gluten-free, high in fiber, and have a low glycemic index. This makes them a better choice than polished rice or wheat. They aid digestion, help control weight, and assist in managing diabetes, which makes them popular with both urban and rural people.
- ***Government Support for Millets (Shree Anna Mission):*** The government's Shree Anna Mission is also having a significant impact. This initiative began after the International Year of Millets in 2023. Millets are being included in mid-day meals and the public distribution system. Startups focused on millet, farmer-producer organizations, and processing units are receiving strong policy and funding support.
- ***Urban Convenience Driving RTC/RTE Sales:*** In cities, busy lifestyles are increasing the demand for convenience. Packaged millet mixes like upma, dosa, and khichdi, as well as cookies, chips, and other snacks, are becoming common in kitchens. We can expect to see improved packaging, such as zip-lock pouches, single-serve packs, and microwaveable options.
- ***4. Diversification Beyond Traditional Products:*** Companies are moving beyond traditional items like rotis and khichdi. They are experimenting with millet noodles, pasta, pizza bases, snack bars, breakfast cereals, and even fusion foods like millet burgers, sushi, milk, and protein shakes.
- ***Rise in Millet-Based Packaged Foods in Tier 2 and Tier 3 Cities:*** Interestingly, it's not just big cities that are driving this trend. Tier 2 and Tier 3 cities are also catching up with affordable RTC/RTE millet options tailored to local tastes. For example, masala millet upma is priced around ₹10–15.
- ***Sustainability and Organic Certification:*** Sustainability is another significant factor. Many people are looking for organic, chemical-free foods. Certified organic RTC/RTE millet snacks and clean-label products are becoming more popular.
- ***Tech-Enabled Millet Startups and D2C Growth:*** At the same time, technology is influencing the millet market. Direct-to-consumer (D2C) startups are using online platforms and health food stores to sell their

products. In the future, we might see AI-driven personalized nutrition, millet subscription boxes, and millet products geared towards sports nutrition, like ragi-based protein bars and shakes.

- ***Export Potential:*** On the global front, India has a strong chance to become a hub for millet-based exports. Countries like the US, UAE, and EU are already showing interest in Indian RTC/RTE millet foods.
- ***Market Size and Growth Projection:*** The numbers also present a clear picture. The current market value in 2024 is estimated to be between ₹800–1,000 crore, with a projected growth of 15–20% CAGR over the next five years. By 2030, this could reach ₹3,000–4,000 crore, positioning millets as a key player in the future of healthy and sustainable foods.

Summary of Key Opportunities

Segment	Growth Potential	Notes
Millet breakfast cereals	High	Urban families, school-age children
Millet-based RTC meal kits	High	Working professionals, single households
RTE millet snacks (cookies, chips)	Very High	Kids, teens, mid-meal snacks
Millet-based functional foods	Emerging	Protein bars, weight-loss blends, diabetic foods
Millet sweets and festive snacks	Moderate	Seasonal demand, regional targeting

SESSION 2: PRODUCTION OF MILLETS-BASED RTC FOODS

Idli Mix (Instant)

Idli is a popular steamed breakfast dish, especially common in South Indian cuisine. Traditionally made using rice, rava, and fermented pulses, idlis are light, fluffy, and often enjoyed with chutneys or sambhar.

In this version, millets are used as a healthier alternative to rice, making the mix nutrient-rich and suitable for Ready-to-Cook (RTC) convenience.

Fig. 2.1: Millet Idli

Ingredient	Quantity
Millet Rava	1 cup
Urad dal flour	1 cup

Rice rava	1 cup
Salt	1 teaspoon
Baking soda	0.5/ teaspoon
Machinery: Mixer, Grinder, Siever, Packing and Sealing Machine	

Step-by-Step Process Flow

1. Make a flour of the urad dal by grinding.
2. In a large mixing vessel, add millet *rava*, rice *rava* and salt. Mix thoroughly to ensure an even blend.
3. Incorporate the urad dal flour into the mixture. Stir well or use a mechanical blender for uniformity.
   Add baking soda if a fluffier texture is desired. It helps in leavening, but it is not mandatory.
4. Pass the blended mix through a fine sieve to remove lumps and ensure a smooth, consistent texture.
5. Fill the final mixture into airtight, food-grade pouches
6. Clearly mention the product name, date of manufacture, ingredients, and best-before date as per FSSAI guidelines

Storage Recommendations

- Keep in a cool, dry place away from moisture
- Shelf life: 4-6 months when properly sealed
- Moisture content: Should not exceed 10%

Instant Dosa Mix (Millet-Based)

Dosa is a classic South Indian breakfast dish, traditionally made as a thin, crispy pancake from a fermented mixture of rice and pulses. It is typically enjoyed with chutneys or spiced vegetable curries.
To offer a quicker and healthier alternative, millet-based instant dosa mixes are now being developed using sorghum, foxtail, or kodo millets in combination with other ingredients. This formulation eliminates the need for long fermentation while maintaining taste and nutrition.

Fig. 2.2: Millet Dosa

Ingredients	**Quantity**
Millet flour (foxtail/kodo)	60%
Rice flour	30%
Urad dal flour	10%
Salt	1%
Optional: Methi	<0.5%

Machinery/Equipment Required

- Weighing Scale
- Grinder (if flours are made in-house)
- Dry Blender or Ribbon Mixer
- Sieve
- Packing Machine (Vacuum/Nitrogen Flush/Heat Sealer)

Process Flow Chart

1. Measure required quantities of millet flour, rice flour, urad dal flour, and salt.
2. Incorporate citric acid and sodium bicarbonate to support aeration and quick cooking.
3. Add minimal quantities of methi/fenugreek for enhanced flavour (if desired).
4. Mix all ingredients thoroughly using a mechanical blender to achieve a uniform texture.
5. Sift the mixture to break any lumps and ensure fine consistency.
6. Fill the prepared mix into food-grade MPET (metalized polyester) laminated pouches or sachets. Use nitrogen flushing or vacuum sealing for better shelf life.
7. Apply product labels with manufacturing date, nutritional facts, usage instructions, and expiration date.

Key Considerations

- Moisture content: Must be below 8 % to maintain product stability.
- Shelf Life: Up to 6 months in dry, cool storage conditions.
- Storage: Airtight packaging, away from humidity and direct sunlight.

Instant Millet Upma Mix

Upma is a traditional savory breakfast dish widely enjoyed across South India. It is usually prepared by cooking semolina (rava) or rice with lentils, spices, and vegetables. In the instant version, millet grains replace wheat semolina to offer a more nutritious, gluten-free, and fibre-rich alternative.

Fig. 2.3: Instant Millet Upma Mix

Ingredients (for small-scale production)

Ingredient	Quantity (%)
Millet Grains (Foxtail/Barnyard/Proso)	60%
Roasted Pulses (Chana Dal, Urad Dal)	10%
Dehydrated Vegetables (Carrot, Peas, Beans, Onion)	10%
Seasoning and Spices (Mustard Seeds, Curry Leaves, Green Chilies, Turmeric)	5%
Edible Oil or Ghee	10%

Salt	5%

Machinery/Equipment Required

- Millet Grain Cleaner and Dehuller
- Roaster (for rava and pulses)
- Vegetable Dehydrator or Procurement of Dehydrated Vegetables
- Dry Blender or Ribbon Mixer
- Pouch Filling and Vacuum/Nitrogen Sealing Machine

Step-by-Step Process Flow

1. Dry roast millet grains or millet rava until golden and aromatic.
2. Use pre-dehydrated vegetables or dehydrate fresh ones using a dehydrator.
3. Heat oil or ghee and add mustard seeds, curry leaves, green chilies, pulses (chana dal and urad dal) and turmeric powder.
4. Mix in roasted pulses and cook until aromatic.
5. Let it cool completely before blending.
6. Combine the roasted millet, seasoning, pulses, and vegetables in a dry blender.
7. Add salt and mix evenly to ensure uniform flavour.
8. Transfer the final mix into food-grade MPET laminated pouches.
9. Seal and label appropriately.

Key Product Characteristics

- Moisture Content: Between 6-8%
- Shelf Life: up to 6 months in sealed, dry packaging
- Preparation Tip: Just add boiling water, stir, cover, and let it sit for 5–7 minutes before serving.

Millet Dhokla Mix

Millet Dhokla is a healthy and instant variant of the traditional Gujarati steamed snack, made using millet flours like foxtail or barnyard millet instead of rice or besan. It's soft, spongy, and perfect for a nutritious breakfast or evening snack. When prepared as a Ready-to-Eat (RTE) mix, it requires only steaming or light heating to consume, offering convenience and health benefits in one product.

Fig. 2.4: Millet Dhokla Mix

Ingredient	Quantity
Foxtail Millet Flour	300 g
Besan (Chickpea Flour)	300 g
Citric Acid	5 g
Baking Soda	8 g
Sugar Powder	20 g
Salt	15 g

Dehydrated Ginger Powder	5 g
Dehydrated Green Chili Flakes	5 g
Eno (Fruit Salt) *(optional)*	—

Machinery/Equipment Required

- Mixing bowl or blender
- Weighing scale
- Tray sealer or pouch filling machine (for packaging)
- Steamer or idli cooker (for consumer use)
- Food dehydrator (for drying curd/vegetables if made in-house)
- Storage containers (airtight, food-grade)

Step-by-Step Process Flow

1. Sieve all dry powders (millet flour, besan, curd powder, salt, sugar, citric acid, soda).
2. Add spices (ginger powder, green chili flakes) and mix thoroughly for uniform distribution.
3. Use a dry blender or mixer to ensure homogeneity in the mixture.
4. Portion the mix into 100g or 200g pouches (sufficient for 2–4 servings).
5. Use laminated or vacuum-sealed food-grade pouches to increase shelf life.
6. Optional: Add a sachet of Eno or fruit salt separately.
7. Store in a cool, dry place away from moisture and sunlight.

Key Product Characteristics

Texture	**Soft, spongy, porous**
Flavour	Mildly tangy, with a hint of spice
Colour	Pale yellow to beige (depending on the millet used)
Shelf Life	4–6 months (in dry, sealed condition)

SESSION 3: PREPARATION OF MILLET-BASED FERMENTED FOODS

Fermented millet foods like idli, dosa, and *uttapam* are popular for their enhanced digestibility, improved nutritional value, and appealing taste. The preparation process involves careful selection and mixing of millets and pulses, appropriate soaking, controlled fermentation, and hygienic handling. This chapter explores traditional and modern preparation techniques, fermentation parameters, and packaging standards for both wet batters and instant mixes.

Proportions of Millets to Pulses

The millet-to-pulse ratio plays a crucial role in determining the taste, texture, and nutritional balance of fermented products.

Fermented Product	Millet	Pulse	Typical Ratio
Dosa	Foxtail/Little/Barnyard Millet	Dehusked Black Gram (Urad Dal) + Rice (optional)	3:1
Idli/Uttapam	Finger Millet (Ragi), Pearl Millet	Urad Dal + Rice (optional)	2:1 or 3:1
Adai/Chilla	Kodo Millet + other millets	Mixed pulses (chana, toor, urad)	2:1 or 1:1

Soaking Time and Water Ratios

Proper soaking is essential for softening grains, initiating enzymatic activity, and improving grinding efficiency.

Ingredient	Soaking Time	Water Ratio (for soaking)
Millets	6–8 hours	1:2 or 1:3
Pulses (Urad Dal)	4–6 hours	1:3
Fenugreek seeds (optional)	4 hours	1:5

Ensure water is potable and containers are clean to prevent contamination.

Fermentation Conditions

Proper fermentation enhances flavour, digestibility, and volume of the batter.

Parameter	Ideal Range
Temperature	28°C – 32°C
Time	8–12 hours (can vary with season)
Hygiene	Use sanitized utensils and cover batter to prevent contamination. Wash your hands and tools thoroughly.
Fermentation Starters	Leftover fermented batter, buttermilk, or fenugreek seeds can be used to initiate fermentation.

Indicators of Good Fermentation:

- Mild sour aroma
- Increased batter volume (1.5x to 2x)
- Smooth and bubbly texture

Preparation Steps for Wet Fermented Batter

1. **Soaking**: As per grain/pulse type.
2. **Grinding**: Use a wet grinder or stone grinder to grind to a smooth paste.
3. **Mixing**: Combine millet and pulse batter uniformly.
4. **Fermentation**: Place batter in a warm, clean area; allow to ferment.
5. **Post-Fermentation Mixing**: Gently stir before use to maintain texture.

Add natural souring agents like buttermilk or previous-day batter to assist fermentation.

Equipment Required

- Wet Grinder, Stone Grinder (Hand/Motorized)
- Stainless Steel Containers
- Electric Steamer, Induction Stoves
- Non-stick or Cast-Iron Tawa

Fig. 2.5: Wet Grinder

Hygiene and Safety Practices:

- Clean all equipment before and after use.
- Store batter in clean, covered containers.
- Regularly inspect equipment for rust or wear.
- Use gloves/hairnets/aprons during handling.

Quality Indicators

Parameter	Desirable Characteristic
Smell	Mildly sour, pleasant
Consistency	Thick but pourable; not watery
Volume	Should increase by 1.5x or more
Taste	Balanced sourness with no off-flavours
Cooking Behaviour	Dosa should brown evenly; idlis should be spongy and rise well

8. Packaging and Storage

- Wet Batter is packed in food-grade plastic tubs and pouches.
- Store refrigerated between 0–4°C for 2-7 days.

Fig. 2.6: Wet Batter in Pouch

Summary Table

Product	Key Ingredient	Moisture %	Shelf Life
Millet Rava	Whole millet	6-8 %	6–9 months
Idli/Dosa Mix	Millet + Urad	6-8 %	6–9 months

Upma Mix	Millet Rava + Veg	6-8 %	6–9 months
Dhokla Mix	Millet + Besan	6-8 %	6-9 months
Fermented Wet Batter	Millet + pulses +rice	50-60 %	2- 7 days

Millets are versatile, nutritious, and suitable for a wide range of RTC products. Their incorporation in India's rapidly growing convenience food market supports both public health and the livelihoods of millet farmers. With adherence to MoFPI guidelines and quality parameters, entrepreneurs can successfully venture into the millet-based RTC segment.

Activity: Compare & Analyse RTC Mixes -any one (Traditional vs. Millet-Based)

Objective:
To help students understand the composition, appearance, texture, and labelling of different RTC mixes available in the market.

Materials Needed (per group):
- 1 packet of *traditional* mix
- 1 packet of *millet-based* mix (e.g., ragi, foxtail, or kodo)
- Observation sheets
- Magnifying glasses (optional)
- Weighing scale (optional)
- Clean plates/spoons
- Pen/pencil

Steps:
1. Read carefully the ingredient lists and nutrition labels of both mixes.
2. Pour a small amount of each mix on a plate and observe colour, texture, and granularity.
3. Use the data on the label/ packaging to compare fibre, protein, and fat content.
4. Answer the following on your sheet:
   - Which product lists a higher millet percentage?
   - What claims (e.g., "gluten-free," "high fibre") are made on the packaging?
   - How do the prices compare?
5. Discuss which mix appears healthier and why, and whether packaging influences your choice.

Submission:
Each group will prepare a comparison table and a short reflective paragraph on their findings.

CHECK YOUR PROGRESS

Practical Activity

1. Prepare a Millet-Based RTC food. Submit a short write-up on the ingredients, process, challenges faced, and suggestions for improvement.

A. Multiple Choice Questions (MCQs)

1. Which of the following is NOT typically an RTC product?
   A. Millet dosa mix
   B. Instant noodles
   C. Cooked Pasta
   D. Poha mix

2. Which of the following best describes "Multigrain Millet Atta"?
   A. Boiled grain mix
   B. Flour mix for rotis and parathas
   C. Pre-cooked noodle mix
   D. Sweet dessert powder

3. What is a key advantage of using millets in dosa and idli mixes?
   A. Increased fermentation time
   B. Low gluten content
   C. Nutritional boost
   D. Increased sweetness

4. What ingredient is replaced with millets in Upma Mix.
   A. Sugar
   B. Rava (semolina)
   C. Butter
   D. Milk

5. Which of the following Ready-to-Cook (RTC) products uses *millet and besan* as its key ingredients?
   A. Millet Rava
   B. Idli/Dosa Mix
   C. Upma Mix
   D. Dhokla Mix

B. Fill in the Blanks

1. RTC foods save _____ and efforts while ensuring taste and nutrition.
2. _____ is a climate-resilient crop that promotes sustainability and is part of India's culinary heritage.
3. Proper soaking of millets usually takes about _____ hours with a water ratio of 1:2 or 1:3.
4. Indicators of good fermentation include a mild sour aroma, _____ increase in batter volume, and smooth bubbly texture.
5. RTC and RTE stands for _____and _____.

C. True or False

1. RTC foods like dosa and idli mixes completely eliminate the need for fermentation. True/False
2. Millets are gluten-free, rich in fibre, and suitable for diabetic-friendly foods. True/False
3. The shelf life of a fermented wet millet batter is 6–9 months. True/False
4. Government's Shree Anna Mission promotes millet inclusion in mid-day meals and public distribution. True/False
5. Foxtail, Kodo, and Little Millet are commonly used in millet noodles and pasta production. True/False

D. Short Answer Type Questions

1. What are Ready-to-Cook (RTC) foods?
2. Name any three millets commonly used in RTC products.
3. Why are millets considered a sustainable ingredient?
4. List any two machines used in the production of RTC idli mix.
5. How will you prepare multigrain millet flour?

E. Long Answer Type Questions

1. Explain the advantages of using millets in RTC products compared to traditional grains.
2. You are asked to design a new millet-based RTC breakfast product. What factors would you consider while choosing ingredients, packaging, and shelf life?
3. Compare and contrast RTC idli mix and dosa mix in terms of ingredient composition, preparation process, and product characteristics.
4. Propose a marketing strategy to promote millet-based RTC products among urban youth. Include branding, health appeal, and convenience aspects.
5. Write key product characteristics of any three RTC products.

Module 3 Millet-Based Extruded Products

About the Module

This module introduces extrusion technology, where millet flours are transformed into value-added products such as puffed snacks, noodles, vermicelli, and breakfast cereals. It explains the principles of cold and hot extrusion, raw material selection, machine operation, and post-processing steps. The focus is on achieving desirable texture, flavour, digestibility, and longer shelf life in extruded foods. Through practical sessions, students gain vocational skills in standardizing recipes, handling extrusion equipment, and innovating new millet-based extruded products for commercial application.

Learning Outcomes

- Explain the principles and processes involved in cold and hot extrusion of millets.
- Operate extrusion machinery to prepare millet-based noodles, vermicelli, and puffed snacks.
- Innovate and standardize millet extruded products considering texture, taste, and consumer demand.

SESSION 1: INTRODUCTION TO EXTRUSION

Extrusion is basically a process where a single commodity or a composite of commodities is passed through shear/pressure with or without the use of heat to get final products with the desired shape and size.

The process is especially useful when creating millet-based functional foods since it can turn ordinary grains into desirable, modern forms geared towards modern consumers.

Extrusion is also carried out without the use of heat, wherein the flour is moistened and put through a mechanical shear process, where the material is compressed and shaped.

The material is both cooked and shaped during the process, protein denaturation, and microbial inactivation, thereby enhancing product safety, digestibility, and shelf life.

Raw Materials and Their Functions in Extrusion

Ingredient	Function
Cereal Flours (e.g., maize, rice, wheat, millet)	Base material: provides starch and bulk
Pulse Flours (e.g., urad dal, soy, chickpea)	Increases protein content, improves texture and nutrition
Starch (tapioca, corn, potato)	Expands product, improves binding and puffing
Water	Hydrates ingredients, controls dough consistency
Oil/Fat	Enhances mouthfeel, lubrication, flavour
Salt	Flavour enhancement and ionic balance
Spices and Seasonings	Flavour, aroma
Hydrocolloids	Improve texture, prevent breakage, act as binders
Emulsifiers	Stabilize fat–water interaction, improve mouthfeel
Fiber sources	Enhance nutritional value, improve structure
Colours (natural/synthetic)	Visual appeal
Preservatives	Shelf-life extension
Flavour Enhancers	Boost umami and overall flavour

1.2 Types of Extrusion

Extrusion in food processing comes in two main forms:

- **Cold Extrusion**
- **Hot Extrusion**

Cold Extrusion

Primarily used for pasta, noodles and vermicelli making. This method mixes dough made from different components and passes it through pressure so that the dough is compressed. This dough exits from a die which shapes the dough that can later be cut in desired sizes. Colours can be added using tomato or spinach paste.

- Machines range from small manual types (used in restaurants) to large electric ones.
- A die shapes the pasta, noodles and vermicelli and blades cut it to size.
- Final products can be cooked, dried, or frozen for storage.

Fig. 3.1: Cold Extruded Products

Machinery

Cold Extruder: Structure and Operation

The cold extruder is constructed entirely from high-grade, corrosion-resistant stainless steel, ensuring durability and food safety. Its primary components include:

- An upper mixing tank equipped with a motor and a robust mixing shaft
- An automatic dough cutter featuring a speed variator and stainless-steel blades
- A cooling blower designed to maintain product quality during extrusion
- A stainless-steel trolley with wheels for mobility and operational convenience

The machine utilizes two types of dough plates to achieve different noodle textures and appearances.

- The bronze die creates a rough-textured dough with a matte surface, suitable for traditional-style pasta.
- The Teflon die produces a smoother, glossier finish and allows for slightly higher production rates, though it is more delicate than the bronze version.

Fig. 3.2: Cold Extruder

During operation, if the dough appears too dry and floury without forming into granules or small balls, a slight increase in liquid is recommended. The mixing shaft initiates the kneading process, and the dough reaches the appropriate consistency for extrusion in approximately 15 minutes. The resulting dough should be friable and granular, ready for shaping.

To optimize continuous production, while the dough is being kneaded in the lower tank, a new batch can be prepared in the upper tank. This dual-chamber design enables uninterrupted processing, minimizing downtime and enhancing overall output, particularly for macaroni and similar pasta products.

Machines Used in Production

Activity: Label the different parts of the Cold Extruder.

Equipment	What It Does
Cold Extruder	Shapes the dough
Cutter	Cuts products to a uniform length
Steamer	Cooks the product lightly to improve digestibility
Seasoning Bath	Adds flavour to steamed product (optional)
Air Drying Rack	Dries products using natural air circulation
Cooling Rack	Brings dried products to room temperature
Packaging Machine	Seals the products in bags or cups

SESSION 2: COLD EXTRUDED PRODUCTS

Millet-Based Chakli

Chakli is crispy snack enjoyed during festivals like Diwali, Sankranti, and Dasara. Traditionally made with rice and urad dal flour, this savoury spiral treat is deep-fried and flavoured with spices.

By replacing traditional flours with nutrient-rich millet flours like little millet, pearl millet, or finger millet, we get a healthier version of Chakli without compromising taste.

Fig. 3.3: Ragi Chakli

Ingredients

Ingredient	Proportion (%)
Millet Flour	50%
Roasted Gram Flour	25%
Rice Flour	25%
Salt and Spices	As per taste

Production Process:

The production process for millet-based Chakli involves a systematic sequence of steps to ensure quality, consistency, and safety.

1. It begins with raw material preparation, where millet, rice, and urad dal are thoroughly cleaned and inspected. These ingredients are then milled into fine flours, followed by mixing in blenders along with salt and spices.
2. Moisture adjustment is carried out by adding a specific amount of water to achieve the desired dough texture.
3. The dough is then allowed to rest in a controlled environment to improve its elasticity and flavour.
4. Next, the dough undergoes cold extrusion, where it is shaped into Chakli spirals using specialized dies.
5. The formed Chakli is then subjected to pre-frying or drying to remove excess moisture, followed by deep frying at controlled temperatures to achieve a crisp texture.

6. Once fried, the product is cooled and drained on racks. An optional seasoning step may be added to enhance flavour post-frying.
7. Quality control checks are performed to assess taste, crunchiness, oil content, and overall consistency.
8. The finished product is then packaged in sealed packs with appropriate labelling and finally moved to storage and distribution, where it is kept in dry conditions before being delivered to markets.

Activity: Prepare Chakli using the ingredients mentioned in the session.

Millet-Based Noodles

Millet noodles are a wholesome, fiber-rich alternative to traditional instant noodles, offering better digestibility and a lower glycaemic index. These noodles are ideal for quick meals and can be flavoured or plain, depending on consumer preference.

Fig. 3.4: Millet-Based Noodles

Typical Product Formulation Table

Ingredient	Percentage Range
Wheat Flour	50–60%
Millet Flour	10–30%
Binding Agents	10–15%
Oil	2–3%
Salt	As needed

Percentages may vary depending on the brand or recipe.

Process

The production of millet noodles involves four key steps. First, in the mixing stage, wheat and millet flours are blended with water, oil, salt, and a binding agent such as cornstarch to create a smooth, uniform dough. In the extrusion step, the dough is pushed through an extruder, where it is shaped into long noodle strands under controlled pressure. These noodles are then cut into uniform lengths and dried, typically using air drying or hot air-drying techniques, which reduce moisture content and extend shelf life. Finally, the noodles are packaged in sealed bags using packaging machines to maintain freshness and hygiene during storage and distribution.

Packaging and Storage Guidelines

- Use moisture-proof and insect-resistant pouches (preferably MPET or multilayer film).
- Seal the pouches airtight using vacuum or nitrogen-flushed techniques.
- Store in a cool, dry place, away from direct sunlight.
- Shelf life: Up to 6–8 months, depending on storage conditions.

Millet-Based Vermicelli

Fig. 3.5: Millet-Based Vermicelli

Millet-based vermicelli and pasta are nutritious alternatives to conventional wheat-based products. These are prepared using cold extrusion technology, which is cost-effective and supports continuous production, making it ideal for both small-scale and commercial units. Finger millet /Foxtail millet /Pearl millet *rava* and wheat *rava* are blended in the mixing c ompartment of the vermicelli-making machine and blended with water for 30 minutes and extruded using a round die. The vermicelli is allowed to temper at room temperature for 8 hours and then dried in a cabinet drier for 6 hours. Vermicelli yield is 99% and by-product yield is 1% (negligible), which varies according to millets.

Product Formulation

Ingredient	Proportion (%)
Wheat Flour	50–60%
Millet Flour	10–30%
Binder	10–15%
Oil	2–3%
Salt	As needed

Essential Machinery

- Dough Kneader
- Extruder with Vermicelli/Pasta Die
- Steamer
- Cabinet Drier
- Cutter
- Pouch Filler and Sealing Machine

Production Process of Millet Vermicelli

The production of millet vermicelli begins with mixing, where millet flour, wheat flour, water, and binding agents are combined to form a cohesive dough. This is followed by kneading, which enhances the dough's elasticity and improves the final product's texture. The dough is then shaped through extrusion, where it is pushed through fine, round dies to create thin vermicelli strands. These strands are cut to the desired length and may undergo optional steaming, which partially cooks the product and pre-gelatinizes the starch, improving its digestibility. In some cases, seasoning is applied by dipping the vermicelli in flavouring solutions to add taste. The strands are then dried, either by air-drying or machine-drying, to reduce moisture content and extend shelf life. Once dried, the vermicelli is cooled to room temperature using racks or conveyor systems, and finally packaged in sealed bags to preserve freshness and prevent contamination.

Millet-Based Pasta

Millet pasta is a healthy twist on traditional Italian pasta, made using millet flour. It comes in many fun shapes like spaghetti, penne, fettuccine, farfalle, and more.

Fig. 3.6: Millet-Based Pasta

Product Formulation

Ingredient	Proportion (%)
Semolina (Rawa)	50–60%
Millet Rawa	10–30%
Binders	10–15%
Oil	2–3%
Salt	As needed

Production Process of Millet Pasta

The production process of millet pasta involves a series of well-defined steps to achieve the desired texture, shape, and shelf life. It starts with mixing and kneading, where millet rawa is blended with semolina, water, and oil to form a uniform, elastic dough. This dough is then subjected to extrusion, where it is pushed through specialized dies in a pasta-making machine to create various shapes such as spaghetti, penne, or fusilli. Following extrusion, the pasta is cut into pieces of the desired length. The cut pasta undergoes drying, either through natural air drying or in controlled drying machines, to reduce moisture content and enhance shelf stability. Finally, the dried pasta is packaged in airtight containers or pouches to preserve freshness and prevent spoilage during storage and distribution.

Did you know?

Pasta dates back to 13th-century Italy but became popular globally in the 20th century due to modern machinery like auger-based extruders, which combine kneading and shaping in one go!

Activity: Find out the cold extruded products available in your locality. Read ingredients and health claims on their labels.

SESSION 3: HOT EXTRUSION

Extrusion food processing is a high-temperature, short-time (HTST) process in which a formulated food mixture—typically consisting of flours, starches, proteins, and other additives—is forced through a shaped die using mechanical shear and pressure. The process is conducted using an extruder,

which typically comprises one or more rotating screws housed within a stationary barrel. As the material advances through the barrel, it undergoes mixing and thermal treatment through external heating.

Fig. 3.7: Millet- Based Puffs

Source: https://www.youtube.com/watch?v=AzafIg3kUMM

At the terminal end of the extruder, the mixture—referred to as the extrudate—is forced through a die to form a specific shape. Immediately upon exiting the die, the extrudate is cut to the desired size by rotating blades.

Hot extrusion machines come in:

- Single-screw
- Twin-screw

The Extrusion Process

It all begins with combining semolina (*rawa*) where millets can be included. This dry mix enters a pre-conditioner where other ingredients (sugars, fats, colouring) and water are added based on the target product. Steam is injected to begin cooking, and the preconditioned mix—now called the *extrudate*—is pushed through the extruder by a rotating screw within a barrel. The time it stays inside is the *residence time*.

As the mix exits through the die, pressure drops, steam escapes, and the product puffs up. This change in texture and size is known as the *expansion ratio*. Blades cut the extrudate to length as it exits, then the product is cooled and dried—becoming firm but still porous.

Preconditioning and its Importance in Extrusion

Preconditioning is the process of partially hydrating and heating raw materials before they enter the extruder. It helps initiate starch gelatinization and protein denaturation, reducing energy load on the extruder. This step improves product consistency, texture, and digestibility. Overall, it enhances processing efficiency and product quality.

Inside the extruder, friction and pressure (up to 10–20 bars) generate heat. This can cause proteins to unfold (denature) and starch to gelatinize, both key to the product's final texture.

Critical parameters include the extrudate's ingredients, screw length and speed, barrel temperature and moisture, die shape, and blade speed. All of these must be precisely controlled to ensure a consistent, high-quality product.

Key factors that influence the final product:

- Temperature and pressure inside the machine
- Die shape and size
- Screw design and speed (affects how much the mix is sheared)
- Moisture content in the mix
- Shear level (High = puffed snacks, Low = meat-like textures)

Heated dies can help expand products more, while cooled dies control or reduce puffing.

Because of so many combinations, small producers should always get expert advice before buying equipment.

Parts of a Food Extruder and Their Functions

Part	Description	Function
Feeding Hopper	Funnel-like entry point where raw materials are loaded into the extruder	Supplies the food mix or ingredients into the barrel
Barrel	Cylindrical housing for the rotating screw(s); may be heated or jacketed	Encloses the screw; provides pressure and temperature control
Screw (Single or Twin)	Helical shaft(s) rotating inside the barrel	Moves, mixes, shears, and compresses the food mixture
Heating System	External electric heaters or steam jackets attached to the barrel	Provides thermal energy for cooking (in hot extrusion)
Shear Locks or Mixing Zones	Specialized sections or screw configurations for intense mixing and shearing	Enhances gelatinization, mixing, or texturization
Die	Metal plate with shaped openings at the end of the barrel	Shapes the extrudate into desired form (e.g., rings, rods, flakes)
Cutter or Blade Assembly	Rotating or fixed blades just outside the die	Cuts the extrudate into uniform lengths or pieces
Discharge Outlet	Exit point for the final product	Allows the formed extrudate to leave the machine for further processing
Control Panel	Electronic interface for operating parameters like screw speed, temperature	Regulates process conditions and ensures consistent operation

Motor and Gearbox	Power Module located at the base or rear	Drives the screw(s) and controls torque and rotation speed
Cooling System	Water- or air-cooling system for barrel zones (especially in cold extrusion)	Maintains temperature stability and prevents overheating

Fig. 3.8: Hot Extruder

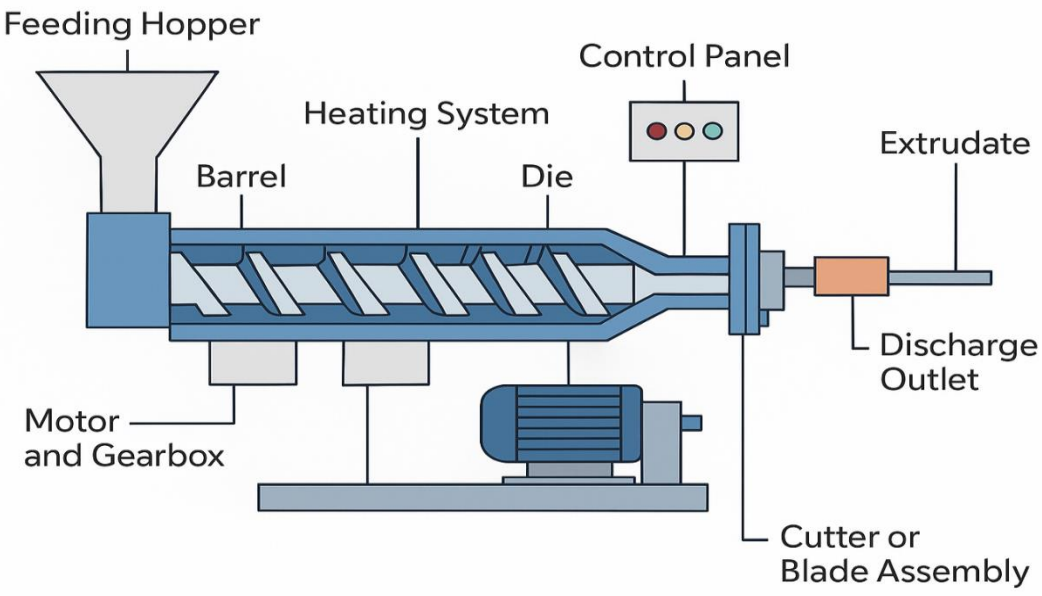

Fig. 3.9: Parts of a Hot Extruder

Other Equipment:

- Dry Mixers or Ribbon Blenders
- Belt or Rotary Dryers
- Cooling Conveyors
- Enrober/ Flavour Coating Drum (Tumbler or Spray Type)
- Weighing, Packing, and Sealing Machines

Activity: Label the Parts of an Extruder and write their functions.

Operating an Extruder: Safety and Setup

Before starting, safety is non-negotiable. Basic safety norms to operate an extruder include the following:

- Wear protective gloves and safety glasses.
- Ensure all moving parts are enclosed.
- Never open the extruder head while operating.
- Clean and dry all parts before and after use.

Key Extrusion Parameters to Monitor:

Parameter	Function
Temperature Zones	Controls starch gelatinization and flow
Feed Rate	Affects residence time and consistency
Screw Speed	Influences shear and expansion
Die Size/Shape	Determines product form (curl, noodle, etc.)

SESSION 4: PRODUCTS OF HOT EXTRUSION

- **Millet-Based Puffs, Curls and Flakes**
  These crunchy extruded snacks are popular among all age groups. Traditionally made with cornmeal or rice flour, they can be made healthier by incorporating millet flours such as sorghum (jowar), pearl millet (bajra), or finger millet (ragi) into the mix.

Ingredients:

Ingredient	Proportion (%)
Millet Flour (e.g. Pearl/Finger/Sorghum)	20 - 30%
Corn/Rice Grits or Flour	50 – 60%
Starch for binding	5–10%
Salt and Spices (pre-extrusion)	As per taste
Water	For dough consistency
Optional Flavouring Mix (Post-Processing):	
Flavouring ingredients: Cheese, Spices seasoning, peri peri, oil etc. Example Ingredients	

Production Process: The production of millet-based puffed snacks involves several carefully controlled steps to ensure texture, flavour, and shelf stability.

1. It begins with mixing, where millet flour is combined with corn or rice flour, starch, and dry ingredients such as salt and spices.
2. This blend undergoes conditioning, where water is added to achieve the optimal moisture content (typically 14–18%) required for efficient extrusion. In the extrusion and shaping stage, the conditioned mix is processed through high-temperature extruders (90–140°C), where steam causes the product to puff.
2. Specific dies are used to shape the extrudate into curls, twists, or irregular forms.
3. The extruded product is then cut into bite-sized pieces using rotary knives. Depending on the desired product, it may undergo drying or pre-frying to reduce moisture if an air-puffed texture is not preferred.
4. After frying or cooling, flavour coating is applied by tossing the snacks in a rotating drum with seasoning powders and a light oil mist to ensure uniform coverage.
5. Quality control checks follow, assessing parameters such as puff size, crunchiness, oil content, and flavour adhesion.

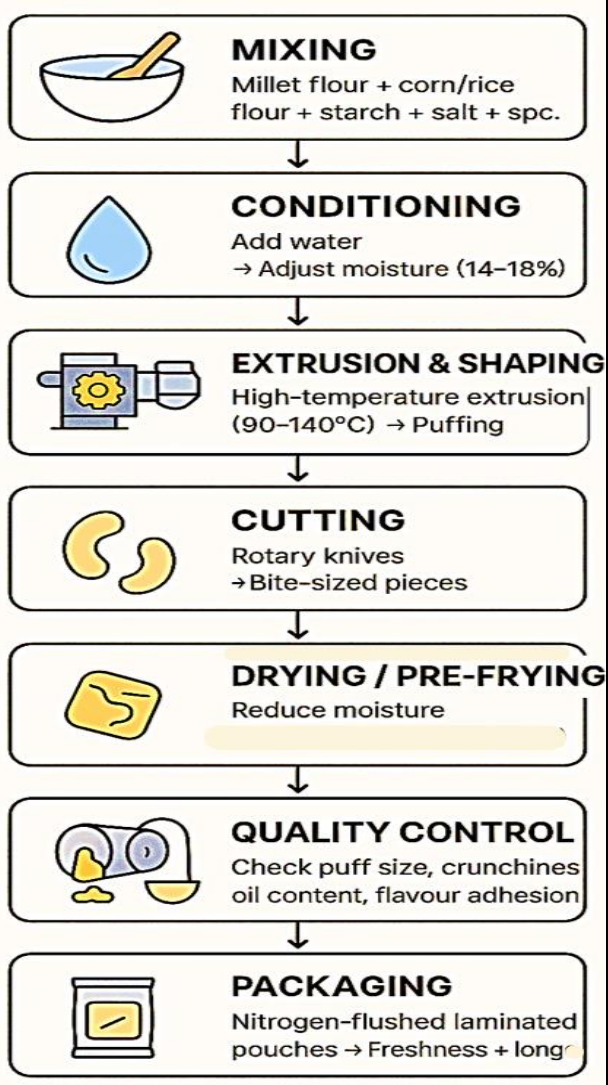

Fig. 3.10: Production Process of Millet-Based Puffs

6. Finally, the snacks are packaged in nitrogen-flushed laminated pouches to retain freshness and extend shelf life.

Quality Evaluation of Extruded Products

Extruded products (like millet puffs, snack sticks, and breakfast cereals) are made by forcing dough or flour through a machine called an extruder. The quality of these products must be checked to ensure they are tasty, safe, and market-ready.

Some important quality parameters are:

Parameter	Ideal Qualities
Expansion Ratio	Measures how much the product has "puffed up." Well-expanded products are light and crispy.
Crunch	Crisp without being too hard; pleasant mouthfeel
Shape Uniformity	Consistent size and shape; clean cut edges
Colour	Even browning (if roasted), no burnt spots or pale patches
Taste	Balanced seasoning, no bitterness or raw taste
Texture	Light and airy (hot extrudates), firm yet pliable (cold noodles)
Shelf Life	Low moisture (<10%), free from rancidity or microbial growth

Extrusion technology has revolutionized the way we process and consume snacks, offering speed, versatility, and efficiency. When combined with the nutritional power of millets, extrusion becomes a powerful tool to create healthier, innovative, and market-ready products such as millet-based puffs, flakes, chakli, noodles, pasta and vermicelli. These products not only cater to modern taste preferences but also address growing demands for nutrient-rich and sustainable alternatives. By understanding the extrusion process and its adaptability with millets, students and food entrepreneurs can explore new opportunities in value-added food product development, contributing to both consumer health and rural millet promotion.

Activity: Sensory Evaluation

Objective: Evaluate products made by peer groups using a structured format.

☑ **Activity Steps:**

1. Form teams of 3–4 students.
2. Each team presents its extruded product batch.
3. Use the following score sheet to rate each sample:

Parameter	Score (1–5)	Comments
Crunch		
Uniformity		
Appearance		
Flavour		
Texture		
Overall Acceptability		

CHECK YOUR PROGRESS

Practical Activity

1. Visit a Facility where extruded products are being manufactured.

A. Multiple Choice Questions (MCQs)

1. What is the main purpose of extrusion in food processing?
   A. To ferment millet flours
   B. To shape and cook food through pressure and/or heat
   C. To preserve foods through refrigeration
   D. To grind grains into fine flour

2. Which step in vermicelli production comes right after extrusion?
   A. Packaging
   B. Mixing
   C. Drying
   D. Tempering

3. What happens when the extrudate exits the die in hot extrusion?
   A. It becomes more compact
   B. It melts completely
   C. It puffs up due to pressure drop and steam escape
   D. It solidifies instantly

4. Which part of the extruder shapes the extrudate into the desired form?
   A. Screw
   B. Barrel
   C. Die
   D. Cutter

5. What is the typical temperature range in hot extrusion?
   A. 30–50°C
   B. 60–80°C
   C. 90–140°C
   D. 160–200°C

B. Fill in the Blanks

1. Extrusion can be done with or without the use of _____.
2. _____ are added in extrusion to stabilize fat–water interaction.
3. In the extrusion process, _____ is the component responsible for shaping the product.
4. The ratio that defines how much the product increases in size after extrusion is known as the _____.
5. In extruded millet snacks, starch is used primarily for _____.

C. True/False

1. Cold extrusion uses high temperatures to cook food.
2. Chakli is always steamed and never fried after extrusion.
3. Millet pasta can be made into various shapes like penne and fusilli.
4. During extrusion, proteins unfold and starch gelatinizes, changing the final texture.
5. In the extrusion process, the moisture content of the mix is irrelevant to product quality.

D. Short Answer Questions

1. What are the two types of extrusion used in food processing?
2. What role does drying play in noodle and vermicelli production?
3. List any two key functions of the screw in the extruder.
4. Name two safety norms that must be followed while operating an extruder.
5. What ingredients are used post-processing for flavouring extruded millet snacks?

E. Long Answer Questions

1. Describe the process of cold extrusion, highlighting its key machinery and benefits.
2. Compare and contrast millet-based noodles and vermicelli in terms of ingredients, processing, and drying techniques.
3. List common raw materials used in extrusion and explain the function of any five.
4. Explain the complete process of making millet-based puffed snacks using hot extrusion.
5. What are the critical parameters to monitor in the hot extrusion process and why?

Module 4 Marketing and Sales of Millet

About the Module

This module equips learners with the knowledge and skills to market and sell millet products effectively. It introduces the basics of marketing, customer analysis, branding, packaging, pricing strategies, and promotional methods. Students will also learn how to plan and execute a millet sales event, gaining hands-on exposure to entrepreneurship. By the end of the module, learners will understand how to position millet products in competitive markets and promote them through both traditional and digital platforms.

Learning Outcomes

- Analyze customer needs and apply suitable marketing and branding strategies for millet products.
- Apply pricing, promotion, and packaging techniques to enhance marketability.
- Plan, organize, and conduct a millet sales event to gain practical entrepreneurial experience.

SESSION 1: MARKETING BASICS

Marketing plays a pivotal role in determining the success of any food product—from the local millet snack sold in a weekly market to health-focused millet bars on e-commerce platforms. It's not just about advertising but about creating value and communicating it effectively to consumers.

In the context of millet-based products, marketing becomes even more significant because these are often unfamiliar or traditional items being reintroduced to modern consumers. Here, marketing must bridge the gap between tradition and innovation, health benefits and taste appeal, and affordability and aspiration.

Key Marketing Concepts: The 4Ps

The 4Ps of marketing—Product, Price, Place, and Promotion—form the foundation of any successful food business. Here's how they relate to millet-based products:

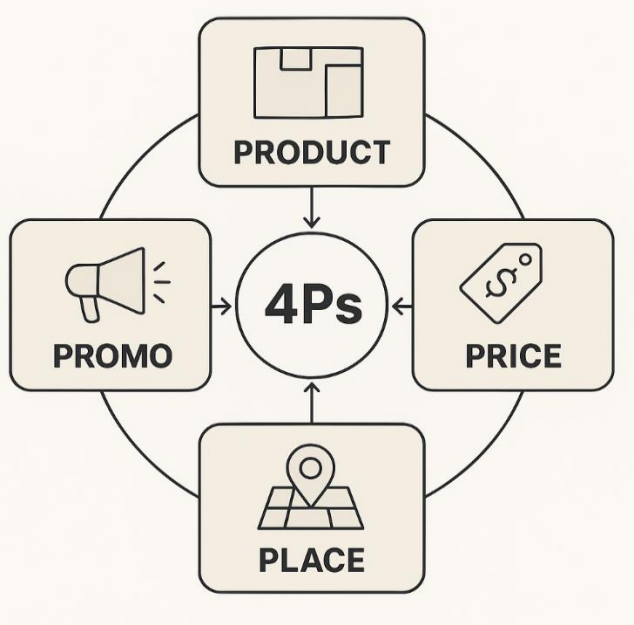

Fig. 4.1: 4Ps of Marketing

Marketing "P"	What It Means	Example in Millet Products
Product	What are you selling? The type, quality, features, and packaging.	Millet-based noodles, ready-to-eat snacks, cereal flakes, vermicelli
Price	How much do you charge, and why? Pricing must balance cost and customer value.	Affordable ₹10 snack packs or premium organic boxes costing ₹150+
Place	Where will you sell it? Choosing the right sales channels and distribution methods.	Local grocery shops, organic outlets, and online marketplaces like Amazon
Promotion	How will you inform and attract customers?	Eye-catching packaging, social media posts, influencer tie-ups, and health fairs

Think of your favourite snack. Can you describe its 4Ps? Now think about how millet can be used to make a healthier version of that snack. How would the 4Ps change?

Value Proposition and USP (Unique Selling Proposition)

Every successful product has a "reason to buy". That's your value proposition. For millet-based items, this may include:

- "Wholesome and gluten-free"
- "Traditional taste with modern convenience"
- "Rich in fibre and minerals"
- "Good for health"

A USP (Unique Selling Proposition) highlights what makes your product stand out. For example, a brand promotes its product saying: "Made with healthy ancient grains— just like your grandma used to make!"

Activity: Explore the Millet Market

Task 1: Identify Millet-Based Products Around You

- Visit a nearby supermarket, local store, or look online.
- List at least 3 millet-based food products. (e.g., Ragi Cookies, Bajra Puffs, Foxtail Millet Noodles)

Task 2: Analyse Packaging and Promotion

For each product you listed, observe and note:

- How is the packaging designed? (Colour, material, information displayed)
- What promotional strategies are used? (Discounts, health claims, celebrity endorsements, social media presence)

Example Table for Recording Observations:

Product Name	Millet Used	Packaging Features	Promotion Techniques
Ragi Cookies	Finger Millet	Zip-lock pouch, colourful, health info	"Gluten-free" tag, Instagram ads
Bajra Puffs	Pearl Millet	Transparent pack, cartoon logo	Free sample in-store
Foxtail Noodles	Foxtail Millet	Eco-friendly box, cooking instructions	Online health blogs

Reflective Questions

1. Which of the 4Ps do you think is most important when launching a new millet product, and why?
2. How would you price a millet bar so that it's both competitive and profitable?
3. If you had ₹5000 to market your own millet snack, how would you spend it?

SESSION 2: KNOWING THE CUSTOMER

In the food industry, the secret to successful sales is not just about making a good product — it's about making the right product for the right people. This is where consumer segmentation and market trend analysis come in.
Before selling a millet-based snack, you must ask:

- Who is most likely to buy it?
- What are their preferences, habits, and income levels?
- Do they care about health, tradition, or convenience?
- How do they choose their food?

Understanding Market Segmentation and Trends

1. Demographic Segmentation
Marketers divide the market based on demographics such as:

- Age – e.g., parents buying healthy snacks for children, fitness-conscious youth
- Income Level – premium organic millet products vs. budget-friendly staples
- Location – urban areas may prefer quick, ready-to-eat millet snacks
- Occupation and Lifestyle – working professionals, athletes, senior citizens

Understanding these groups helps businesses design and promote products effectively.

2. Emerging Health Trends
In recent years, consumers are shifting towards the following

Health Trend	Description	Why Millets?
Gluten-Free Diets	Increasing demand for gluten-free grains among celiac and gluten-sensitive people	Most millets are naturally gluten-free (e.g., ragi, jowar, bajra)
Low Glycemic Index (GI) Foods	Diabetic-friendly foods with slower sugar release are in demand	Millets like foxtail and barnyard have low GI, helping manage blood sugar
Weight Management and Satiety	Focus on fibre-rich foods for weight loss and appetite control	High fibre in millets improves digestion and keeps one full for longer
Plant-Based and Sustainable Eating	Rising trend toward plant-forward, environmentally friendly diets	Millets use less water and are carbon-efficient crops

High-Protein Vegetarian Diets	Shift toward protein-rich plant foods for vegetarians and vegans	Millets like pearl millet and kodo millet have moderate to high protein content
Heart Health Awareness	More consumers are choosing heart-friendly, cholesterol-lowering foods	Millets are rich in magnesium, potassium, and fibre, supporting heart health
Gut Health and Prebiotics	Focus on foods that support the gut microbiome and digestion	Millets contain resistant starch and insoluble fibre beneficial for gut health
Bone Health in Aging Populations	Increased intake of calcium-rich foods to prevent osteoporosis	Ragi is exceptionally high in calcium, great for bone strength
Clean Label and Traditional Nutrition	Consumers prefer minimally processed foods with local/natural ingredients	Millets are traditional Indian grains with no need for chemical processing

3. Millets as Functional Foods

Millets are not just basic grains – they are functional foods. They provide health benefits beyond basic nutrition, as listed in table below:

Millet Type	Key Functional Components	Health Benefits
Ragi (Finger Millet)	High Calcium, Polyphenols, Fiber	Strengthens bones, manages diabetes, has antioxidant and anti-aging properties
Jowar (Sorghum)	Antioxidants, Iron, B Vitamins, Tannins	Improves digestion, supports heart health, and lowers cholesterol
Bajra (Pearl Millet)	Iron, Magnesium, Insoluble Fiber, Protein	Boosts haemoglobin, aids in managing blood pressure and cardiovascular health
Foxtail Millet	Low GI, Dietary Fiber, Lecithin	Diabetes management promotes nerve and brain health
Barnyard Millet	Low GI, Resistant Starch, Iron	Supports weight loss, is diabetic-friendly, and good for anaemic individuals
Little Millet	Polyphenols, B-complex vitamins, and Minerals	Supports gut health, immunity, and reduces oxidative stress

Kodo Millet	Phenolic compounds, Fiber, Minerals	Anti-obesity, anti-diabetic, reduces inflammation
Proso Millet	Phosphorus, Protein, Antioxidants	Supports cellular repair, tissue strength, and metabolic health
Browntop Millet	Fiber, Antioxidants, Phytochemicals	Detoxifying effects, supports colon health

PRACTICAL ACTIVITY

A. Create Buyer Personas

A buyer persona is a simple profile of your ideal customer.
Instructions:

In small groups, create 2–3 personas based on different target segments. Include:

- Name & Age
- Occupation
- Health goals or food habits
- Preferred millet product
- What influences their buying decision (taste, price, packaging, health benefits)

Example Persona:

- Name: Meera, 34
- Occupation: Working mother
- Health Goal: Wants healthy snacks for her kids
- Product Preference: Baked ragi cookies
- Decision Drivers: Nutritional value, child-friendly packaging

B. Conduct a Peer Survey

Survey your classmates or community to understand preferences.
Suggested Questions:

1. Have you ever eaten a millet-based product?
2. Which millet product do you like the most?
3. What influences your choice—taste, price, packaging, or health claims?
4. Would you be willing to try new millet-based snacks? Why or why not?

Analyze Results:

- Summarize responses in a chart or table
- Identify trends: What age group is most open to millet products? What are common preferences?

Wrap-Up Discussion

- Who are the key target consumers for millet-based products?
- How do current health trends help millet businesses grow?
- Based on your survey, what new millet product would you recommend developing?

SESSION 3: BRANDING AND PACKAGING

In a crowded grocery shelf or a buzzing online store, the first thing a consumer sees is not your product; it is your packaging. Branding and packaging are your silent salespeople. They tell your story, promise quality, and create desire.

Key Functions of Branding:

- **Creates Identity** – Gives the product a recognizable name, logo, or symbol. Can you think of famous brands already present in the market?
- **Builds Trust** – Customers feel confident about consistent quality. And for example, consumers associate good packaging with hygiene and quality.
- **Differentiates Your Product** – It helps your product stand out from competitors. For example, you need to identify what makes your millet noodle different from another brand.

Branding Essentials for Millet-Based Products

1. Brand Name

Should be:

- Easy to pronounce
- Memorable
- Reflective of health/nature/Indian heritage or innovation

Examples: NutriRoti, MilletMunch, DesiCrunch, SwasthaBite

2. Logo Design

- Keep it simple and visible even when small
- Use colours that represent health (green), tradition (earth tones), or energy (orange/red)
- Incorporate millet grains, leaves, or cultural symbols for identity

Fig. 4.2: Example of Logo

3. Tagline

A short, catchy phrase that highlights the product's benefit.

E.g., "Wholesome Crunch. Ancient Grain Power!"

Understanding Packaging Elements

1. Material

- Use food-grade, moisture-proof materials
- Transparent windows can attract consumers
- Pouches with zip-locks or vacuum sealing help extend shelf life

2. Design Considerations

- Front: Logo, Name, Image of product, Tagline
- Back: Ingredients, Nutritional info, Storage advice, Barcode
- Sides: FSSAI License No., Mfg./Exp. dates, Batch No., MRP

FSSAI Labelling Requirements

As per FSSAI, food labels must include:

- Product name and description
- Net weight
- Ingredient list in descending order
- Nutritional information (per 100g)
- Allergen info (if applicable)
- Manufacturer details
- FSSAI license number
- Veg/Non-veg logo
- Date of manufacturing and expiry
- Storage instructions

Deviating from FSSAI norms can lead to product rejection or fines.

Hands-On Practical Activity: "Design Your Millet Brand"

Task 1: Create Your Mock Brand Identity

In small groups:

- Come up with a brand name, logo, and tagline
- Define your target customer (Use your previous persona)
- Choose your product (e.g., millet curls, energy bars, instant khichdi mix)

Task 2: Design Packaging Label

Use chart paper or Canva/PowerPoint to design a full label (front and back view)

Include:

- Logo and brand name
- Tagline
- Photo or sketch of the product
- FSSAI-compliant label content
- Colour theme and visual style

Task 3: Display and Showcase

- Package your product in mock materials (paper pouch, jar, small zip lock bag)
- Stick or attach the designed label
- Display as a mini "product launch"

Optional Challenge: Pitch your product in 60 seconds to the class like a Shark Tank contestant!

- Use brown paper or recycled-looking material for eco-brand appeal
- Bright colours like yellow and red work well for *snacks*; subtle greens and blues for *health mixes*
- "Handcrafted," "Naturally Gluten-Free," or "No Preservatives" are great badge-style callouts
- QR codes to Instagram pages, recipe videos, or farmer stories can add storytelling power

Reflection Question:

"Which brand caught your attention the most and why?"
"If your product were to be sold on e-commerce platforms, how would you describe it in 3 lines?"

SESSION 4: PRICING STRATEGIES AND COST ANALYSIS

Pricing is a crucial decision in a millet-based business. A good price balances what customers can afford with what the business can earn. Since millet products are often seen as healthy, traditional, and sustainable options, their price reflects not only the cost of ingredients and production but also the value of nutrition, quality, and trust. Looking at costs, competitor prices, and consumer demand helps set a fair price that draws in buyers while allowing the business to grow steadily.

What Goes into a Price?

When you see a millet-based snack priced at ₹35, what are you really paying for? It is not just the cost of the grains! The price includes many hidden elements as listed in the Table below:

Key Components of Product Cost:

Cost Type	Examples
Cost of Production	• Raw materials (Millets, spices, binders, oil) • Labor (wages, salaries) • Machinery & equipment • Utilities (electricity, water, fuel)
Fixed cost/ Overheads	• Rent • Marketing and advertising • Transportation cost to deliver to shops or customers & storage • Packaging (Pouches, jars, labels, stickers)

Marketing	• Competitor's prices • Customer demand & willingness to pay • Seasonality (festive discounts, off-season sales) • Flyers, social media, sample giveaways
Profit Margin	• The extra amount added so the business earns profit.
Government and Taxes	• GST/VAT • Import duties or subsidies

Pricing Strategies Explained

1. Cost-Based Pricing

Price = Total Cost + Profit Margin

Simple and safe. Often used by startups or homemade food brands.

2. Competitor-Based Pricing

Price = Aligned with what similar products cost in the market.

Useful when entering a competitive shelf like retail stores.

3. Value-Based Pricing

Price = What the customer is willing to pay based on product value.

Good for premium products like organic, gluten-free, or heritage grain snacks.

Activity: "Price My Snack!"

Objective: Learn how to calculate the cost and price of your product using real numbers.

Step 1: Costing Sheet Preparation (Group Task)

Each group will:

1. Pick their millet-based product (from previous branding activity)
2. Estimate the cost of each component

Item	Estimated Qty	Cost/Unit (₹)	Total (₹)
Ragi Flour	100g	40/kg	₹4.00
Oil for Roasting	10g	120/litre	₹1.20
Spices & Masala	5g	300/kg	₹1.50
Packaging Pouch	1 unit	₹2.00	₹2.00
Labor (per unit)	–	–	₹1.50
Total Cost	–	–	₹10.20

Add:

- Profit Margin (e.g., ₹2.80 or 30%)
- Final Selling Price = ₹13.00

Step 2: Price Comparison Challenge

Each group will:

- Research the price of similar millet products online.
- Compare their price to yours: Is it cheaper, similar, or premium?

Answer these:
- How does your price stand out?
- Is your product value-for-money or premium?

Reflection & Discussion
- Is it better to keep a small profit and attract many buyers, or aim for premium pricing and fewer customers?
- Which pricing strategy works best for homemade vs large-scale millet snack businesses?

Create a 1-page business proposal that includes:
- Product name and description
- Target customers
- Final selling price and how it was calculated
- Unique Selling Point (USP)
- Marketing pitch (3 lines max)

SESSION 5: PROMOTION AND SELLING

Even the tastiest millet snack won't sell if no one hears about it! That's where promotion and selling come in. In today's world, marketing is not just about TV ads—it's about connecting with your audience through engaging stories, beautiful visuals, and compelling pitches.

From social media reels to local food stalls, this section teaches students how to get their millet-based creations into the spotlight. There are two main ways to reach your customers:

1. Retail Selling
- Products are sold through grocery stores, supermarkets, or local kirana shops
- Requires packaging, barcodes, MRP, and consistent supply

2. Direct-to-Consumer (D2C)
- Products are sold directly to customers via stalls, WhatsApp, Instagram, or food fairs
- Offers more personal connection and feedback, but may have limited reach

Now think and answer

"If you had 100 packs of ragi curls, would you sell them in a shop or through Instagram? Why?"

Promotional Tools

Promotion plays a key role in raising awareness about millet-based products and encouraging consumers to try them. A mix of traditional and digital methods can effectively reach different audiences.

Traditional Promotion:

- Brochures and Flyers: These can be handed out at local events, fairs, or community gatherings to provide product information.
- Banners and Stalls: Setting up attractive stalls or banners with messages about the benefits of millets during exhibitions, school events, or local markets can draw attention.
- Word-of-Mouth: Encouraging consumers to taste the products and share their experiences with others can spread awareness.

Digital Promotion

- Social Media Content: Short videos or reels (15–30 seconds) on social media platforms can showcase stories about millet products, how to prepare them, or their health benefits.
- Messaging Applications: A digital product catalog can be shared through messaging applications and platforms to connect with family, friends, and community groups.
- Digital Posters**:** Designing tools can help design informative and eye-catching posters about millet products.

Keep in mind; while promoting, it is important to keep the message clear and simple. Focusing on key benefits like “gluten-free”, “rich in minerals”, and “suitable for children” can really attract potential consumers.

Activity: Create a Promotional Poster or Reel

- Use a designing app, tools, PowerPoint, or phone apps or sketching /drawing to design a visual post
- Highlight product name, benefits, ingredients, price, and a catchy slogan

  Example: "Ragi Twisters – Tasty. Crunchy. Nutritious!"

Wrap-Up Reflection:

Prepare a short note and discuss the following in your class:

- What worked best in promoting your product?
- What challenges did you face in convincing someone to buy?
- What would you improve in future sales efforts?

SESSION 6: PLANNING A MILLET SALES EVENT

This is the final step of the marketing journey — the Millet Sales Fair. After learning about branding, packaging, pricing, and promotion, students will now apply their skills in a live sales activity. The event may be organized as a stall in school, a community gathering, or a classroom fair. This hands-on experience develops entrepreneurial spirit, teamwork, and confidence.

Key Concepts Before the Event

Features vs Benefits

It is important to explain not just what the product is (features), but why it is good for the buyer (benefits).

Feature	Benefit
Made with foxtail millet	Diabetic-friendly
Baked, not fried	Healthier snack option
Local ingredients	Supports farmers

Persuasive Sales Talk Techniques

- Begin with a smile and a polite greeting.
- Ask questions such as: *"Would you like to try a healthy alternative to chips?"*
- Use phrases like *"Limited offer," "Home-made," "Customer favourite."*
- Highlight millet benefits: *"It is rich in iron, provides energy, and is gluten-free."*

Handling Customer Objections

Objection	Possible Response
"Too expensive"	"That's because it's made with premium, local millets and contains no additives."
"Never heard of this before."	"Would you like a free sample? It's a great alternative to *maida*-based snacks."

Sales Etiquette to Practice

- Be neatly dressed and maintain personal hygiene.
- Keep the stall clean and welcoming.
- Speak politely and avoid over-selling.
- Thank customers, even if they do not purchase.
- Stay patient and calm in all situations.

Organizing a Millet Fair

1. Event Planning Basics

A successful sales event needs careful planning and teamwork. Key components include:

- Objective Setting: Decide if the aim is to generate awareness, to do the sales, or to collect feedback.
- Target Audience: Identify whether the focus is students, teachers, parents, or the wider community.

2. Team Roles and Responsibilities

Divide the class into small teams with clear roles:

- Product Team: Prepares millet-based food samples.

- Marketing Team: Designs posters, flyers, and promotional slogans.
- Sales Team: Interacts with customers, explains product benefits.
- Finance Team: Sets prices, manages cash or coupons, and calculates profits/losses.
- Feedback Team: Engages customers to collect reviews and suggestions.

3. Budgeting

- Estimate the costs: ingredients, packaging, decoration, printing.
- Estimate the earnings: set realistic prices for your millet snacks.
- Maintain a simple ledger or budget sheet.

4. Stall Setup

The stall should act as a mini brand showroom! Focus on:

- Presentation: It should be clean, colourful, and welcoming.
- Branding: Display posters, millet facts, and health benefits.
- Display: Attractive and hygienic food presentation.
- Packaging**:** Use eco-friendly, labelled and food-grade packaging, ensuring FSSAI safety norms wherever possible.

5. Live Sales Execution

- Welcome customers with warmth.
- Explain product ingredients and health benefits clearly.
- Provide tasting samples, if permitted.
- Handle payments and issue tokens or coupons for tracking.
- Thank every customer and encourage feedback.

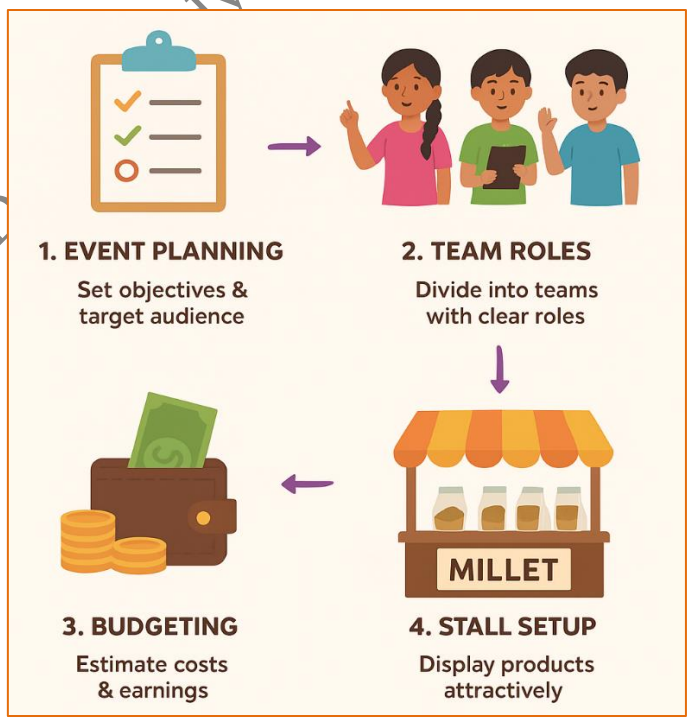

Fig. 4.3: Basic Steps for Organizing a Millet Fair

Millet Marketing & Sales Event Worksheet

Section A: Event Planning Sheet

1. Event Name:

_____

2. Event Date & Time:

_____

3. Team Name:

_____

4. Team Members & Roles:

Name	Role (e.g., Product, Sales, Finance, Marketing)

Section B: Product Planning

1. Millet-Based Products You'll Sell (2–3 items):

Product Name Main Millet Used Special Features (e.g., low sugar, baked)

2. Pricing Plan:

Product Name	Cost per Unit (Rs.)	Selling Price (Rs.)

Section C: Stall Setup Plan

Theme/Decoration Ideas:

Posters or Banners to Display (Tick those you plan to use):

- ☑ Millet health benefits
- ☑ Ingredient details
- ☑ Offers/Discounts
- ☑ Brand name/logo
- ☑ Eco-friendly message

Section D: Promotion Strategy

Slogans or Taglines for Your Product:

1. _____
2. _____

How will you promote your stall?

☐ Class announcements
☐ Posters on noticeboards
☐ Word-of-mouth
☐ WhatsApp/social media (with teacher's help)

Section E: Feedback Collection Format

Sample Questions for Customers:

- Which product did you like the most? _____
- Would you buy this again? ☐ Yes ☐ No
- Suggestions: _____

Section F: Sales Summary

Total Income (Rs.): _____
Total Expense (Rs.): _____
Profit/Loss: _____

Section G: Reflection Journal

Write 3–4 sentences on each:

1. What did your team do well today?

_____

2. What problems did you face during the event?

_____

3. What did you learn about selling and customer preferences?

_____

4. What would you do differently next time?

In conclusion, branding and selling millet-based products is not just about offering healthy alternatives—it is about telling a compelling story that connects nutrition, tradition, and modern consumer needs. Effective marketing strategies such as understanding the target audience, creating strong visual identities, setting the right price points, choosing appropriate sales channels, and promoting through engaging messages help millet products stand out in a competitive food market. By participating in hands-on sales events and learning from real customer feedback, students gain practical insight into how innovative thinking and strategic branding can transform humble millets into sought-after functional foods for today's health-conscious world.

You are now a Milletpreneur in the Making!

CHECK YOUR PROGRESS

Practical Exercise

1. Design Your Millet Brand

In small groups:

1. Create a brand name, logo, and tagline for a millet-based product.
2. Define your target customer (age, income, preferences).
3. Design packaging (front and back) including FSSAI label info.
4. Display your product with mock packaging and present a 60-second pitch to the class.

Reflection: Which brand caught your attention and why? How would you describe your product in 3 lines for an e-commerce platform?

A. Multiple Choice Questions (MCQs)

1. What do the 4Ps of marketing stand for?
   A. Product, Promotion, Purchase, Price
   B. Price, Place, Product, Promotion
   C. Product, Production, Price, Packaging
   D. People, Product, Place, Promotion
2. In branding, a good tagline should be:
   A. A detailed explanation
   B. A catchy phrase showing product benefit
   C. A list of ingredients
   D. A long marketing pitch
3. Which type of segmentation considers factors like age, income, and occupation?
   A. Geographic
   B. Psychographic
   C. Demographic
   D. Behavioural

4. What must be present on food labels as per FSSAI?
   A. Brand ambassador
   B. Cooking time
   C. FSSAI license number
   D. Production video link

5. Which pricing strategy focuses on what the customer is willing to pay for the product's perceived value?
   A. Cost-Based Pricing
   B. Competitor-Based Pricing
   C. Value-Based Pricing
   D. Discount Pricing

B. Fill in the Blanks

1. _____ is a millet known for its high calcium content.
2. A _____ highlights what makes a product unique in the market.
3. Products sold via Instagram or stalls follow the _____ model.
4. A _____ is a group of consumers with shared characteristics.
5. In Cost-Based Pricing, the formula is: Price = _____ + profit margin.

C. True or False

1. Marketing is only about advertising.
2. Packaging has no role in product shelf life.
3. A simple logo is better for visibility on packaging.
4. Flyers and brochures are examples of traditional promotion. True/False
5. Product features and benefits mean the same thing.

D. Short Answer Questions

1. Give one example of a value proposition for a millet product.
2. What is the role of packaging in product marketing?
3. List any two functions of branding.
4. What are some digital promotion tools for millet products?
5. Why is demographic segmentation important in marketing?

E. Long Answer Questions

1. Explain the role of marketing in promoting millet-based food products.
2. Describe the elements of good branding for a millet-based product.
3. What are the mandatory FSSAI labelling requirements for food products?
4. Outline the key steps in organizing a successful millet sales event.
5. How can consumer segmentation and health trends guide product development in the millet industry?

ANSWER KEY

Module	MCQ	Fill in the Blanks	True / False
Module 1	1. B. Planetary Mixer 2. C. Corn 4. B. Whole wheat flour 5. C. Absence of gluten 6. B. Increase water by 10–15%	1. Nutri-cereals 2. Creaming 3. Zest 4. Rotary convection 5. Gluten	1. False 2. False 3. True 4. False 5. True
Module 2	1. Cooked Pasta 2. Flour mix for rotis and parathas 3. Nutritional boost 4. Rava (semolina) 5. Dhokla Mix	1. Time 2. Millet 3. 6 to 8 4. 1.5x to 2x 5. Ready-to-cook and Ready-to-eat	1. False 2. True 3. False 4. True 5. True
Module 3	1. To shape and cook food through pressure and/or heat 2. Tempering 3. It puffs up due to pressure drop and steam escape 4. Die 5. 90–140°C	1. Heat 2. Emulsifiers 3. Die 4. Expansion ratio 5. Binding	1. False 2. False 3. True 4. True 5. False
Module 4	1. Price, Place, Product, Promotion 2. A catchy phrase showing product benefit 3. Demographic 4. FSSAI license number 5. Value-Based Pricing	1. Ragi 2. USP (Unique Selling Proposition) 3. Direct-to-Consumer (D2C) 4. Market segment 5. Total cost	1. False 2. False 3. True 4. True 5. False