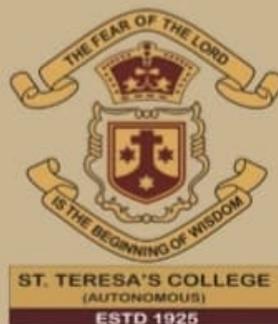


# **DEVELOPMENT OF MILLET-BASED SNACKS FOR PRE SCHOOLER**



**Project submitted to  
MAHATMA GANDHI UNIVERSITY**



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**PROJECT WORK  
ON  
DEVELOPMENT OF MILLET-BASED SNACKS FOR  
PRESCHOOLERS**

( B.Sc Final Year Home Science )

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**DEVELOPMENT OF MILLET-BASED SNACKS  
FOR PRESCHOOLERS**

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# CHAPTER - 1

## INTRODUCTION

Preschool is the age when kids tend to consume more snacks and not show interest in having normal meals. Consumption of processed snacks with high quantities of fat, added sugar, refined carbohydrates, and chemical preservatives can affect a child's health in an undesirable way. This can result in several health disorders like obesity, digestive issues, diabetes, etc.

As this is a challenge faced by our generation, finding a solution for this is very important. Bulk-cooking nutritious snacks made with millet can result in better eating habits among children. Since these recipes are purely homemade parents can be more aware of what their children eat. Creating a healthy eating pattern among kids results in the prevention of chronic diseases in their future and also helps in building a healthy generation.

Developing snacks like cookies, nut bars, muffins, etc. by including millet instead of refined wheat flour makes the snacks nutritious while maintaining taste and flavor.

Different types and varieties of millet are commonly cultivated throughout different regions of India; hence its availability is easy and cheap for Indians. The major attraction of millet is the high nutritional value it holds compared to other common cereals like rice and wheat. Due to this property millets are also known as Nutri-cereals.

Finger millet, pearl millet, foxtail millet, barnyard millet, proso millet, kodo millet, and tiny millet are the seven major millets grown around the world. Millets are C4 plants with very superior photosynthetic efficiency, short duration, higher dry matter production capacity, and a high degree of tolerance to heat and drought, which has paved the way for their introduction into agriculture production systems to formulate climate resilient cropping systems (Paschapur, 2021).

Millets are high in phytochemicals that are good for health, such as polyphenols, lignans, phytosterols, phytoestrogens, and phytocyanins. They serve as immune system regulators, detoxifying agents, antioxidants, and other roles, preventing age-related degenerative illnesses like cancer, diabetes, and cardiovascular diseases (CVD). In addition to their well-known roles in avoiding nutritional deficiency diseases, certain of the known nutrients, including vitamins, minerals, and essential fatty acids, have advantages in the prevention of degenerative diseases.

Millets improve digestion, lower the risk of cancer, and detoxify the body. Hence incorporating millets with other ingredients enhances the nutritional aspects of the dish.

The year 2023 was declared as the International Year of Millets and a lot of programs had been envisaged concerning the popularization of millets across the globe. This study was hence planned to develop snacks for preschool children by adding millet to the recipe.

**AIM:** To develop millet-based dry snacks for pre-schoolers.

**OBJECTIVES:** The main objectives of the given study include :

- To develop millet-based dry snacks for pre-schoolers.
- To analyze and evaluate the sensory attributes of the developed recipes.
- To create a booklet that give more information on the recipes.

## **CHAPTER – 2**

### **REVIEW OF LITERATURE**

Review of literature for the study titled “Development of millet-based snacks for preschoolers” is discussed under the following headings:

1. Importance of nutritious snacks for pre-schoolers
2. Incorporating millet in the preparation of snacks
3. Health benefits of millets

#### **2.1 Importance of nutritious snacks for pre-schoolers**

Having healthy snacks is a great way to manage children's hunger and provide them with the necessary nutrients. Snacks can help avoid crankiness due to hunger and even prevent overeating during meal times. They are also an excellent opportunity to add more nutrients to the diets of picky eaters. For best results, it's recommended to choose snacks that are low in sugar, fat, and salt. **(Mary L Gavin, 2021)**

Snacks are mini meals that keep us going until lunch or dinner. Children seem more inclined to snack than adults and can often get addicted to a range of tasty but distinctly unhealthy snacking options such as chips, cookies, and aerated drinks. Most parents find it hard to ensure that their kids eat a selection of healthy snacks. A good snack is one that is well-balanced and nutrient-dense. This means that each bite contributes to the child's intake of healthy foods. Six nutrients are needed to maintain a growing and healthy body – carbohydrates, protein, fat, minerals, vitamins, and water. **(Himanshu Joshi, 2006)**

In reality, children consume less nutritious snacks since ultra-processed foods are readily available and people tend to buy them more often. Numerous research has shown that eating lots of ultra-processed foods increases our risk of chronic diseases like obesity, type 2 diabetes, and heart diseases, damages our mental health and shortens our lifespan. **(Ayesha Shaikh, 2023)**

Ultra-processed foods (UPF) are industrial formulations of substances derived from foods with little or no whole food and often contain added colorings, flavourings, emulsifiers, thickeners, and other cosmetic additives to make them palatable or even hyper-palatable. Despite their low

nutritional quality, these food products are currently present in the dietary patterns of several high-income countries. **(Juliana Morais, 2022)**

Nutritious snacks play a vital role in the growth and development of pre-schoolers, especially during their growing stage. To ensure that a child's fast-growing body receives sufficient nutrients, it's best to provide delicious snacks that are easily appealing to young ones and are high in nutritional value at the same time. Adding millets to snacks is an easy and effective way to increase their nutritive value. This ensures that children receive enough vitamins and minerals through appetizing snacks.

## **2.2 Incorporating millet in the preparation of snacks**

Millets are known for their nutritional benefits on a person's health. These gluten-free grains have high values of vitamins and minerals and can be substituted for refined wheat flour - which has no nutritional value or fibre in it. The addition of millet in the preparation of snacks increases the nutritional value of the snack, making it beneficial to the overall health of the child and making sure that the child gets adequate nutrition through snacks.

The use of millet in the diet helps improve the digestive system's function due to the presence of dietary fibre. It can help with constipation, flatulence, bloating, cramping, and regular bowel function. It also helps improve the overall health of other vital organs like the liver and kidney and boosts the immune system. Millets are also an excellent source of antioxidants, which have been shown to reduce LDL cholesterol levels and total cholesterol and keep blood vessels healthy. These antioxidants play a crucial role in lowering the risk of chronic heart disease. Carbohydrates such as rice and wheat are simple for the body to break down and process, often leaving a person feeling hungry soon after eating. It can lead people to turn to unhealthy eating habits to satisfy their hunger. Millets have a more complex structure and take longer for the body to break down, which can help keep people from unhealthy eating habits. Hence including millets in our diet is important for maintaining good health. **(Zarafshan Shiraz, 2022)**

Although millets are nutritionally superior to cereals, their utilization is not widespread. One possible way of extending their utilization could be by blending them with wheat flour. In addition to millet flour, there would be changes in physico-chemical, nutritional, and functional characteristics. Multigrain flour by combining wheat and finger millet in the ratio of 7:3 is one of the simple semi-finished products suitable for baking. It was found that substitution of wheat flour with millet flour was possible from 10 to 20% level. Barnyard millet and proso millet can be added 20 and 15% respectively. The optimum level of addition of finger millet, foxtail

millet, and little millet was 10%. The increase in the level of millet in blends increased the ash content and decreased the gluten and sedimentation value. **(Austin J, 2022)**

There are different ways to use millets in snack recipes. One can replace refined wheat flour with millet flour, mix millet flour with rice or wheat flour, or add millets to the snack mix. This can lead to the creation of many new recipes. Most store-bought snacks are highly processed and contain high amounts of sugar, preservatives, chemicals, cholesterol and refined wheat flour. They have low nutritional value and can have negative effects on children's health. Refined wheat flour may taste better and have a smoother texture, but it lacks fibre and nutrients. By avoiding refined wheat flour and incorporating millets instead, you can increase the fibre content and nutrient value of the snack. Therefore, it's essential to include millets in snack preparation.

### **2.3 Health benefits of millets**

When absorbed by the body, finger millet's nutritional composition lowers the chance of developing diabetes mellitus, high blood pressure, and gastrointestinal disorders. These procedures are used to enhance the dietetic and sensory qualities of FM and also help lessen the anti-nutritional and inhibiting effects of tannins, phenols, and phytic acids. **(Ramashia, 2019)**

It possesses a variety of advantageous health traits, including anti-diarrheal, anti-ulcer, anti-inflammatory, anti-tumorigenic (K562 chronic myeloid leukemia), atherosclerogenic effects, antibacterial, and antioxidant capabilities. **(Chandra, 2016)**

Also, it is advantageous to individuals with cancer, cardiovascular disease, and other mental illnesses. Ragi can be transformed using a variety of processing techniques into a food supplement that is appealing in terms of look, flavor, and consistency. Nonetheless, despite its advantageous effects, its use is restricted in the regions where it is produced. There is a big chance to transform finger millet into a variety of nutritious dishes that may be consumed by the majority of people in our nation. **(Padmaja, 2021)**

They are renowned for their hardiness, ability to withstand drought, and relative resistance to serious pests and diseases. Millets offer antioxidant characteristics that protect human health from deterioration, such as lowering blood pressure, reducing the risk of heart disease, preventing cancer and cardiovascular illnesses, diabetes, and decreasing the incidence of tumors, among other things. Millet grain is currently attracting more research from food

scientists, technologists, and nutritionists because to its contribution to national food security and potential health advantages. **(Padmaja, 2021)**

Antioxidants counteract the effects of reactive oxygen species, which accelerate the progression of diabetes mellitus problems. Kodo millet contains a lot of phenolics, tannins, and phytates, all of which have antioxidant properties. This led researchers to look at the positive effects of a millet-based diet in type II diabetes for preventing oxidative stress and stabilizing glucose levels in vivo **(Hegde, 2005)**.

Natural bioactive chemical substances known as nutraceuticals have therapeutic, disease-preventing, or health-promoting qualities. The nutrients in sorghum millets have been shown to have the potential for lowering blood pressure, decreasing the rate of cholesterol and fat absorption, delaying gastrointestinal emptying, and promoting gastrointestinal health. They also have the potential to reduce the risk of coronary heart disease, diabetes, tumor incidence, cancer risk, and blood pressure. Hence, consuming sorghum millets and their processed products on a daily basis can contribute to health promotion and illness prevention. Foods that promote health hold promise for the nation's economic development, and inexpensive, nutrient-dense foods may be processed for use around the world. India has a promising future in the production of nutraceutical foods thanks to its abundant raw material sources, economically viable human resources, and its sizable local market. **(Mathanghi, 2012)**

A study was conducted where Little millet flour (LMF) was substituted for wheat flour in the breadmaking process in several amounts (10, 30, and 50%), with the goal of creating a functional loaf that is fibre-enriched. The produced loaves were assessed for their nutritional, sensory, and physical qualities. At higher amounts of LMF, the loaf's volume, weight, height, and specific 10 volume all significantly decreased. The sensory scores for the wheat bread (control), 10%, and 30% incorporation of LMF did not differ significantly. Further nutritional evaluations of the control and bread containing 30% LMF were conducted. When LMF was used in place of wheat bread, there was an increase in the percentage of micronutrients including iron (94%), zinc (29%), copper (70%), phosphorus (28%) and fibre (19%), which enhanced the nutritional value of the wheat bread. For the management of dietary-related metabolic diseases, the incorporation of LMF at a 30% level in bread might be viewed as a functional and nutritional food option. **(Mannuramath, 2015)**

Millet grain is ideal as food and feed since it is rich in minerals and phenolic compounds that have positive health effects. The range of minerals and phenolic compounds found in finger

and pearl millet are strong indicators that choosing millet for use as food or feed requires careful consideration. Millets include phenolic characteristics that include phenolic acids, flavonoids, and tannins, all of which are good for human health. In addition, finger millet has a phenolic profile that is remarkably distinct, more varied, and plentiful than pearl millet's.

## **CHAPTER – 3**

### **METHODOLOGY**

Research methodology is the method of solving a research problem. It helps in identifying how research is done scientifically. (Fred N. Kerlinger, 2004).

The methodology adopted for the study entitled “*Development of millet-based snacks for preschoolers*” is discussed under the following headings:

- 3.1. Development of millet-based snack recipes
- 3.2. Preparation of the developed recipes
- 3.3. Evaluation of sensory attributes of the prepared snacks
- 3.4. Nutritive assessment of the developed snacks
- 3.5. Documentation of snack recipes

#### **3.1 Development of millet-based snack recipes**

A snack is a small portion of the food of generally eaten between meals. Snacks come in a variety of forms including packaged snack foods and other processed foods, as well as items made from fresh ingredients at home. Snacks are prepared from ingredients commonly available at home without a great deal of preparation. The nutritional value of a snack can be enhanced by the incorporation of millets to it. A snack with high nutritional value can have a positive role in the health of children during their growing age. Pre-schoolers usually prefer sweet snacks, so in order to improve their healthy snacking habits, millet-based snacks that can be made at home which are easy to prepare and healthy were identified and developed. A total of six recipes were formulated. The major millets used were Finger millet, Pearl millet, Proso millet, Foxtail millet, Little millet, and Sorghum millet.

#### **3.2 Preparation of the developed recipes**

Developed recipes were prepared according to the procedure demanded. All of them are easy to prepare and very little time is needed to cook the snack. The developed snacks were - Ragi-banana muffin, Pearl millet-date and nut balls, Little millet biscuit, Foxtail millet-peanut and oats bar, Proso millet choco cookie, and Sorghum carrot cake.

### 3.3 Evaluation of sensory attributes of the prepared snacks

The sensory attributes of the developed recipes with respect to colour, texture, appearance, and taste were evaluated on a 5 point Hedonic scale by a panel of 6 members as depicted in Table – 1

**TABLE – 1**

#### **HEDONIC SCALE TO ASSESS THE SENSORY ATTRIBUTES OF THE DEVELOPED RECIPES**

| Score | Interpretation           | Colour | Texture | Appearance | Taste | Overall acceptance |
|-------|--------------------------|--------|---------|------------|-------|--------------------|
| 1     | Dislike extremely        |        |         |            |       |                    |
| 2     | Dislike moderately       |        |         |            |       |                    |
| 3     | Neither like nor dislike |        |         |            |       |                    |
| 4     | Like moderately          |        |         |            |       |                    |
| 5     | Like extremely           |        |         |            |       |                    |

### 3.4. Nutritive assessment of the developed snacks

The nutritive value of the prepared recipes was computed using the nutritive value table proposed by ICMR. Total Energy (K/Cal), Carbohydrates (g), Protein (g), Calcium (mg), Vit – A (mcg) and Iron (mg) content of the recipes were calculated.

### 3.5 Documentation of snack recipes

The recipes of the developed snacks were documented in the form of a booklet.

## **CHAPTER – 4**

### **RESULT AND DISCUSSION**

The results of the present study “*Development of millet-based snacks for preschoolers*” can be discussed under the following headings:

- 4.1. Development of millet-based snack recipes
- 4.2. Preparation of the developed recipes
- 4.3. Evaluation of sensory attributes of the prepared snacks
- 4.4. Nutritive assessment of the developed snacks
- 4.5. Documentation of snack recipes

#### **4.1 Development of millet-based snack recipes**

Recipes for millet-based snacks were developed. Locally available millets were selected along with other nutritious ingredients. The main millets used were Finger millet, Pearl millet, Proso millet, Foxtail millet, Little millet, and Sorghum millet. Other ingredients such as Banana, Dates, Nuts, Chocolate, Carrot, etc were used along with the millets. A total of six recipes were prepared which can be fondly consumed by preschoolers and all of them were easy to prepare.

#### **4.2 Preparation of the developed recipes**

##### **MILLET BASED RECIPES**

##### **4.2.1 RAGI - BANANA MUFFIN**

###### **Ingredients**

1. Ragi flour – 1 ½ cup
2. Milk – ¼ cup
3. Butter – 1/3 cup
4. Egg – 1 no.
5. Ripe banana – 1 ½ cup
6. Choco chips – ½ cup
7. Coco powder – ¼ cup
8. Powdered jaggery – 1 cup

9. Baking soda – 1 tsp.
10. Baking powder – ¼ tsp
11. Salt – ½ tsp
12. Vanilla extract – 1 tsp.

### **Method of preparation**

1. Preheat your oven to 180 degrees Celsius for 15 minutes.
2. Take 1.5 cups of mashed banana in a large bowl.
3. Add jaggery to the bowl and beat the banana and jaggery for 2 minutes.
4. Add butter and beat again. Then add the egg and vanilla and beat for another minute.
5. For the dry ingredients, place a sieve over the bowl and add the ragi flour, baking soda, baking powder, cocoa powder, and salt. Mix well and sieve it into the bowl.
6. Gently combine the wet and the dry ingredients. Do not overmix the batter.
7. Add choco chips and mix them in.
8. Line a muffin tray with paper liners. Fill the liners about halfway with the batter. Tap the tray on the counter to remove air bubbles.
9. Bake in the preheated oven for 16-18 minutes or until a skewer comes out clean.
10. Once done, remove the muffins and bake the next batch.

## **4.2.2 PEARL MILLET – DATE AND NUT CHOCO BALLS**

### **Ingredients**

1. Pearl millet flour – ¼ cup
2. Seedless dates – 1 cup
3. Chopped almonds – ¼ cup
4. Chopped pistachio – ¼ cup
5. Chopped cashew – ¼ cup
6. Chocolate – ¼ cup
7. Butter – 3 tbsp

### **Method of preparation**

1. Mash the seedless dates.
2. Add the millet flour to the mashed dates and mix well.
3. Combine the chopped nuts along with the mashed dates and millet flour mixture.
4. Divide the mixture into 10 equal portions and shape each portion into round balls.

5. Melt the chocolate and butter using a double boiler.
6. Take each ball and dip it in the melted chocolate.
7. Refrigerate the balls for 10 minutes, and they are ready to be served.

### **4.2.3 LITTLE MILLET BISCUIT**

#### **Ingredients**

1. Little millet – ½ cup
2. Whole wheat flour – ½ cup
3. Baking powder – 1 tsp
4. Egg – 1 no.
5. Butter – ½ cup
6. Jaggery – ½ cup
7. Milk – ¼ cup
8. Vanilla essence – ½ tsp

#### **Method of preparation**

1. Mix all the dry ingredients - millet flour, baking powder, and sugar in a large bowl.
2. Add butter and mix it along with the flour mixture until the butter is almost incorporated coarsely into the flour.
3. Then, add vanilla essence, egg, and milk. Combine everything until there isn't any dry flour left.
4. Keep the dough in the freezer for 5 minutes or refrigerate it for 30 minutes to 24 hours.
5. Preheat the oven to 180 degrees Celsius or 365 degrees Fahrenheit and line the baking tray with parchment paper.
6. Use a tablespoon to scoop out balls of dough, flatten them, and place them on the cookie sheet. Keep 1cm of space between each cookie. Bake for 10-12 minutes. The sides will be set, but the center will remain soft.
7. Remove the cookies from the oven and cool them on a cooling rack.
8. After that, cut out Millet Cookies and bake them in the preheated oven for 6-7 minutes. Keep an eye on the cookies until they become crisp when cooled.
9. Finally, remove the cookies and cool them on a cooling rack.

## **4.2.4 FOXTAIL MILLET – PEANUT AND OATS BAR**

### **Ingredients**

1. Foxtail millet – ½ cup
2. Oats – ½ cup
3. Chopped peanuts – ½ cup
4. Peanut butter – 2 tbsp
5. Sesame seeds – 2 tbsp
6. Jaggery powder – ½ cup
7. Water – 2 tbsp
8. Few drops of oil (to grease the tray)

### **Method of preparation**

1. Dry roast oats for 3 to 4 minutes till they turn golden brown. Be careful while roasting as they tend to burn very fast. For this, keep stirring on a medium flame. Once golden brown, immediately take them out in a bowl.
2. Similarly, dry roast foxtail millet for 3 to 4 minutes on medium flame only.
3. Next, roast peanut and sesame seeds.
4. Chop the roasted nuts finely.
5. Grease a tray and keep it aside.
6. Take jaggery powder in the same pan, add water, and let it dissolve fully. Once dissolved, boil it for a minute or so. Throughout the process, keep stirring, and do not leave it unattended as it tends to burn very fast.
7. Add peanut butter and give one more boil.
8. Add the roasted mix.
9. Toss everything for 30 to 40 seconds till everything gets together and leaves sides.
10. Put this mixture on the greased plate and spread it with the back of the spatula.
11. Leave it for half an hour or till sets completely.
12. Cut into desired shapes.
13. Store in an airtight container.
14. You may wrap it individually in butter paper too.

## 4.2.5 PROSO MILLET CHOCO COOKIE

### Ingredients

1. Proso millet – ½ cup
2. Wheat flour – ½ cup
3. Egg – 1 no.
4. Butter – ¼ cup
5. Choco chips – ½ cup
6. Jaggery – ½ cup
7. Baking powder – ¼ tsp.
8. Baking soda ½ tsp.
9. Vanilla extract – 1 tsp.
10. Salt – ¼ tsp.

### Method of preparation

1. Whisk melted Butter and eggs in a bowl.
2. Add in Vanilla and sugar, and whisk till mixed.
3. Now add in the dry ingredients and mix well.
4. Cling wrap and keep in the fridge for at least 30 min.
5. Preheat oven to 180 C and line a cookie sheet using parchment paper.
6. After 30 min, scoop out the cookies onto the cookie sheet with 2 inch space. If you prefer, you can add more chocolate chips on top.
7. Bake for 8-10 min or until the sides are golden brown.

## 4.2.6 SORGHUM CARROT CAKE

### Ingredients

1. Sorghum flour – ½ cup
2. Almond flour – ½ cup
3. Milk – ½ cup
4. Egg – 2 nos.

5. Banana puree – ½ cup
6. Grated carrot – 1 cup
7. Powdered jaggery – ½ cup
8. Almonds – 10 nos.
9. Oil – 3 tbsp.
10. Baking powder – ½ tsp.
11. Baking soda – ½ tsp
12. Salt – ½ tsp

### **Method of preparation**

1. Dry roast Sorghum flour on low heat. Let it cool down completely.
2. In a wide bowl, add powdered jaggery, oil, egg and banana puree, and mix well.
3. To that, add salt, baking soda, and baking powder and mix well. Now add all the flours and carrots to it.
4. Add milk and combine everything well.
5. Grease a cake tin and dust it with sorghum flour. Pour the prepared cake batter. Tap to remove air. Sprinkle the sliced almonds on top.
6. Preheat the oven to 180 degrees. Place the tin and bake for 50 to 60 minutes. The timing may vary with ovens. So check after 50 minutes by inserting a toothpick. If it comes out clean, then remove it. Otherwise, bake for some more time.
7. Once done, remove, de-mould, and cool it on a wire rack.

### **4.3. Evaluation of sensory attributes of the prepared snacks**

A panel of 6 members evaluated the recipes on a 5-point Hedonic scale and the consolidate score of each recipe are given Table – 2

**Table – 2 Mean Score of the Sensory Attributes of the Developed Recipes**

| Sl. No | Recipe Name                             | Colour | Texture | Appearance | Taste | Overall acceptance |
|--------|---|--------|---------|------------|-------|--------------------|
| 1      | Ragi – banana muffin                    | 5      | 4.5     | 4.8        | 4.6   | 4.5                |
| 2      | Pearl millet – date and nut choco balls | 4.8    | 4.6     | 4.8        | 5     | 4.8                |
| 3      | Little millet biscuit                   | 4.6    | 4.5     | 4.1        | 4.8   | 4.6                |
| 4      | Foxtail millet - peanut and oats bar    | 4.6    | 4.1     | 4.1        | 4.5   | 4.3                |
| 5      | Proso millet choco cookie               | 4.6    | 4.6     | 4.8        | 4.8   | 4.8                |
| 6      | Sorghum carrot cake                     | 4.5    | 4.6     | 4.6        | 4.3   | 4.5                |

Pearl millet – date and nut choco balls and Proso millet choco cookie had the highest overall acceptance of 4.8, followed by Little millet biscuit scoring 4.6. Ragi – banana muffin and Sorghum carrot cake had an overall acceptance of 4.5. Foxtail millet – peanut and oats bar had the least overall acceptance of 4.3.

#### **4.4. Nutritive assessment of the developed snack**

The nutrient composition of 'Ragi - banana muffin' was computed and is depicted in Table - 3.

**Table – 3**

| Ingredients     | Weight (g) | Energy (K/cal) | Carbohydrates (g) | Protein (g) | Calcium (mg) | Vit-A (mcg) | Iron (mg) |
|-----------------|------------|----------------|-------------------|-------------|--------------|-------------|-----------|
| Ragi            | 180        | 577.34         | 120.28            | 12.89       | 655.2        | 2.75        | 8.32      |
| Milk            | 60         | 43.74          | 2.96              | 1.96        | 70.8         | 8.2         | -         |
| Butter          | 75         | 562.5          | -                 | 0.75        | 14.25        | -           | 0.15      |
| Egg             | 50         | 84.13          | -                 | 6.57        | 25.07        | 9.28        | 0.82      |
| Ripe banana     | 330        | 350.98         | 77.25             | 4.92        | 28.81        | 189.19      | 1.15      |
| Chocolate chips | 85         | 453.05         | 56.67             | -           | -            | -           | 2.04      |
| Cocoa powder    | 30         | 113.1          | 15.33             | 6.9         | -            | -           | -         |
| Jaggery         | 200        | 734            | 117.34            | -           | 166          | -           | 20        |
| Total           |            | 2918.84        | 389.83            | 33.66       | 959.93       | 209.42      | 31.86     |

Servings – 4 persons

The nutrient composition of 'Pearl millet – date and nut choco balls' was computed and is depicted in Table – 4

**Table – 4**

| Ingredients  | Weight (g) | Energy (K/cal) | Carbohydrates (g) | Protein (g) | Calcium (mg) | Vit-A (mcg) | Iron (mg) |
|--------------|------------|----------------|-------------------|-------------|--------------|-------------|-----------|
| Pearl millet | 30         | 104.4          | 18.53             | 3.29        | 8.21         | 8.47        | 1.93      |
| Dates        | 225        | 353.25         | 84.6              | 2.03        | 114.75       | -           | 2.93      |
| Almonds      | 35         | 214.2          | 2.42              | 7.39        | 84           | -           | 1.05      |
| Pistachio    | 35         | 222.95         | 5.43              | 7           | 49           | -           | 4.9       |
| Cashew nut   | 35         | 203.94         | 8.91              | 6.57        | 11.9         | -           | 2.08      |
| Chocolate    | 43         | 257.14         | 19.74             | 3.35        | 31.39        | 8.17        | 5.12      |
| Butter       | 42         | 315            | -                 | 0.42        | 7.98         | -           | 0.08      |
| Total        |            | 1670.88        | 139.63            | 30.05       | 307.23       | 16.64       | 18.09     |

Servings – 4 persons

The nutrient composition of 'Little millet biscuit' was computed and depicted in Table – 5.

**Table – 5**

| Ingredients       | Weight (g) | Energy (K/cal) | Carbohydrates (g) | Protein (g) | Calcium (mg) | Vit-A (mcg) | Iron (mg) |
|-------------------|------------|----------------|-------------------|-------------|--------------|-------------|-----------|
| Little millet     | 60         | 207            | 39.33             | 6.08        | 9.64         | 1.15        | 0.76      |
| Whole wheat flour | 60         | 204            | 43                | 8           | 0.02         | -           | 0.12      |
| Milk              | 60         | 43.74          | 2.96              | 1.96        | 70.8         | 8.2         | -         |
| Butter            | 113        | 847.5          | -                 | 1.13        | 21.47        | -           | 0.23      |
| Egg               | 50         | 84.13          | -                 | 6.57        | 25.07        | 9.28        | 0.82      |
| Jaggery           | 100        | 367            | 88.67             | -           | 83           | -           | 10        |
| Total             |            | 1753.37        | 173.96            | 23.74       | 210          | 18.63       | 11.93     |

Servings – 3 persons

The nutrient composition of 'Foxtail millet – peanut and oats bar' was computed and depicted in Table – 6

**Table – 6**

| Ingredients     | Weight (g) | Energy (K/cal) | Carbohydrates (g) | Protein (g) | Calcium (mg) | Vit-A (mcg) | Iron (mg) |
|-----------------|------------|----------------|-------------------|-------------|--------------|-------------|-----------|
| Foxtail millet  | 100        | 331            | 60.9              | 12.3        | 31           | 32          | 2.8       |
| Oats            | 45         | 168.3          | 28.26             | 6.12        | 22.5         | 0           | 1.71      |
| Chopped peanuts | 60         | 352.2          | 12.76             | 14.61       | 34.8         | 0           | 0.95      |
| Peanut butter   | 30         | 179.1          | 6.69              | 6.75        | 14.7         | 0           | 0.52      |
| Sesame seeds    | 20         | 101.53         | 2.06              | 3.83        | 332.8        | 2.62        | 2.78      |
| Jaggery         | 100        | 367            | 88.67             | 0           | 83           | 0           | 10        |
| Total           |            | 1499.13        | 199.34            | 43.61       | 518.8        | 34.62       | 18.76     |

Servings – 4 persons

The nutrient composition of 'Proso millet choco cookie' was computed and depicted in Table

- 7

**Table -7**

| Ingredients     | Weight<br>(g) | Energy<br>(K/cal) | Carbohydrates<br>(g) | Protein<br>(g) | Calcium<br>(mg) | Vit-A<br>(mcg) | Iron<br>(mg) |
|-----------------|---------------|-------------------|----------------------|----------------|-----------------|----------------|--------------|
| Proso millet    | 60            | 217.8             | 42.54                | 6.78           | 5.4             | -              | 1.26         |
| Wheat flour     | 60            | 192.34            | 38.5                 | 6.34           | 18.56           | 1.6            | 2.46         |
| Butter          | 115           | 862.5             | -                    | 1.15           | 21.85           | -              | 0.23         |
| Egg             | 50            | 79.5              | 0.35                 | 6.4            | 27              | -              | 1.35         |
| Chocolate chips | 60            | 319.8             | 40                   | -              | -               | -              | 1.44         |
| Jaggery         | 100           | 367               | 88.67                | -              | 83              | -              | 10           |
| Total           |               | 2038.94           | 210.06               | 20.67          | 155.81          | 1.6            | 16.74        |

Servings – 3 persons

The nutrient composition of 'Sorghum carrot cake' was computed and depicted in Table – 8.

**Table – 8**

| Ingredients      | Weight<br>(g) | Energy<br>(K/cal) | Carbohydrates<br>(g) | Protein<br>(g) | Calcium<br>(mg) | Vit-A<br>(mcg) | Iron<br>(mg) |
|------------------|---------------|-------------------|----------------------|----------------|-----------------|----------------|--------------|
| Sorghum<br>flour | 60            | 215.4             | 45.98                | 5.06           | 7.2             | -              | 1.88         |
| Almond<br>flour  | 60            | 360               | 12                   | 12             | 139.8           | -              | -            |
| Milk             | 120           | 87.48             | 5.93                 | 3.91           | 141.6           | 16.4           | -            |
| Egg              | 100           | 159               | 0.7                  | 12.8           | 54              | -              | 2.7          |
| Banana           | 115           | 148.3             | 35.77                | 1.31           | 1.55            | -              | -            |
| Carrot           | 55            | 22.55             | 5.27                 | 0.51           | 18.15           | 4554           | 0.17         |
| Jaggery          | 100           | 367               | 88.67                | -              | 83              | -              | 10           |
| Almonds          | 30            | 182.77            | 3.15                 | 6.24           | 69              | -              | 1.38         |
| Oil              | 30            | 265.2             | -                    | -              | -               | -              | -            |
| <b>Total</b>     |               | <b>1807.7</b>     | <b>197.47</b>        | <b>41.83</b>   | <b>514.3</b>    | <b>4570.4</b>  | <b>16.13</b> |

Servings – 3 persons

#### 4.5. Documentation of snack recipes

The developed recipes were compiled into a booklet that includes the recipes themselves, preparation instructions, and nutritional information. Illustration of the developed booklet is given below

## MILLET BASED SNACK RECIPES FOR PRE SCHOOLER



Delicious snack ideas and its  
nutritional significance for your young  
ones

## **CHAPTER - 5**

### **SUMMARY AND CONCLUSION**

The study entitled "*Development of millet-based snacks for preschoolers*" was planned with the aim of developing easy and nutritious millet-based recipes for preschoolers. The recipes were distributed among preschoolers and was made a mean scoreboard to know which was more acceptable among preschoolers. Six recipes were developed and distributed.

The major findings of the study include:

- Incorporation of millets like Finger millet, Pearl millet, Proso millet, Foxtail millet, Little millet, and Sorghum millet were used for the development of recipes. Millets were combined with Banana, Chocolate, Dates, Nuts, Oats, and Carrot. Combination of nuts and chocolate was found to be liked by preschoolers more.
- All the ingredients used were highly nutritious and were found to have a positive impact on children's health.
- From the mean scoreboard we were able to see which recipe was most acceptable and which recipe was least accepted.
- Among the developed recipes, Pearl millet – date and nut choco balls and Proso millet choco cookie were considered to be more accepted. Following Pearl millet – date and nut choco balls and Proso millet choco cookie, Little millet biscuit had an acceptance score of 4.6. Ragi – banana muffin and Sorghum carrot cake had an acceptance of 4.5. Foxtail millet – peanut and oats bar had the least overall acceptance of 4.3.

#### **CONCLUSION**

Millet-based snacks provide preschoolers with energy and other nutrients like Carbohydrate, Protein, Calcium, Vitamin – A, Iron, etc which are essential for their overall growth and development. The development of nutritious and easy-to-make millet-based snacks is always appreciated. Snacks constitute a major portion of preschool nutrition and preschooler always love to have tasty and healthy snacks.

## CHAPTER - 6

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