

Millet Cookies with Pumpkin Pulp as a Functional Product

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Abstract: *This research work was carried out to explore the possibility of utilization of underutilized but highly nutrient rich pearl millet and pumpkin pulp in cookies. Cookies are generally made from Maida flour that provides high energy but low in fibre. Bakery products are often high in energy and fat and the most consumed bakery products is cookies. This research work proposed a healthy composition of cookies by incorporating pumpkin pulp while replacing usual principal ingredients like Maida flour with Pearl Millet (Bajra) and refined sugar with honey. The quality cookies were prepared from 50% pearl millet flour and 50% pumpkin pulp, 60% pearl millet flour and 40% pumpkin pulp, 70% pearl millet flour and 30% pumpkin pulp and 80% pearl millet flour and 20% pumpkin pulp. There was decrease in carbohydrates and fat and increase in moisture, vitamins, ash and dietary fibre. Good quality cookies can be prepared by substituting pumpkin pulp (40%) with pearl millet flour (60%). This study evaluated the health benefits of millet pumpkin cookies based on their nutritional value and sensory analysis. pearl Millets are rich in all nutritious aspects like vitamins, fats, protein and also high in micronutrients such as folic acid, niacin and Vitamin B6, B complex vitamins that help in providing various medical and health benefits, millets into diet will reduce the risk of cardiovascular problems helps in treating constipation, diabetes, obesity, hyperlipidemia. Pumpkin flesh is rich in fibre, vitamin C, vitamin E, Mg, K and a variety of carotenoids being the important sources of these amazing phytonutrients and its prevent various diseases, such as antidiabetic, antioxidant, anticarcinogenic, and anti-inflammatory.*

Keywords: Cookies, Pearl Millet, Pumpkin, Health Benefits, Nutrient Quality, Sensory Quality

I. INTRODUCTION

All age groups are highly fond of baked products like cookies. They have a longer shelf life due to their low moisture content [1]. Cookies are one of the practical and delicious treats we eat on a daily basis [2]. The cookie formula consists of refined flour, hydrogenated fat, sugar and other additives. It is well documented that most of the ingredients used in commercial cookies lack important nutrients. The refined flour lacks in dietary fiber and micronutrients which are important health promoting components [3]. According to Basic Health Research (2018), obesity affects 21.8% of people over the age of 18. Low fibre intake, a sedentary lifestyle, a high fat diet, and high energy intake are all associated with obesity. Frequently high in calories and fat, cookies are the most popular bakery item. In General made from wheat flour cookies are high in energy but low in other nutrients [4]. It is well known that many cookies contain industrial pollution or are made with unhealthy all-purpose flour [5]. Due to the negative effects of all-purpose flour, health experts never recommend eating cookies made with it. The idea of multigrain cookies has grown significantly over the past few years, with claims that they are filled with energy, fibre, and carbohydrates. Consumers now readily accept these cookies [6]. To combat a number of diseases caused by a lack of fibre, it is essential to produce high-fibre foods with low energy contents [7]. Moreover, because of its widespread utility, health prospects have taken on importance, so efforts are being made to improve the nutritional value of the cookies [2][8]. Therefore this research is based on making cookies that are baked and contain a high nutritional value which imposes beneficial health effects of rich antioxidants [6].

Since the beginning of time, millets have been used to prepare a variety of traditional foods in rural India. Millets are still used in food, but this is rapidly declining for a number of reasons. Therefore, in order to improve the nutritional

value of consumers' diets, it is necessary to revive these crucial categories of health-promoting foods. [3]. Pearl Millet (*Pennisetum glaucum*), also known as Bajra [9]. Pearl millets are high in micronutrients like folic acid, niacin, and Vitamin B6 as well as B complex vitamins, which contribute to a number of medical and health benefits. They are also rich in vitamins, fats, and protein. [10]. Millets are simple to digest because they are rich in lecithin, which helps to regenerate myelin fibre, enhance brain cell metabolism, and restore nerve cell function. [11][12]. They are also referred to as "nutri-cereals" because they contain phytochemicals with nutraceutical properties in addition to these nutrients. Pearl millet has some antinutritional components that reduce its bioavailability in the human gut, but processing can increase digestibility[13]. A regular inclusion of millets into diet will reduce the risk of cardiovascular problems helps in treating constipation, diabetes[10], obesity, hyperlipidemia etc[14]. Generally, postmenopausal women experience symptoms of cardiovascular disease, such as high cholesterol and blood pressure. Consequently, adding pearl millet to one's daily diet is highly beneficial for preserving good health.[15]. Pearl millet has a high fibre content (1.2g/100g), which can be used to prepare a variety of nutritious foods for people who need a high fibre diet, especially to help with obesity and constipation issues[16]. Millets help in prevention of Type II Diabetes due to their significant levels of magnesium[17] and millets derived BAMPs are a potential source of DPP4 inhibitory peptides targeted at diabetes[18]. Millets aid in regulating blood sugar levels and, with the help of antioxidants, speed up the healing of dermal wounds[19]. Millets have been found to be rich in phenolic acids, phytates, and tannins, antinutrients that lower the risk of colon and breast cancer. It has been proven that millets' phenolics are effective at stopping the development and spread of cancer in test tubes. Linoleic acid, which is found in millet, has anti-tumor properties [20]. Many of the antioxidants in millet have a positive effect on scavenging the cancer-causing free radicals and eliminating other toxins from the body, including those in the kidney and liver[21]. Pearl millet contains high amount of Iron (8mg/100g) and Zinc (3.1mg/100g), (NIN, 2003) which may help to increase the Hb levels [22]. These have a variety of health advantages, such as a low glycemic index and low glycemic load, are gluten-free and aid in the treatment of celiac disease, are anti-cancer, antioxidant, anti-cholesterol, anti-hypertensive, and prevent atherosclerosis, among others. Millets have a lot of potential for use in various food systems because of their nutritional value and economic significance[23]. India is the largest producer of these gluten-free coarse cereals and the largest consumer of millets[10]. As a result, the value of these millet food grains has not been widely recognised, and approximately 44 percent of the population in 129 countries is dealing with serious health problems like adult obesity and overweight. Consuming various millet varieties can rectify this nutritional imbalance [24].

Pumpkin belongs to the family Cucurbitaceae and is a widely grown vegetable all over the world. Based on the colour of the seeds, the origin of pumpkin has been attributed to Guatemala, Central Mexico or Columbia. The name pumpkin originated from a Greek word Pepon which means large melon[25]. Among the ingredients in pumpkin are *Telfairia occidentalis*, *Cucurbita moschata*, *Cucurbita pepo*, *Cucurbita maxima*, *Cucurbita mixta*, and *Cucurbita ficifolia*[26]. The three most widely cultivated pumpkin species worldwide are *Cucurbita pepo*, *Cucurbita maxima*, and *Cucurbita moschata*[27]. It is grown all over the world, and depending on the region and traditions, it is used in various ways. With few exceptions, pumpkins are prized for their delicious flesh, which can be eaten raw or processed and the seeds can be used to make vegetable oil and protein. Pumpkins are also highly perishable or can be stored for months without much change in quality [28]. Worldwide production of pumpkin, squashes, and gourds is 24.62 million metric tones from an area of 5,10,000 ha and in India, the total production is 49,00,000 tones from an area of 45,000 ha. The weight of the fruit varies from 8 to 10 kg on average, and sometimes even up to 20 kg[29]. Three varieties of pumpkin are widely grown all over the world *Cucurbita pepo*, *Cucurbita maxima*, and *C. moschata* [27]. In India, pumpkin is also commonly referred to as "Sitaphal," "Kashiphal," or "kaddu." It is a member of the Cucurbitaceae family and the genus *Cucurbita*. Jeffrey One vegetable that satisfies the needs of a healthy diet is pumpkin. It is a tasty and valuable vegetable crop that is outstanding for its dietary qualities and contains a lot of biologically active compounds[30]. Interests on pumpkin are increasing due to its low in energy compared with other vegetables[31] and containing high amount of carotenoids, lutein, zeaxanthin, vitamin E[32], ascorbic acid, phytosterols, selenium, and linoleic acid, which act as antioxidants in human nutrition [33]. Pumpkin flesh is a great source of fibre, vitamin C, vitamin E, magnesium, vitamin K, and a variety of carotenoids, which are all amazing phytonutrients. One of the plant carotenoids, beta-carotene, is converted to vitamin A in the body. Pumpkin is high in vitamins, low in fat and sodium, and cholesterol-free. For the majority of people living in developing countries, carotenoids are their main source of vitamin A.

[34]where there are still many people who lack vitamin A [35]. Pumpkin has been used in the treatment and prevention of a number of illnesses, including hyperlipidemia and hypoglycemia.[36][37].Pumpkin is low in fat and a good source of carotene, dietary fibre, vitamins, and minerals. It is thought to be used for a variety of medical conditions, including antidiabetic, antioxidant, anticarcinogenic, and anti-inflammatory ones[38][39].Pumpkin pulp showed anti-diabetic activity by reducing the blood glucose with the increment of plasma insulin in alloxan-induced diabetic mice [40]reported that phenolic phytochemicals of pumpkin have anti-diabetic effects in terms of β -glucosidase and α -amylase inhibition. Pumpkin also has hypotensive effects in terms of angiotensin I-converting enzyme-inhibitory activities[41]. For the food industry, pumpkin is considered to be a potential source of antimicrobial agents[42]. Pumpkin-rich diets have also been linked to a lower risk of colorectal, breast, and gastric cancers[43]. The biological activity of pumpkin, particularly its antioxidative activity because of the carotenes content, is one of its most significant quality traits. pumpkin for atherosclerosis because it lowers cholesterol in obese people [31]. The possibility of using pumpkin in the bakery, confectionary, and beverage industries has increased with the rise in demand for functional foods. The pumpkin puree-based biscuit had higher levels of protein, crude fibre, calcium, beta-carotene, and vitamin C. Pumpkin puree addition altered the samples' textural qualities, but their nutritional value increased and their other sensory qualities were acceptable. Results showed that adding more pumpkin puree caused a reduction in lightness and an increase in greenness [44]. The growing market for snacks, where pumpkin can be used to naturally improve the flavour and colour of these products, represents a promising area of development for pumpkin-based products [45].

II. MATERIALS AND METHOD

2.1 Ingredients

The ingredients for the preparation of products were pearl millet flour and pumpkin pulp and others are baking powder, vanilla essence, butter, salt , sodium bicarbonate procured from local market.

2.2 Packaging Material

The packaging material viz., LDPE (above 51 micron) bags were procured from local market and used for packaging of cookies and for storage study.

2.3 Treatment Details

The pearl millet cookies were prepared by using different levels of pearl millet flour with pumpkin pulp as shown below:

Table 1: Treatment details for preparation of pearl millet cookies

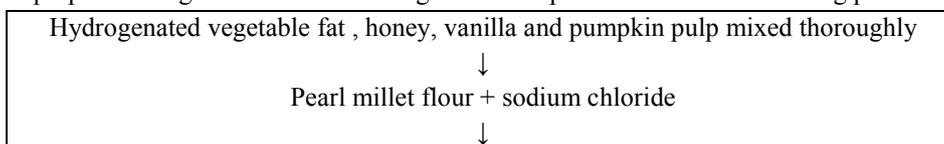
Treatment	Pearl millet (%)	Pumpkin pulp (%)
T ₀ (Control)	100	0
T ₁	90	10
T ₂	80	20
T ₃	70	30
T ₄	60	40

2.4 Method Procedure for Preparation of Pearl (Millet) Flour

The pearl millet grains were cleaned to remove extraneous matter and taken in small bowl and then attached to the electric decorticator to remove brans. The dried debraned pearl millet grains were grinded in to flour and passed through sieve of 80 mesh to get uniform flour.

2.5 Preparation of Pearl Millet Flour Cookies

The cookies were prepared using standard levels of ingredients as per the traditional creaming process.



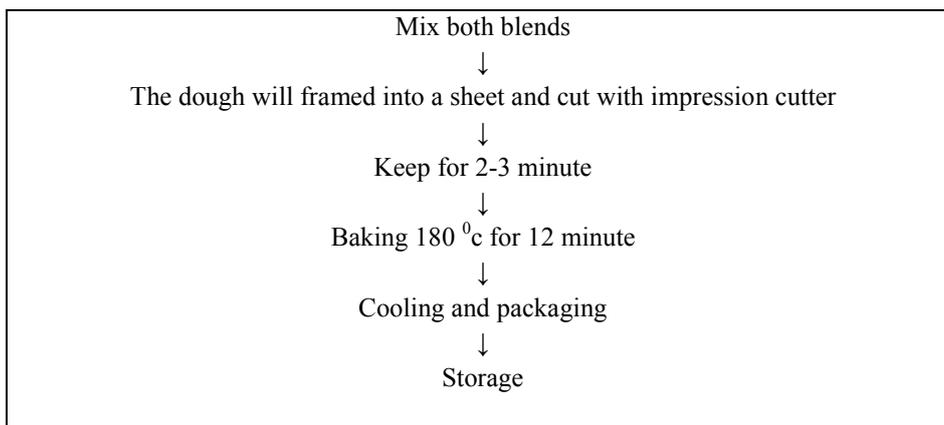


Figure 1: Flow chart for preparation of pearl millet

2.6 Chemical properties of raw materials and cookies

Chemical constituents like moisture, fat, protein, carbohydrate, crude fiber and minerals like calcium, phosphorous and iron content of raw material and cookies were determined as per the standard procedure.

2.7 Packaging and storage of pearl millet cookies

The selected treatments of pearl millet cookies were packed in low density polyethylene and stored at ambient (30+4 0C) for 3 months. The samples were drawn at an interval of 1 month and evaluated for chemical and sensory quality.

2.8 Sensory evaluation of cookies

Sensory evaluation of pearl millet cookies was carried on 9 point hedonic scale. The average scores of the ten judges for different quality characteristics viz. colour and appearance, flavour, texture, taste and overall acceptability were recorded.

The organoleptic evaluation of cookies prepared by different combination of pearl millet flour and pumpkin pulp were carried out. Pearl millet cookies were prepared and presented to panel of ten judge for assessing the quality and acceptability of product. Organoleptic evaluation of cookies was carried out using a 9 point hedonic scale of sensory characteristics such as colour, flavour texture, taste and overall acceptability. The score obtained for sensory evaluation for pumpkin pulp and pearl millet flour cookies are shown in Table 6.

III. RESULTS

3.1 Chemical characters of Raw Materials

The results obtained for chemical characteristics of pumpkin and pearl millet flour are presented here:

Table 2: Chemical characters of raw materials (value per 100grams)

Chemical constituent	Pearl millet	Pumpkin
Moisture (%)	12%	85%
Protein	11.0g	1g
Calories	378kcal	30kcal
Dietary fiber	8.5g	0.5g
Fat	4.2g	0.1g
Carbohydrates	72.8g	0g
Calcium	8mg	2%
Magnesium	1.6mg	3%
Iron	3.0mg	4%

Table 3: Chemical characters of pearl (millet) cookies

Chemical constituent	Cookies
Moisture (%)	0.033%
Protein	12g
Dietary fiber	7.5g
Fat	10g
Carbohydrates	95g
Calcium	13mg
Iron	4.0mg
Synthetic colours	Absent
Artificial sweeteners	Absent

3.2 Sensory Evaluations of Fresh Pearl Millet Cookies

Overall acceptability of product is a function of various factors including colour and appearance, flavour, texture and taste. Amongst all samples containing millet 60 per cent and pumpkin pulp 40per cent combination was found to be more acceptable. Sensory analysis showed that sample MP40is best sample in all sensory attributes. reported overall acceptability of product like cookies is a function of various factors including colour and appearance, flavour, texture and taste.

Table 4: Sensory evaluation pumpkin pulp and pearl millet cookies

Sample code	Sensory attributes					
	Colour and appearance	Flavour	Taste	Texture	Overall acceptability	Rank
MP ₁₀	8.0	8.0	8.0	8.0	8.0	5
MP ₂₀	8.5	8.4	8.4	8.3	8.2	2
MP ₃₀	8.3	8.4	8.2	8.5	8.2	3
MP ₄₀	9.0	9.0	9.0	9.0	9.0	1
MP ₅₀	8.2	8.2	8.1	8.3	8.1	4

*Maximum score out of 9. All results are mean value of five determinations.

Whereas,MP₁₀= (90 pearl millet flour : 10 pumpkin pulp)

MP₂₀= (20 pumpkin pulp : 80 pearl millet flour)

MP₃₀= (30 pumpkin pulp: 70 pearl millet flour)

MP₄₀= (40 pumpkin pulp: 60 pearl millet flour)

MP₅₀= (50 pumpkin pulp: 50 pearl millet flour)

IV. CONCLUSION

The cookies with the incorporation of Pearl millet flour (PMF) and pumpkin pulp were successfully prepared with high nutrient composition .The addition of pearl millet flour by replacing maida and add pumpkin pulp in cookies is a useful strategy to increase the consumption of important nutrients in the human diet. It can be concluded that the cookies prepared from pumpkin pulp and PMF blend in the ratio of 40:60 were found acceptable with respect to almost all sensory parameters and nutrient composition.

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