



Formulation and Nutrient Analysis of Millet and Muskmelon Seed Health Mix Powder Incorporated Value-Added Products

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ABSTRACT

Muskmelon (*Cucumis melo*.) is a fruit belongs to Cucurbitaceae family are rich in phytochemicals in addition to other vitamins and minerals. The phytochemical constituents namely flavonoids, phenolics, saponins, alkaloids present in seeds make them more effective. The oils from this seed have significant level of Poly Unsaturated Fatty Acids like omega-6 (Linoleic acid) and Mono Unsaturated Fatty Acids like omega-9 (oleic acid). Millets belongs to "True" grains of family "Poaceae". Millets are Gluten free and has low glycemic index with increased fiber along with micronutrients. Both muskmelon seeds and millets are loaded with pharmacological effects. In the present work, Ready-To-Cook (RTC) Health Mix was developed by incorporating Muskmelon seed powder with selected millets namely Little Millet flour, Barnyard Millet flour and Barley flour. From the Formulated Health Mix, six different products like Chappathi, Inippuputtu, Karaputtu, Adai Dosa, Pudding and Sweet Balls were prepared along with Control. All these products are subjected to its organoleptic Evaluation. The Nutritive and Microbial analysis were carried out by using Standard procedure. The analyzed macronutrient content per 100 grams was Carbohydrate (84.15%), Energy (391.34kcal), Total fat (1.26%) and the protein content (10.85%). The micronutrient content Calcium and Iron was 7.86mg and 15.43mg respectively. This study revealed that the muskmelon seed powder incorporated millet mix was a good source of Nutrient especially protein, Calcium, Iron. It indicated that muskmelon seed powder incorporated millet mix was organoleptically accepted due to its flavour and enhanced taste for healthy consumption of mankind.

Keywords: Phytoconstituents, RTC health mix, Organoleptic, Nutritive source

Introduction

Multigrain mixes are made by mixing two or more grains and processing them to create a food with unique health advantages. Its fundamental tenet is that because each grain has a unique nutritional makeup, mixing two or more grains might result in the addition of more nutrients. Thus, a multigrain product offers a variety of nutrients that may not be properly available through the ingestion of a single grain (Arya *et al.*, 2013). The idea of multi-grain flour or composite flour is not brand-new to humanity since it contains a variety of healthy ingredients, such as vitamins, minerals, phytochemicals, antioxidants, and vital amino acids that have preventive effects against non-communicable illnesses. The multigrain flour's nutritional and biological value is increased by the addition of useful components (Slavin, 2003).

One of the first meals that people have been able to recognize is millets, which may have been the first cereal grain utilized in household settings (Vudugula, 2018). The term "millet" is frequently used to describe a range of grains that are well-liked for their culinary applications and their health-promoting properties (Chandrasekara *et al.*, 2012). People in Africa and India use it in many of their recipes. Although millet is one of the world's most significant food crops, it is cultivated typically in the Eastern hemisphere and predominantly in regions with primitive agricultural practices and high population densities. Millets are chief food sources for millions of people, especially those who live in hot, dry areas of the world (Adekunle, 2012). Millets are typically farmed in marginal locations and under agricultural conditions when main grains fail to provide a significant yield (FAO, 2008). India is the world's leading producer of millets, producing 10.30 million tonnes and accounting for 36% of total global production (FAO, 2017). These are nutri-cereals that are very nutritious and have a high nutrient content that contains protein, essential fatty acids, dietary fibre, B-vitamins, and minerals such as calcium, iron, zinc, potassium, and magnesium. They contribute to health advantages such as blood sugar control (diabetes), blood pressure regulation, thyroid, cardiovascular, and celiac disease prevention (Rao *et al.*, 2017).

Small millet (Wheat semoline) is high in cholesterol and, when ingested, raises excellent cholesterol levels in the body, making it ideal for developing children and strengthening the body. Its complex carbohydrate digests slowly, which is ideal for diabetics (Gayatri, 2015). Another advantage is its high fibre content, which makes it an excellent substitute for rice in Pongal or kheer (Reddy, 2017). It contains high phosphorous (220 mg/100g) and iron (9.3 mg/100g). It is especially good for people have low body mass. Few recipes which can be prepared using little millet are dosa, idly, Pongal, kichadi (Nutritive value of Indian foods NIN 2007). Barnyard millet is a multipurpose crop which is cultivated for food and fodder. It is a good source of protein, which is highly digestible and is an excellent source of dietary fiber with good amount of soluble and insoluble fractions. Barnyard millet has a low carbohydrate content that is slowly digested, making it a natural gift for modern humans who are sedentary. Barnyard millet is most effective in reducing

blood glucose and lipid levels. (Veena *et al.*, 2005). Barley is one of the most significant cereal crops, ranking fourth globally behind wheat, rice, and maize. It is well-known for its protective properties against degenerative illnesses including as diabetes, obesity, hypertension, and colon inflammation, all of which are linked to poor eating habits and unhealthy lifestyles. These benefits are mostly related to its high fibre content, namely its b-glucan composition. Moreover, barley is a wonderful source of carbohydrates, minerals, vitamins, and protein, making it a great dietary supplement. Muskmelon (*Cucumis melo L.*) commonly called as cantaloupe is a member of Cucurbitaceae family. Consumer preference for this fruit is determined largely by its rich source of phytonutrients, sweetness, flavor or aroma and texture (Pandidurai *et al.*, 2018). Traditionally it is used for the treatment of kidney stones, flatulence, leprosy, fever, jaundice, diabetes, obesity, cough, bronchitis, ascites, anemia, constipation and other abdominal disorders. C. melo is a rich source of vitamin A, folate, flavonoids such as β -carotene, Lentin, xanthin and cryptoxanthin. Its various pharmacological activities have been evaluated such as antihyperlipidemic, antidiuretic, gastroprotective, anti-hyperglycemic, anti-inflammatory and antihypothyroidism (Asif *et al.*, 2014)

Globally the demand for Ready-to-cook (RTC) meal products has been increasing over a last few years on account of busier lifestyle of consumers and their rising income levels. The major changes in the life style, education, income and consumption patterns of the Indian consumers in the last two decades have encouraged the consumers to consume ready to cook food. Factors such as consumer attitude, price, preferences and service dimensions play a major role in influencing the choice of convenience food. An effort to improve the branded convenience food resulted in expanding the menu items and provided a platform for food innovation and made it easier to serve a great variety of products. Consumer behaviour towards ready to cook food products has received considerable attention from the competition in the market place. Ready to cook food is very popular among women due to taste, easy availability and convenience. They know that ready to cook food is not fresh, but still, they choose to consume ready to cook food at least once in a week. Improved standard of living and changing lifestyles of people across the globe are major driving factors for the significant growth of global RTC food market. Today, consumers are living a fast-paced life with lesser time available for cooking and other time-consuming activities. Also, they are more focused on their goals which occupy them with work load, in turn leading to growth in demand for RTC foods worldwide (Usha Udaiyar, 2018).

With this background, the present study focused to formulate RTC health mix from selected millets namely Little millet, Barnyard millet, Barley and muskmelon (*Cucumis melo.*) seed powder. Because *Cucumis melo.*, seed contains antioxidant and radical scavenging properties with high phenolic content, flavonoids, saponins and so on. It has direct effect on reducing blood pressure. As millets are rich in Calcium and low in iron content and vice versa in muskmelon. On mixing millets with muskmelon seeds nutrients get balanced. Since millets are rich in carbohydrates and micronutrients and muskmelon seed contains unsaturated fats, it is evident that it can be used as instant nutritious energy provider. Due to the inclusion of phenolics, flavonoids and tocopherols, muskmelon seeds are a good source of antioxidants in addition to the fruit flesh. A natural anti-cancer substance called cucurbitacin B was discovered in *Cucumis melo.*, plant. The triterpenoid compound, asiaticoside was reported to have anti-hypertensive and cardio protective effects in pulmonary hypertension (Wang *et al.*, 2018). This study helps for better understanding in Formulation of mix with blending of millets for value added seeds and nutrients were analysed. The best variation was selected by organoleptic evaluation and assessed the consumer acceptability with its good property.

Materials and Method

A. Selection of Ingredients

Muskmelon and Millets namely Barnyard, Little Millet and cereal include Barley were purchased from the local market in Coimbatore. These ingredients are used for the formulation of Healthmix. Millets are rich in fiber as well as possess low glycemic index and muskmelon seeds are loaded with polyunsaturated fatty acids (PUFA) and mono-unsaturated fatty acids (MUFA) and also helps in controlling hypertension. High Density polythene bags were used for packaging and storage of samples.

B. Processing of Ingredients

Millets are washed to remove dirt and sun dried for 7 hours followed by roasting and grinding each ingredient separately to make flour. The seeds were separated and cleaned manually and allowed to sun drying for 2 days. The seeds were roasted to grind them to make powder. All flour were packaged and stored in an air tight container.

C. Formulation of Health Mix

The RTC Health mix was made from Barnyard millet flour, Little millet flour, Barley flour with the incorporation of Muskmelon seed powder. All these flours were mixed in a proportion and stored in an airtight container.

TABLE 1 FORMULATION OF HEALTH MIX

| INGREDIENTS | QUANTITY(G) | | | |
|-----------------------|-------------|-------------|--------------|---------------|
| | CONTROL | VARIATION I | VARIATION II | VARIATION III |
| Barley Flour | 33.33 | 50 | 40 | 30 |
| Little millet flour | 33.33 | 20 | 25 | 30 |
| Barnyard Millet flour | 33.33 | 20 | 25 | 30 |
| Muskmelon seed powder | - | 10 | 10 | 10 |

Recipe For The Preparation Of RTC Health Mix

Take 30 grams of the processed millet flours individually and 10 grams of Muskmelon seed powder and blend them together so that they mix homogeneously to make Health mix. Store them in an air tight container.

FLOWCHART FOR PREPARATION OF HEALTH MIX

30g of processed millets flour and cereal (Barley) flour is taken separately

↓
Take 10g of Muskmelon seed powder

↓
Blend all the flour to make Health Mix

↓
Stored in an air tight container

D. Products prepared from Health Mix

Chappati

Take 100g of Formulated Health Mix and add required amount of water and a pinch of salt to make them into dough. Made them into balls and roll them. Put on pan and toast them.

Inippu puttu

Take 75gram of the Formulated Health Mix. Add 50gram of Powdered jaggery and desiccated Coconut powder. Blend them in a bowl. Add 5ml of gingelly oil and mix them well. Serve it in a bowl.

Karaputtu

Pour some water to the mix and steamed the Formulated Health Mix for 2minutes. Take pan and add oil. Saute all seasonings and add steamed health mix with pinch of salt. Saute them well and sprinkle coriander leaves as garnisher. Serve hot in bowl.

Adai Dosa

Take Health Mix in a vessel and add chopped onion, green chilly, grated ginger a pinch, grated carrot, salt and add water. Mix them to batter consistency and prepare dosa as usual. Serve hot with red or coconut chutney.

Pudding

Take 25g Health mix in a small cup and add little water to it. Blend them well leaving no cake formation. Boil milk with water. Add blended mix and stir it well. Add jaggery at gel consistency and stir well. Add desiccated coconut powder finally, stir well and off the stove. Serve hot in a bowl.

Sweet Balls

Roast the ghee with Health Mix in medium flame. Add 25ml water to jaggery with grounded cardamom to make it a sugar syrup.

RESULTS AND DISCUSSION

Sensory Evaluation of the Products

Sensory evaluation has been defined as a scientific method used to evoke, measure, analyze and interpret those responses to products as perceived through the senses of sight, smell, touch, taste, and hearing (Stone and Sidel, 1993).

The six different products were made with one control and three variations. The variations were named as "V1", "V2", "V3" and Control as "C". The six different products were prepared from flours of Barley, Little Millet, Barnyard and Muskmelon Seed Powder in Variation V1 (50:20:20:10), V2 (40:25:25:10), V3 (30:30:30:10) ratios. The scorecard was prepared and the evaluation was made with the help of 9-point hedonic scale by 40 semi trained panel members. With the result of sensory evaluation highly accepted Variation (V3) in all the six products was selected and further proceeded for Nutrient Analysis. Mean score is given below.

SENSORY ATTRIBUTES OF VALUE-ADDED PRODUCTS

| Value Added Products | Control And Variation 3 | Sensory Attributes | | | | |
|----------------------|-------------------------|--------------------|--------|---------|---------|-------|
| | | Appearance | Colour | Texture | Flavour | Taste |
| Chappathi | C | 6.60 | 6.60 | 6.57 | 6.02 | 6.60 |

| | | | | | | |
|--------------|---|------|------|------|------|------|
| | V | 7.03 | 7.03 | 6.80 | 7.00 | 6.89 |
| Inippu Puttu | C | 6.60 | 6.60 | 6.00 | 6.02 | 6.00 |
| | V | 7.41 | 7.40 | 7.60 | 7.70 | 7.62 |
| Karaputtu | C | 6.60 | 6.60 | 6.57 | 6.02 | 6.57 |
| | V | 7.02 | 7.02 | 6.80 | 7.00 | 6.80 |
| Adai Dosa | C | 6.60 | 6.60 | 6.57 | 6.02 | 6.00 |
| | V | 8.00 | 8.00 | 9.00 | 8.40 | 7.90 |
| Pudding | C | 6.60 | 6.72 | 6.40 | 7.40 | 6.80 |
| | V | 7.80 | 7.80 | 7.90 | 7.60 | 7.90 |
| Sweet Balls | C | 6.72 | 6.72 | 6.40 | 7.40 | 6.80 |
| | V | 7.80 | 7.90 | 7.80 | 7.90 | 7.70 |

Chemical Analysis

Nutrient Analysis consists of the amount of nutrients in the product and is typically based on 100grams. The analysis was most accurate and representative with a combination of database nutritional analysis and laboratory nutritional analysis. The macro nutrients like Energy, fat, protein, carbohydrate and micronutrients like iron, calcium was analyzed for both the control (C) and variation (V1) of the developed product using standard procedures (AOAC 20th edition 2016 and AOAC 21st edition 2019). Shelf life of the selected product was analyzed using standard microbial analysis method. It was done at initial, 7th and 15th day at proper interval of the study

NUTRIENT ANALYSIS OF HELTH MIX

| S.NO | PARAMETER | CONTROL (WITHOUT MUSKMELON SEED POWDER) | VARIATION |
|------|--------------|---|------------|
| 1. | ENERGY | 389.42kcal | 391.34kcal |
| 2. | PROTEIN | 7.68% | 10.85% |
| 3. | CARBOHYDRATE | 84.10% | 84.15% |
| 4. | FAT | 0.94% | 1.26% |

- ❖ The macronutrients such as Energy, Protein, Carbohydrate and Fat were examined for Control and Variation V3. The values of Energy, Protein, Carbohydrate and Fat of Variation V3 were 391.34kcal, 10.85%, 84.15%, 1.26% respectively on comparison with Control sample. It might be due to the addition of value-added Muskmelon seed powder as muskmelon seeds are rich in amino acids, unsaturated fatty acids contributing Energy to our body.

MOISTURE AND ASH CONTENT OF THE FORMULATED HEALTH MIX

| S.NO | PARAMETER | CONTROL | VARIATION |
|------|-----------|---------|-----------|
| 1 | MOISTURE | 1.01% | 1.37% |
| 2 | ASH | 1.34% | 2.37% |

- ❖ The moisture and ash content were analyzed for Control and Variation. The increased moisture content in Variation V3 is due to incorporation of Muskmelon seed powder as the seeds removed the fruit pulp has higher moisture on comparison with Control sample as it does not contain seeds and the Control sample is made of millets and cereal flour which should not exceed 13% as per FSSAI Standards.
- ❖ The Ash content for millets should not exceed more than 1.75% on dry basis as per FSSAI Standards. The increased ash content in variation V3 is due to the incorporation of muskmelon seed powder as it is rich in minerals whereas ash content for control is 1.34% which comes under FSSAI standards.

THE MINERAL CONTENT OF THE FORMULATED HEALTH MIX

| S.NO | PARAMETER | CONTROL | VARIATION |
|------|-----------|---------|-----------|
| 1. | CALCIUM | 7.82mg | 7.86mg |
| 2. | IRON | 12.45mg | 15.43mg |

- ❖ The Calcium and Iron content were analysed and compared for Control and Variation V3. Both the Calcium and Iron content in variation V3 was higher when compared to Control as it is due to the addition of Muskmelon seed powder. The Iron content is higher of 15.43mg whereas Control sample has 12.45mg. The Calcium content does not show the much difference between Control and Variation.

PHYSICAL PARAMETERS EVALUATION OF THE FORMULATED HEALTH MIX

| S.NO | PARAMETER | CONTROL | VARIATION | STANDARD DEVIATION |
|------|-----------|---------|-----------|--------------------|
|------|-----------|---------|-----------|--------------------|

| | | | | |
|----|----|------|------|------------|
| 1. | pH | 5.92 | 5.89 | 0.02121320 |
|----|----|------|------|------------|

- ❖ The parameter pH was analyzed for Control And Variation with help of FSSAI manual for millets , Nuts and oilseeds. The pH value differs for each millet. But mostly the millets are alkaline in nature so the pH does not exceed 9 and greater than 5. The optimum pH for seeds are 5.5 to 7.0 and the variation V3 has the lowest value as it might be due to the incorporation of muskmelon seed powder

THE MICROBIAL ANALYSIS OF FORMULATED HEALTH MIX

| S. No | Parameter | Storage period (days) | Control | V3 |
|-------|-------------------------------------|-----------------------|---------|----|
| 1 | Total bacteriological count (CFU/g) | 0 | 5 | 7 |
| | | 07 | 14 | 15 |
| | | 15 | 25 | 24 |

- ❖ The microbial load was analysed for control and variation for the period of 15 days at 07 days interval. The total bacteriological count in control on 0th day, 7th day and 15th day was 5 CFU/g, 14 CFU/g, 25 CFU/g respectively and in Variation V3 was 7 CFU/g, 15CFU/g, 24 CFU/g respectively. The table clearly depicts that there was no significant development of microbial growth till 15th day as minimum colony forming units are 30 CFU/g and the maximum colony forming units are 300 CFU/g. Beyond that Limits the product is not acceptable and the reason might be due to handling errors while processing the ingredients in development of product. In this Variation V3 and Control Sample the microbial count is very low. It is concluded that the variation V3 is acceptable and not provide threats for Human consumption.

CONCLUSION

Calcium presents in Barnyard Millet, Little Millet and Barley had protective roles of reducing the risk of osteoporosis, osteoarthritis, osteomalacia and other joint related problems. Also helps in the better absorption of Vitamin D. Millets possess Low glycemic index as better suited for diabetic patients in maintaining blood sugar level at constant level. As millets are rich source of Fiber, which aids constipation and other bowel related diseases.

The Beta carotene present in musk melon had protective roles of reducing the risk of certain types of cancers and cardiovascular diseases. The biomolecule cucurbitacin present in musk melon is a potential therapeutic in the treatment of human cancer diseases.

The Muskmelon seed powder infused Millets Mix was organoleptically accepted with high overall acceptability scores due to its taste and texture. The formulated Health Mix was superior in sensory, nutritional and microbial parameters. The study revealed that the formulated Health Mix having a good source of nutrients especially Protein, Calcium and Iron. The Nutrition Education mainly focused on imparting knowledge to the community about the plausible health benefits of RTC Health Mix than any other synthetic or artificial products. Then the developed Health Mix, its nutritional composition as well as health benefits were popularized among the community.

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