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FORMULATION AND NUTRIENT ANALYSIS OF MILLET AND PULSES PRE-MIX FLOUR INCORPORTED VALUE ADDED PRODUCT

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A B S T R A C T:

Millets are a very nutritious, non-glutinous, and non-acidifying food. As a result, they are both calming and easily digestible. They are thought to be the least allergic and digestible grains available. Pulses belong to Leguminosae family and include those species that are consumed by human beings and domestic animals, commonly in the form of dry grains. Pulses contain approximately 21–25% protein; however, have limiting amount of essential amino acids such as methionine, tryptophan and cystine. In this study, Ready-To-Cook (RTC) Pre-Mix was created by combining chosen millets such as little millet, kodo millet, barley flour, and pulses such as chickpea and mung bean flour. Five distinct products were made from the formulated Pre-Mix, including Sweet Puttu, Kolukattai, Kara Sevvu, and Ribbon Murukku, as well as Control. All of these goods undergo an organoleptic evaluation. The Nutritive and Microbial analyses were performed according to standard procedures. The macronutrient content per 100g was 374 kcal of energy, 1.24g of fat, 85.35g of carbs, 5.36g of protein, and 6.12g of fibre. The micronutrient composition is as follows: calcium 40mg, phosphorous 214.6mg, iron 3.22mg, and magnesium 92.2mg. This study found that millet flours mixed with pulse flours were a rich source of nutrients such as protein, fiber, calcium, magnesium, and phosphorus. It suggests that this pre-mix, which included millets and pulses, was organoleptically acceptable due to its flavour and increased taste for healthy eating. The combinations of Millet and Pulses enhanced the nutritive value of the product with fibre, iron, phosphorus, magnesium and antioxidants

Keywords: RTC pre-mix, Organoleptic, Nutritive value, Microbial count

Introduction:

Today, the concept of using foods to promote a state of well-being, improve health and reduce the risk of diseases has become the new frontier in the nutrition sciences and related fields. Moreover, the emphasis has moved from medication to prevention. In this context, the development and contribution of functional foods must receive attention and should be key pillars of the healthcare system. Functional foods not only act as traditional nutrients, but they also have some additional beneficial effects such as improving health status, preventing and reducing nutrition-related diseases, and promoting a state of physical and mental well-being **(Paul lachance, 2008).**

In recent years, millets have been recognized as important substitutes for major cereal crops to hope up with the world foods storage and to meet the demands of increasing population of both developing and developed countries. Millet grains which account for about one sixth of the total food grain production hold an important place in the food grain economy of India **(Shree *et al.*, 2008).** Millets contain higher proportion of unavailable carbohydrate and release of sugar from millet is slow. Millet protein contains amino acids in balanced proportions and is rich in methionine, cysteine and lysine. These are especially beneficial to vegetarians who depend on plant food for their protein nourishment. Important vitamins namely thiamine, riboflavin and niacin are present in high quantities. Millets, a rich source of dietary fibre provide a wide range of nutrients and phytochemicals including dietary fibre, vitamin E, magnesium and folate that optimize health **(Thilagavathy *et al.*, 2010).**

Millets are highly nutritious, non-glutinous and non-acid forming foods. Hence, they are soothing and easy to digest. They are considered to be the least allergenic and most digestible grains available. Due to urbanization, increase in health awareness and buying capacity among city dwellers, the demand for processed and convenience foods have increased drastically. Millets are much cheaper, but they have to be properly processed for further usage. About 50 million Indians suffer from diabetes, 15% of the Indian population are obese and India ranks 128th among all the mal-nutrition countries. Hence, there is a need to educate people about the health and nutritional benefits of millets to increase the consumption of millets and millet-based products to save

people from health and malnutrition related issues **(Arya, 1992).**

Pulses have a high protein content, the value is about twice that in cereal and several times that in root tuber **(FAO, 1968),** so they can help to improve the protein intake of meals in which cereals and root tubers in combination with pulses are eaten **(Kushwah *et al.*, 2002).** Pulses contain complex carbohydrates and are one of the richest natural sources of dietary fiber, and many of the benefits associated with pulses are attributed to their high-fiber profile. Higher dietary fiber intake can induce satiety and is associated with numerous positive health outcomes, including reduced risks for several chronic diseases and all-cause mortality **(Liu *et al.*, 2015; Veronese *et al.*, 2018).**

With this background, the present study focused to formulate RTC pre-mix from selected millets namely Little millets, Kodo millet, Barley and Pulses like Chickpea, Mung bean flour. Because these contains antioxidant, fiber, protein and so on. It has direct effect on reducing blood pressure. As millet are rich in Calcium and low in iron content and vice versa in pulses. On mixing millets with pulses nutrients get balanced. Since millets are rich in carbohydrates and micronutrients and pulses contains high proteins, it is evident that it can be used as instant nutritious energy provider. Due to the inclusion of phenolics, flavonoids and tocopherols, chickpea and mung bean are a good source of antioxidants. 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.

Materials and Methods:

2.1 Selection of Ingredients

Millets namely Little Millet, Kodo Millet; Cereals include Barley; Pulses like Green gram and Chickpea are used as ingredients for the formulation of Pre-mix flour. Millets are hypercholesteraemic and hypoglycaemic effect on humans. Barley, decreased total cholesterol and LDL cholesterol levels and the atherosclerosis index while increasing HDL cholesterol levels. The protein content in pulses is almost double than that found in cereals. These ingredients are purchased from the local market.

2.2 Processing of Ingredients

Millets and Cereals are washed to remove dirt and shadow dried for 2 days; Pulses are cooked in a boiling water for 45mins and then shadow dried followed by roasting and grinding of each ingredient separately to make flour. All flours were packaged and stored in an air tight container.

2.3 Formulation of Pre-mix

The RTC Health mix was made from Little millet flour, Kodo millet flour, Chickpea flour, Barley flour, Green gram flour were mixed in a proportion and stored in an airtight container.

INGREDIENTS	QUANTITY (g)			
	CONTROL (g)	VARIATION I (g)	VARIATION II (g)	VARIATION III (g)
Rice Flour	100	-	-	-
Little Millet Flour	-	20	20	20
Kodo Millet Flour	-	20	20	20
Barley Flour	-	20	20	20
Chickpea Flour	-	20	15	10
Green gram Flour	-	20	25	30

Table 2.1: Formulation of Pre-Mix

RECIPE FOR THE PREPARATION OF RTC PRE-MIX

Table 2.2: Preparation of RTC Pre-Mix

Ingredients	Quantity (g)
Little Millet Flour	20g
Kodo Millet Flour	20g
Barley Flour	20g
Chickpea Flour	20g
Green gram Flour	20g

Method

Take selected millet and pulses were soaked for 5hrs and shadow dry for 2days to remove anti-nutritional factors

↓

Roasted for 15min and grinded them into flours, then it is used for the preparation of recipes

↓

20g of processed millets flours, cereal (Barley) flour and Pulses flours is taken separately

↓

Blend all the flour to make Pre-Mix

↓

Stored in an air tight container

2.3 Products prepared from Pre-Mix

From the prepared Health Mix six different products were made namely Sweet Puttu, Kollukattai, Karra Sevvu, Ribbon Murukku, Sesame Balls (Ellu urundai). The procedure on preparation of above-mentioned products were Mentioned.

SWEET PUTTU

Take 50g of Formulated Pre-Mix

↓

Add a pinch of salt and steam for 10-15min

↓

Add 20g of Jaggery

↓

Add 3ml of oil and mix them well

↓

Serve it in a bowl

KOLUKATTAI

Take 60g of Formulated Pre- Mix

↓

Add a pinch of salt, Grated coconut, Bengal gram and 20g of Jaggery syrup

↓

Add 2ml of oil and Mix well then make them as a dough

↓

Hand mould it the Steam for 15min

↓

Serve it in a bowl

KARRA SEVVU

Take 50g of Formulated Pre- Mix

↓

Add a pinch of salt, Chilli powder 2g, Melted Butter 2ml and Water

↓

Mix well and make them as a dough then take a tray coated with melted butter

↓

Murukku made with Murukku maker by using circle shape disc

↓

Pre-heat the oven for 10 min at 180^0C

↓

Bake at 180^0C for 20min

↓

Serve it in a bowl

RIBBON MURUKKU

Take 100g of Formulated Pre- Mix

↓

Add a pinch of salt, Jaggery syrup 25ml, Melted Butter 2ml and Water

↓

Mix well and make them as a dough then take a tray coated with melted butter

↓

Ribbon Murukku made with Murukku maker by using Rectangle shape disc

↓

Pre-heat the oven for 10 min at 180^0C

↓

Bake at 180^0C for 15min

↓

Serve it in a bowl

SESAME BALLS

Take 100g of Formulated Pre- Mix

↓

Add a pinch of salt, Jaggery syrup 25ml, Sesame seeds 10g and Water

↓

Mix well and make them as a dough

↓

From the dough make them into small balls

↓

Take a pan deep fry pan and add oil into it

↓

After oil is heated add the balls into the pan and fry it for 5-10mins

↓

Serve it in a bowl

2.4 Organoleptic evaluation

The formulated products using pre-mix was evaluated by a panel of 25 members. The samples were randomly coded and presented to the panel members. Water was provided to rinse their mouth in between evaluations and the responses was given in the score card. The samples were evaluated based on a 9-Hedonic scale and were rated for color, appearance, taste, flavour, consistency and overall acceptability.

2.5 Physiochemical parameters

Assessing Physicochemical parameters such Moisture and Ash. These parameters are analysis for the samples by using AOAC 1970.

2.6 Nutrient analysis

The nutrient value of the formulated pre-mix was analyzed. The macronutrients like Energy, Carbohydrate, Protein, Fat and Fibre and Micronutrients like Calcium, Phosphorus, Magnesium and Iron were determined using standard procedure.

2.7 Microbial load analysis

The total bacterial count in the formulated product was determined by microbiological examination on the 0^{th}, 7^{th} and 15^{th} days interval the growth of the bacteria was examined. The colonies formed were counted to determine the quality of food and to determine the shelf life of the product.

2.8 Antioxidant activity

The antioxidant activity of flavonoids was determined. In this determination, the spectrophotometer method is used to measure the amount of light absorbed or transmitted by a substance at different wavelengths, allowing for the determination of its concentration, identification and analysis of its properties.

2.9 Statistical analysis

Following the completion of the sensory evaluation by panel members, the data was collected from the analyzed panellists and the nutritional analysis results are arranged for further statistical analysis. The Post-hoc (Ducan) method was used for the analysis.

Results and Discussion:

3.1 Organoleptic evaluation

SWEET PUTTU					
CRITERIA	**COLOR**	**APPEARANCE**	**FLAVOR**	**TASTE**	**OVERALL ACCEPTABILITY**
Control	0.57 ± 6.44	0.63±6.64	0.61±6.6	0.77±7.04	0.58±6.44
Variation I	0.75±8	0.78±7.96	0.59±8.04	0.8±8.08	0.5±8.28
Variation II	0.76±7.36	0.76±7.4	0.94±7.24	1±7.08	0.86±7.2
Variation III	0.75±7.2	0.69±7.16	0.62±7.08	0.81±6.72	0.84± 6.64
KOLLUKATTAI					
Control	0.58± 6.32	0.63±6.2	0.57±6.56	0.73±6.44	0.82±7.28
Variation I	0.707± 7.88	0.67±7.84	0.67±7.76	0.7±7.88	0.67±8.08
Variation II	0.81±7.48	0.76±7.36	0.83±7.12	0.86±6.96	0.81±7.2
Variation III	0.81±7.16	0.68±7.08	0.7±7	0.79±6.88	0.75±6.8
KARRA SEVVU					
Control	0.55± 6.6	0.76± 8.04	0.58±8.24	0.5 ± 8.16	0.73±6.44
Variation I	0.66 ± 7.6	0.68± 7.56	1.2±7.16	0.97±7.44	0.75±8.56
Variation II	0.77 ± 7.36	0.7±7.32	0.92±7.32	0.88±7	0.7±7.36
Variation III	0.79± 6.64	0.75±6.72	0.707±6.48	0.83±6.44	0.7±6.96
RIBBON MURUKKU					
Control	0.61±6.72	0.73±7.04	0.64±6.8	0.82±6.44	0.55±6.32
Variation I	0.82±8.48	0.71±8.52	0.65±8.56	0.57±8.6	0.4±8.8
Variation II	0.72±7.88	0.88±7.96	0.84±7.96	0.91±8	0.67±7.96
Variation III	0.72±7.88	0.79±7.72	0.7±7.64	0.93±7.72	0.82±7.56

SESAME BALLS					
Control	0.82±6.44	0.55±6.32	0.61±6.72	0.76±6.2	0.55±6.32
Variation I	0.57±8.6	0.4±8.8	0.7±8.08	0.79±7.16	0.66±7.88
Variation II	0.91±8	0.67±7.96	0.73±7.04	0.76±6.2	0.77±7.48
Variation III	0.93±7.72	0.82±7.56	0.702±8.08	0.81±7	0.61±6.72

From the above table, it was clear that, among the organoleptic score of the Sweet puttu, Kolukattai, Karra sevvu, Ribbon murukku and Sesame balls from the Formulated Pre-mix in the Variations, Variation V1 had got the highest score in all sensory parameters like Appearance, Colour, Flavour, Consistency, Taste and Overall acceptability. This indicates that participants found this variation to be most acceptable among all the tested variations. The Control received the lowest mean overall acceptability score. This suggests that participants found this variation to be less acceptable compared to the other tested variations.

3.2 Physicochemical analysis

Physicochemical parameters of the formulated Pre-mix

PARAMETER	CONTROL	VARIATION-I
Moisture	3%	4.99%
Ash	0.55%	3.06%

The moisture and ash content were analysed for Control and Variation. The increased moisture content in Variation I is due to mixed flour of Barley flour, Little millet, Kodo millet, Chickpea flour, Mung bean flour and the control sample is made of Rice flour. The Ash content is increased in Variation I is due to the addition of millet, pulses and cereal flours.

3.3 Nutrient analysis

Nutrient content of the formulated Pre-mix

CRITERIA	CONTROL	VARIATION-I
Energy (kcal/100g)	345	374
Carbohydrate (g/100g)	75.20	85.35
Protein (g/100g)	5.36	5.5
Fat (g/100g)	0.5	1.24
Fiber (g/100g)	0.20	6.12
Calcium (mg/100ml)	10	40
Phosphorous (mg/100ml)	98	214.6
Magnesium (mg/100ml)	35	92.2
Iron (mg/100ml)	0.35	3.22

The macronutrients like carbohydrate, protein and fat along with energy were analyzed for control and Variation. The nutritional composition analysis revealed notable differences between the control and variation-I. The Nutritive value of Protein for control was lower (5.36g) when compared to Variation I (5.5g). Variation I exhibited a higher carbohydrate content (85.35g) compared to the control (75.20). Both control and variation show the marginal difference in fat. Control and Variation I exhibited similar energy content with V-I slightly higher at 374kcal compared to 345kcal in the control. Variation I exhibited higher levels of Phosphorous 214.6 mg compared to control 98mg. Calcium and iron content are increased in V-I 40mg and 3.22mg compared to control because of the addition of millet of little millet, kodo millet, barley and pulses of mung bean & chickpea. When compared to control at 35mg, V-I also increase at 92.2mg in magnesium.

3.4 Microbial analysis

Microbial analysis of the formulated Pre-mix

Parameter	Storage Period (Days)	Control	Variation I
Total Bacteriological count (CFU/ml)	0th	20×10^4	10×10^4

	7th	50×10^6	20×10^5
	15th	75×10^6	60×10^6

The total bacterial count was found on the 0th day, on the 7th day, and on the 15th day. The initial bacteriological count of the control group on the 0th day was 20×10^4 CFU/ml, which is increased on the 7th day 50×10^6 CFU/ml, and elevated to 75×10^6 CFU/ml on the 15thday. In contrast, the initial bacteriological count of Variation I on the 0th day was slightly lower at 10×10^4 CFU/ml. However, the count remained relatively stable over the course of storage, with values of 20×10^5 CFU/ml on the 7th day and 60×10^6 CFU/ml on the 15thday. 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 V1 and Control Sample the microbial count is very low. It is concluded that the VariationV1 is acceptable and not provide threats for Human consumption.

3.5 Total antioxidant activity

Antioxidant activity of the formulated Pre-mix

Parameter	Control (mg)	Variation-I (mg)
Flavonoids	10.3	67.5

From the above table, it is concluded that the antioxidant value of Flavonoids was high at 67.5mg in variation I when compared to the control 10.3mg because of the addition of millets like barley, little millet & kodo millet and pulses like mung bean & chickpea.

Conclusion:

In conclusion, combining barley flour, kodo millet, little millet, and pulses such as chickpea and mung bean flour into a premix flour provides a healthful and diverse alternative to typical wheat-based flours. These components provide several health advantages, including higher fibre content, improved digestive health, and a high concentration of plant-based proteins, vitamins, and minerals. The premix is excellent for people who are gluten sensitive or follow gluten-free diets because it contains gluten-free grains and pulses. Furthermore, the distinct textures and tastes of these flours contribute to a more enjoyable culinary experience, allowing for the creation of a diverse range of baked products, snacks, and traditional meals with increased nutrition. This premix not only encourages healthy eating habits by diversifying the types of grains and legumes used in flour mixes, but it also promotes sustainable agriculture and the use of local, less-processed foods. The study revealed that the formulated pre-mix was a good source of nutrients especially Protein, Iron, Fiber and Phosphorous. It indicated that, the combining barley flour, kodo millet, little millet, and pulses such as chickpea and mung bean flour into a premix flour provides a healthful and diverse alternative to typical wheat-based flours. The premix is excellent for people who are gluten sensitive or follow gluten-free diets because it contains gluten-free grains and pulses. Furthermore, the distinct textures and tastes of these flours contribute to a more enjoyable culinary experience, allowing for the creation of a diverse range of baked products, snacks, and traditional meals with increased nutrition. The formulated pre-mix V1 variation had higher acceptability and was superior in nutritional, microbial and sensory parameters.

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