RESEARCH ARTICLE

FORMULATION OF IRON AND CALCIUM RICH HEALTH MIX FOR SUPPLEMENTATION IN WOMEN SUFFERING FROM PREMENTRUALSYNDROME

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ABSTRACT

Consumption of refined and fast foods along with the lifestyle modification and stress has compounded to the problem of premenstrual syndrome in majority of women of reproductive age. Various studies have pointed out that there is alteration in the iron, calcium and magnesium levels among women with and without premenstrual symptoms. The present study was aimed at formulating a health mix cookies made of locally available cereals and pulses that supply good amount of minerals like iron, calcium, magnesium and B-complex vitamins.

Materials and methods: The ingredients used were sprouted ragi, horse gram, soaked and dried soya bean, roasted bengal gram dhal, rice flake and gingelly seed. All the ingredients were roasted and powdered in to flour separately. Different quantities of these flours are combined into five variations and made in to cookies by adding butter, coconut oil and vegetable oil. The five variations of health mix cookies were analysed for the nutrients (calorie, protein, fat, iron, calcium, magnesium, thiamine, riboflavin, niacin and vitamin-C). Sensory evaluation of the five variations of health mix cookies was conducted by a panel of sensory evaluators. The variations which secured high score was considered as the best sample and used for further intervention study.

Results: The variation V had the highest amount of iron, calcium and magnesium content and scored highest in the sensory evaluation apart from having adequate amount of essential fatty acids and amino acids.

Conclusion: Hence the variation V can be taken as supplement in women suffering from Premenstrual Syndrome.

INTRODUCTION

Dietary intakes of certain micronutrients, including calcium, vitamin D (ACOG, 2010), thiamin, and riboflavin (Halbreich, 2003), have been reviously associated with the development of PMS, but the role of minerals has not been thoroughly explored. Iron, magnesium, zinc, copper, manganese, potassium, and sodium may be involved in the pathophysiology of PMS through a variety of mechanisms. Blood levels of potassium, magnesium, and zinc fluctuate across the menstrual cycle (Bertone-Johnson *et al.,* 2005). Magnesium and potassium (Chocano Bedoya *et al.,* 2011) have been studied as treatments for premenstrual symptoms in a few small studies, with inconclusive results.. Six out of ten Life style changes with fast food culture and stress has compounded the problem of Premenstrual Syndrome. Various studies have pointed out that there is alteration in nutrient levels (iron, calcium, magnesium and some vitamins) among women with

and without premenstrual symptoms and need to have remedial measures. Most of the women feel that it is a natural biological process and need not be treated with drugs. Hence many women try to seek relief from PMS through natural ways or natural products rather than drugs (Das and Chowdhury, 1997). One Retrospective Control Trial, using soy protein, containing isoflavones, as an intervention, the group taking soy protein experienced a reduction in overall symptoms compared to the counterpart having baseline. Primrose oil (1 to 2 grams per day) can significantly relieve premenstrual symptoms including depression and breast pain, prolonged bleeding, and faulty thinking. Prolonged use (more than 3 months) works best. Good food sources of omega-6 includes: meat and milk products, safflower oil, corn oil, nuts, and seeds (Quaranta *et al.,* 2007). PMS may serve as a clinical marker of low calcium status perhaps reflecting an underlying abnormality in calcium metabolism and it may serve as an early warning sign to young women of a possible risk to osteoporosis. Low calcium levels were associated with low back pain, abdominal cramping and aches and pains all over body. Magnesium is involved in the activity serotonin and other neuro- transmitters. Lower levels of which may lead to

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mental disturbances. (it has been hypnotized that PMS is linked to a deficiency of serotoninergic activity). Lower manganese levels are associated with increases mood and pain symptoms (Khine *et al.* 2006; Walker *et al.,* 2002). Iron found in plant foods and supplements, non-heme iron reduced a woman's chance of developing PMS. Heme iron from animals like red meat and poultry did not have the same effect. Magnesium is involved in the activity of serotonin and other neuro-transmitters. Lower level lead to mental disturbances. It has been hypothesised that PMS is linked to a deficiency of serotoninergic activity. Lower manganese levels are also associated with increased mood and pain symptoms. Iron found in plant foods and supplements, non-heme iron reduced a woman's chance of developing PMS. Heme iron from animals like red meat and poultry did not have the same effect with these literature , the present study was aimed to formulate a health mix using locally available foods rich in macro and micro elements and vitamins.

MATERIALS AND METHODS

Locally available low cost, seasonal foods like sprouted ragi, rice flake, roasted bengal gram dhal, soya, sprouted horse gram, gingelly seed and jaggery rich in iron, calcium, magnesium and manganese and used for the formulation of health mixes with different variations (Fig-1).
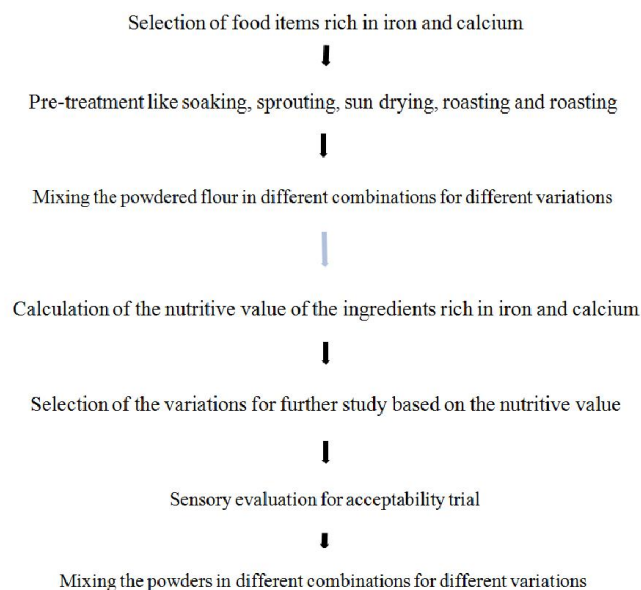

Fig-1. Formulation and Sensory Evaluation of the Health Mix

Pre-preparation of the health mix cookies

The ingredients used for the preparation of the health mix cookies were sprouted ragi, horse gram, soaked and dried soya bean, roasted bengal gram dhal, rice flake and gingelly seed. Ragi and horse gram were germinated to increase the nutritive value and bioavailability of the nutrients. The other ingredients were sun dried and roasted to enhance flavour and texture and to remove moisture content. Sprouting has improved the calcium, iron protein and vitamin –C content of the ragi and horse gram (Desai *et al.,* 2010). All the ingredients were powdered separately. They were mixed in five combinations and kneaded with measured quantities of water, butter and vegetable oil to prepare cookies. Using these processes, ingredients, in different combinations in different Variations were developed. Out of the 10 mixes prepared, five mixes that satisfied the nutritive value and acceptability qualities were used for the preparation of health mix cookies.

Formulation of Health mix cookies

Table -1 highlights variations used in the formulation of iron and calcium rich health mix cookies**.**

Table-1 Variations used in the formulation of iron and calcium rich health mix cookies

Ingredients	Variations (g)				
	I	II	III	IV	V
Sprouted ragi flour	20	30	40	50	55
Rice flake	30	20	10	5	10
Sprouted horse gram flour	5	5	5	5	5
Roasted Bengal gram flour	5	10	5	5	5
Soya flour	5	5	5	5	5
Gingelly seed	5	5	5	5	5
Jaggery	20	20	20	20	10
Butter and oil	10	10	10	5	5
Total	100	100	100	100	100

Table-2 shows the different variations in the formulation of the health mix cookies. The Steps involved in preparation of cookies is presented in Fig-2.
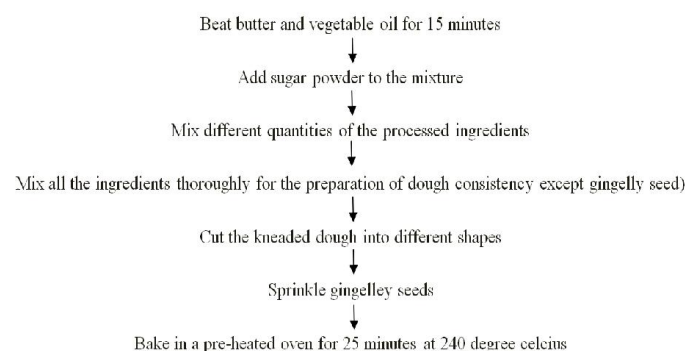

Fig. 2.

Steps involved in preparation of cookies

Table -3 and Table -4 highlight the nutrient content of sprouted and unsprouted ragi and horse gram.

Table 3. Nutrient content of sprouted and unsprouted ragi flour

Nutrient	Ragi flour (100 g)	Sprouted ragi flour(100 g)
Carbohydrate (mg)	72.0	76.18
Protein (g)	7.3	7.60
Fat (mg)	1.3	1.14
Calcium (mg)	344	429.8
Iron (mg)	3.9	12.4
Vitamin-C (mg)	0	5.89

Table 4. Nutritive value of sprouted and unsprouted horse gram

Nutrient	Horse gram flour (100 g)	Sprouted horse gram flour(100 g)
Energy (kcal)	321	225.7
Carbohydrates	57.2	22.337
Protein (g)	22	29.143
Calcium (mg)	287	632.9
Iron (mg)	6.77	9.43
Thiamine (mg)	0.42	0.5062
Riboflavin (mg)	0.2	0.2245
Niacin (mg)	1.5	11.811
Vitamin-C (mg)	1	19.864

From Tables 3 and 4, it was noted that sprouting increases the nutritive content of the food items especially in protein, iron, calcium, niacin and vitamin-C content. Hence the present study sprouted ragi and horse gram were used for the health mixes to enhance the nutritive value.

Analysis of the nutrient content of the five variations

Table – 5 highlights the nutrient content of the health mix cookies.

Table 5. Nutrient content of the variations of the health mix cookies

Nutrient	Variations				
	I	II	III	IV	V
Energy (Kcal)	271.5	296.5	226.6	301.4	239.6
Carbohydrate (g)	28.80	31.79	27.66	41.90	32.60
Protein (g)	27.82	33.04	20.05	26.10	18.25
Fat (g)	5.087	4.223	3.986	4.361	3.989
Calcium (mg)	613.3	707.2	994.2	953.8	998.3
Magnesium (mg)	673.3	881.3	914.6	666.8	1100
Iron (mg)	9.89	8.18	8.01	8.10	9.1
Vitamin –A (µg)	905	337	902	204.5	667
Thiamine (mg)	0.575	0.756	0.854	0.934	1.224
Riboflavin (mg)	1.255	0.845	0.599	2.464	0.725
Niacin (mg)	4.49	3.801	2.733	3.026	5.251
Vitamin-C (mg)	13.07	10.77	7.877	10.25	8.927

Table -6 indicates the sensory evaluation of different variation used in health mixes.

Table 6. Sensory evaluation of the variation of health mixes

S.No.	Sensory attributes	Variations				
		I	II	III	IV	V
1.	Appearance	3.46	3.78	3.71	4.66	4.80
2.	Colour	4.0	3.84	3.84	3.75	4.0
3.	Flavor	3.16	3.16	3.15	3.9	4.16
4.	Taste	4	3.96	3.93	3.83	3.98
5.	Texture	4.2	4.0	3.95	3.95	4.6
6.	Overall acceptability	4.08	4.16	4.32	4.05	4.36

Table-6 reveals the data related to the sensory evaluation of the five variations based on the expert panel of 30 members showed that highest acceptability scores were secured by variation V. The mean score of Variation-V was 4.36, followed by the Variation III (4.32) and variation I with mean score of 4.08. The variation V had highest mineral content minerals (iron, calcium and magnesium) and also had the highest acceptability mean score among the five different variations of health mix cookies.

Conclusion

The health mix cookies were formulated using locally available, low cost and nutrient dense ingredients and were evaluated for the sensory attributes and also analysed for their nutrient content. The nutrient analysis indicated that the formulated iron and calcium rich health mixes had appreciable amount of minerals (iron, calcium and magnesium) and vitamins and considered as the best supplement for nutrition intervention for women suffering from Premenstrual Syndrome.

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