

Sensory evaluation and nutritive values assessment of self developed sports potential enhancing food supplements

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ABSTRACT

This study conducted as a IV phase of experimental research. The sensory evaluation and nutritive values assessment of self developed sports potential enhancing food supplement relate to II phase in which, energy, protein and calcium, iron rich six food supplements namely choko flavoured germinated wheat drinking powder, choko flavoured germinated pearl millet drinking powder, choko flavoured germinated finger millet drinking powder, choko flavoured germinated green gram dal drinking powder, choko flavoured soybean drinking powder and choko flavoured germinated multi grain drinking powder were developed, standardized, analyzed nutritionally and tested organoleptically. Choko flavoured germinated multigrain drinking powder, which had scored the higher acceptance values with best nutritious supplement from six, were chosen for supplementation study.

Key Words : Food supplements, Germinated, Multigrain, Sports potential, Nutritive value

INTRODUCTION

Food supplements are popular worldwide. They are required for their ability to increase physical power and mental strength of the athletes. Food Supplements delay the fatigue during prolonged exercise; improve strength, stamina, agility, speed, endurance and aid rapid recovery from injuries. Most of the supplements act as an antioxidant to quench free radicals generated during exercise and some as immune boosters. Commercial supplements available in India and other countries include protein supplements in the form of shakes or protein bars, whey protein, branched chain amino acid supplements, meal replacement products, creatine, antioxidant supplements, glutamine, caffeine and beta-hydroxy beta methyl butyrate from leucine. Demands of the dietary supplements are increasing on a greater scale in developing countries like the Brazil, Russia, India and China (Devla *et al.*, 2011). Nutrition per iodization ensures

that the athlete receives the nutrients that are required to enhance health, improve strength, and sustain power and endurance at the right time. At the same time, this strategy helps the athlete maintain a healthy immune system and ensures appropriate body weight and composition. Nutrition per iodization supports changes in training load so that the athletes are able to achieve high-quality workouts and recover rapidly. Properly planned nutrition supports physical training, enables athletes to practice and recover well and move ahead to achieve the goal of improved performance. Nutrition per iodization is meant to be a year- long endeavour to support the athlete's changes in energy consumption. The science of nutrition and performance is growing at a great pace. As this body of research expands and as scientists carefully scrutinize the factors that can affect an athlete's performance and physique, the need and demand for sport nutrition practitioners also grows (Bob Seebohar, 2012). Karnik (2010) had pointed out that rice, wheat and millets are

How to cite this Article: Malik, Shweta and Kaur, Parvinder (2019). Sensory evaluation and nutritive values assessment of self developed sports potential enhancing food supplements. *Internat. J. Appl. Home Sci.*, **6** (6-8) : 236-242.

the cheapest sources of calories. And iron fortified foods such as cereals can be a good way to get iron along with carbohydrates needed to fuel the training. FAO (2009) had declared that cereal based foods as the most important sources of nutrients for the mankind. All cereals are belonging to grass family, "Graminea". The cereals includes many different types of grains like- Wheat, Rice and maize are more common Whereas the term 'Millets' which is applied for the different several species of cereals provides small grains includes Barley, Oats, Ragi, Sorghum and others varieties also. Wheat (*Triticum aestivum*) cereal is largely consumed in various forms like breads, biscuits, cookies cakes, pasta, noodles and is the major sources of dietary energy and protein for humans (Hussain *et al.*, 2004). A soybean with its high protein content is considered as a substitute for meat protein which is expensive. A complete protein is one that contains significant amounts of all the essential amino acids that must be provided to the human body because of the body's inability to synthesize them. For this reason, soy is a good source of protein. The use of soybeans without oil extraction that is full fat soybeans has great nutritional properties. It is high in protein with unique biological value, its fat content contribute to the energy required for protein synthesis. A full fat soybean has between 38-40% CP, 18% fat and 5% crude fiber (Smith, 2001). Whole moong bean/Green gram is a protein rich staple food. It contains about 23- 25% protein (Khattak, 2007) good source of vitamins, minerals, enzymes complex carbohydrates and have better quality than others (Kataria *et al.*, 1989; Jood *et al.*, 1998) and have no cholesterol (Dostalova *et al.*, 2009). Pearl millet contains more calories than wheat, probably because of its higher oil content, which are 50% polyunsaturated fatty acids. It is rich in calcium, potassium, magnesium, iron, zinc, manganese, riboflavin, thiamine, niacin, lysine and tryptophan and fiber whereas Finger millet is scientifically called 'Eleusinian Caracara' and commonly called 'Ragi' It is widely consumed without any refining by many people in rural areas. It contains B Vitamins but is poor in thiamine. Finger millet (Ragi) is rich in minerals especially calcium. It is also rich in fiber and is a fair source of iron also. Soaking and Germination is a common household technique carried out at low cost without the use of any sophisticated and expensive equipment. It reduces anti-nutrients thereby improving nutritional and functional properties of pearl millet and also the mousy odor of damp millet is eliminated. It was observed that

decrease in the anti-nutritional factors of cereal grains was a result of soaking and germination (Gupta and Sehgal, 1991). More patience required in natural drying formula method consists essentially of exposing the threshed products to the air (in sun or shade). To obtain the desired moisture content, the grain is spread in thin layers on a drying-floor, where it is exposed to the air. Roasting and grinding processes render the grain digestible, without the loss of nutritious components (Krantz *et al.*, 1983). Roasting of cereals, pulses and oilseeds is a simpler and more commonly used household and village level technology which is reported to remove most anti-nutritional or toxic effects such as trypsin inhibitor, hemagglutinin, gioterogenic agents, cyanogenic glycosides, alkaloids and saponins and increase storage life (Gopaldas *et al.*, 1982; Huffman and Martin, 1994).

Objective: When a market survey conducted by the fact finder indicated that in India locally produced sports supplements are scanty and the available ones are imported from other countries. Their exorbitant cost and scarcity curb the use of these supplements by the local athletes who are from a humble background. The cost ranged from Rs. 70 to Rs. 100 per 100 gm/ ml which was unaffordable by most of the sports persons in India. Therefore there is an urgent need to formulate innovative low cost food supplements to help the players who cannot afford to buy expensive supplements from the market. Today, India is making rapid records in the field of sports and Indian athletes are endeavouring to reach the top position in national and international arena. Ours athletes performance is often obstructed by lack of stamina and poor health due to nutritional deficiencies and disorders. Keeping in view the beneficial impact of underutilized millets/grains/ cereals the present objective was planned for Sensory Evaluation and Nutritive Values Assessment of Self developed Sports Potential Enhancing Food Supplements.

METHODOLOGY

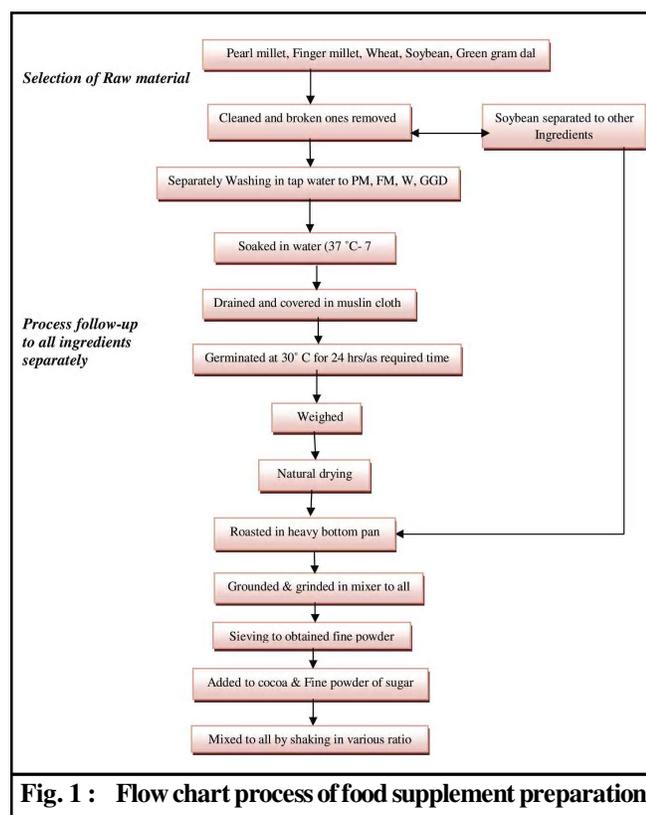
My present investigation Sensory Evaluation and Nutritive Values Assessment of Self developed Sports Potential Enhancing Food Supplements was conducted in Food and Nutrition department of BPSIHL, BPS Women University, Khanpur Kalan, Sonipat district of Haryana.

Development of food supplements:

Indian Science Congress focal theme emphasizes

Internat. J. Appl. Home Sci. | June - August, 2019 | 6 (6-8)

that the products suited to Indian needs can be designed and developed indigenously. Based on the information received during dietary survey, Energy, protein, calcium and iron rich six drinking powders were developed by using processing methods like soaking, germinating, drying, roasting and grinding. All constituents were prepared separately. Soybeans were only roasted without germination. For improving the palatability and appearance cocoa powder was added to resemble chocolate milk powders. Grinding of sugar for making fine powder in the above mix made the product was dense of calorie. Six types of food supplements were developed in form of nutritious drinking powder namely Choko flavoured germinated wheat powder, Choko flavoured germinated pearl millet powder, Choko flavoured germinated finger millet powder, Choko flavoured germinated green gram dal powder (whole green moong), Choko flavoured soybean powder and Choko flavoured germinated multi grain powder. As showing in (Fig. 1) flow chart of process for food supplements preparation is given.



Sensory evaluation:

Sensory quality consists of judging the quality of food

using our sense organs viz., eyes, nose, mouth and skin. All the developed food supplements were assessed for organoleptic evaluation by a trained panel of judges from B.P.S. Institute of Higher Learning of Khanpur Kalan, Sonipat and some athletes from G.S.S. School Khanpur Kalan (Sonipat). The judges were asked to score the samples for colour, appearance, flavor, texture taste and overall acceptability using a score card of 9-point Hedonic scale. From each product the level having better acceptability was selected for further nutritional evaluation.

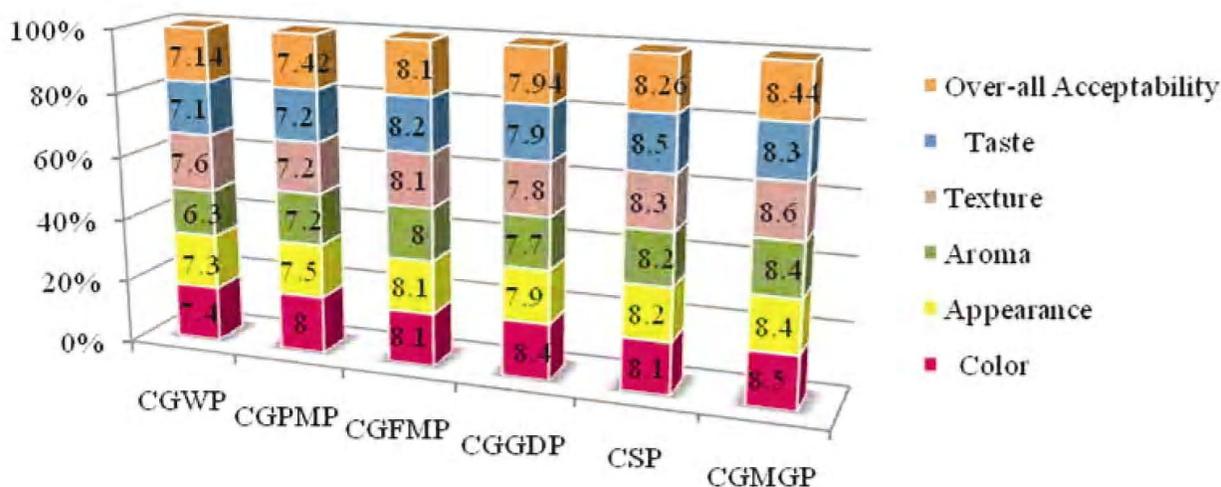
Nutrient analysis of developed products:

Nutrition composition of food supplement was conducted in practical laboratory of NIMS University Jaipur in the department of Advance Science. For nutrient analysis of developed organoleptically food supplements were already in fine powder form dried in oven at 50±5°C to constant weight. Dried samples were packed in polyethylene bags and analyzed for the following parameters: Six food supplements were chemically analysed for proximate composition such as moisture, crude protein, and crude fat, crude fiber by using the method of AOAC (2007). Calcium and iron were determined by AOAC (2007). Carbohydrate was calculated by differential method. The calorie value was calculated by sum of the percentages of proteins and carbohydrates multiplied by a factor of 4(kcal/g) and total lipids multiplied by a factor of 9(kcal/g). Shelf life of the food supplement was assessed through total bacterial count by pour plate (Dhawale and La Master, 2003), method in comparison with the initial.

RESULTS AND DISCUSSION

All food supplements evaluated for colour, appearance, aroma, texture, taste, overall acceptability characterised by a panel of ten judges using 9- point rating hedonic scale (Fig. 2) these characteristics have been discussed individually as follows:

Colour: The highest mean score for colour was obtained by sample VI (8.5) and sample I got the lowest 7.4 score. The colour of all developed food supplements was liked by the judges and scores were more than the minimum acceptability score of five. **Appearance:** Average highest 8.4 score for appearance which pleases to sense of vision was obtained by sample VI. The lowest 7.3 mean score was obtained by sample I for appearance. The appearance of six food supplements was acceptable



CGWP : Choko flavoured germinated wheat powder (sample I)
 CGPMP : Choko flavoured germinated pearl millet powder (sample II)
 CGFMP : Choko flavoured germinated finger millet powder (sample III)
 CCGGDP : Choko flavoured germinated green gram dal powder (sample IV)
 CFSP : Choko flavoured soybean powder (sample V)
 CGMGP : Choko flavoured germinated multi grain powder (sample VI)

Fig. 2 : Graphical representation of organoleptic scores of developed food supplements

which were high than minimum acceptability score point 5. **Aroma:** the regarding acceptability mean scores for aroma the highest score 8.4 out of 5 were obtained by sample VI and the score 6.3 for aroma was observed to be the lowest for again sample I. Again Figure: 2 indicate the **Texture** of the sample VI was obtained the highest score 8.6 for texture whereas sample II was obtained 7.2 lowest score, respectively. **Taste:** The mean score of taste of Sample V was obtained highest 8.5 whereas lowest score 7.1 was obtained by sample I, respectively. All the food supplements taste scores ranged from 7.1 to 8.5, which were moderate and like very much organoleptic score (7 and 8) due to different taste of grains, cocoa powder and fine sugar. **Overall acceptability:** The mean scores of all food supplements samples were as sample I (7.14), sample II (7.42), sample III (8.1), sample IV (7.94), sample V (8.26) and sample VI (8.44). The highest score 8.44 was obtained by sample VI.

Food supplement sample VI was highly acceptable by panellists with having highest 8.44 score in all organoleptic criteria out of six food supplements; Whereas sample V was second 8.26 score highly acceptable by panellists. Sample VI was most liked by judges due to roasted multigrain flavour with cocoa and

sweet taste, so that's why sample VI (Choko flavoured germinated multi grain drinking powder) was selected for feeding trial. Consumers trial based on organoleptic characteristics were conducted to check acceptability of malted ready mixes and their products (Kumari, 2003).

Hemrabha and Sreelakshmi (2012) had developed an egg protein enriched ready to eat cookies to enhance sports performance. Organoleptic analysis revealed that incorporation of spray dried whole egg at 5 per cent levels in cookies with best overall acceptability scores. Jose and Chandrasekhar (2013) studied the iron enriched biscuits (IEB) was developed and the organoleptic evaluation for the five formulations revealed that the highest score for appearance, texture, colour, flavor and taste was obtained by sample I and the least score was for sample III. IEB sample I got the highest overall acceptability score of 22 out of 25.

Nutrient analysis of food supplements:

Table 1 showed the results of nutrient analysis of food supplements *i.e.* Moisture, Crude Protein (g), Crude Fat (g), Crude Fiber (g), Ash (g), Carbohydrates (g), Energy (kcal), Calcium (mg) and Iron (mg). The 100 gram sample of food supplements were analysed for

moisture content. The highest moisture content was observed 2.75 in choko flavoured germinated multi grain powder and lowest mean 1.66 of choko flavoured germinated finger millet powder. The mean of moisture content in choko flavoured soybean powder and choko flavoured germinated wheat powder was 2.25 and 2.09, respectively. The moisture content of choko flavoured germinated pearl millet powder and choko flavoured germinated green gram dal powder was 2.47 and 1.87. The highest crude protein content 24.14g/100g and 2nd highest 22.18g/100g were found in choko flavoured soybean powder and choko flavoured germinated multi grain powder, while maximum 14.37g/100g crude protein of choko flavoured green gram dal powder. Lowest crude protein was observed in choko flavoured germinated finger millet powder (7.28), choko flavoured germinated wheat powder (7.33) and choko flavoured germinated pearl millet powder (8.13), respectively. Crude fat mean of developed food supplements ranged from 3.45g/100g to 11.0g/100g. First highest crude fat mean 11.0g/100g and 2nd highest 10.77g/100g was found in choko flavoured soybean powder and choko flavoured germinated multi grain powder, whereas maximum 4.57g/100g crude fat was found in choko flavoured germinated wheat powder. The lowest crude fat was found in, choko flavoured germinated green gram dal powder (3.65g/100g), choko flavoured germinated pearl millet powder (3.52g/100g) and choko flavoured germinated finger millet powder

(3.45g/100g), respectively.

The highest 2.93g/100g and 2.01g/100g crude fiber was observed in Choko flavoured germinated multi grain powder and choko flavoured soybean powder. The lowest crude fiber was observed in choko flavoured germinated pearl millet powder (1.21g/100g), choko flavoured germinated finger millet powder (1.11g/100g), choko flavoured germinated wheat powder (1.77g/100g) and choko flavoured germinated green gram dal powder (1.76g/100g), respectively. The obtained ash content of food supplements range start from 1.15g/100g to 2.50g/100. It was highest 2.50g/100g in choko flavoured soybean powder and 2nd highest ash content 1.99g/100g was observed in choko flavoured germinated multi grain powder. Whereas lowest ash content was found in choko flavoured germinated wheat powder (1.66g/100g), choko flavoured germinated green gram dal powder (1.66g/100g), choko flavoured germinated pearl millet powder (1.17g/100g) and choko flavoured germinated finger millet powder (1.15g/100g), respectively.

The highest 92.58g and 87.29g carbohydrate content in per 100g food sample was found in choko flavoured germinated wheat powder and choko flavoured germinated pearl millet powder while the maximum 82.2g/100g and 81.83g/100g carbohydrate contents were found in choko flavoured germinated green gram dal powder and choko flavoured germinated finger millet powder, respectively. Choko flavoured germinated multi grain

Table 1 : Proximate composition of developed food supplements (per 100g dry weight basis)

Food sample	Moisture	Crude Protein(g)	Crude Fat(g)	Crude fiber(g)	Ash(g)	Carbohydrates	Energy (Kcal)	Calcium (mg)	Iron(mg)
CFGWP	2.09±	7.33±	4.57±	1.77±	1.66±	92.58±	440.77	134.44±	5.36±
	0.01	0.01	0.02	0.02	0.01	0.06		11.09	1.05
CFGPMP	2.47±	8.13±	3.52±	1.21±	1.17±	87.29±	413.36	127.55±	6.6±
	0.01	0.01	0.05	0.01	0.015	0.02		14.01	1.12
CFGFMP	1.66±	7.28±	3.45±	1.11±	1.15±	81.83±	387.49	272.01±	7.81±
	0.01	0.01	0.015	0.01	0.01	0.11		10.12	1.35
CFGGGDP	1.87±	14.37±	3.65±	1.76±	1.66±	82.2±	419.13	172.19±	5.64±
	0.02	0.01	0.02	0.02	0.01	0.02		12.01	1.19
CFSP	2.25±	24.14±	11.0±	2.01±	2.50±	61.37±	441.04	267.65±	5.06±
	0.01	0.41	0.05	0.015	0.05	0.05		18.06	1.05
CFGMGP	2.75±	22.18±	10.77±	2.93±	1.99±	76.23±	489.57	288.77±	9.19±
	0.02	0.01	0.01	0.01	0.01	0.049		15.08	1.43

All values are mean of triplicates. Results expressed on dry weight basis

- CFGWP : Choko flavoured germinated wheat powder
- CFGPMP : Choko flavoured germinated pearl millet powder
- CFGFMP : Choko flavoured germinated finger millet
- CFGGGDP: Choko flavoured germinated green gram dal powder
- CFSP : Choko flavoured soybean powder
- CFGMGP : Choko flavoured germinated multi grain powder

powder (76.23g/100g) and choko flavoured soybean powder (61.37g/100g) were the lowest carbohydrate content food supplements.

Table 1 indicated that all developed food supplements were calorie dense food products for a sports person. The highest energy 489.57kcal/100g and 441.04kcal/100g was observed in choko germinated flavoured multi grain powder and choko flavoured soybean powder whereas maximum energy was observed in choko flavoured germinated wheat powder (440.77kcal/100g), choko flavoured germinated green gram dal powder (419.13kcal/100g) and choko flavoured germinated pearl millet (413.36kcal/100g), respectively. Choko flavoured germinated finger millet powder was a lowest (387.49kcal/100g) energy food supplement.

The Table 1 indicates the result about calcium contents of developed food supplements ranged from 127.55mg/100g to 288.77mg/100g. The food samples named Choko flavoured germinated multi grain powder, choko flavoured germinated finger millet powder and choko flavoured soybean powder were found in highest ranged 288.77mg/100g, 272.01mg per 100g and 267.65mg/100g, respectively. The lowest calcium contents were found in choko flavoured germinated pearl millet (127.55mg/100mg), choko flavoured germinated wheat powder (134.44mg/100g) and choko flavoured germinated green gram dal powder (172.19mg/100g), respectively. The iron content of CFGMGP (9.19mg/100g) and CFGFMP (7.81mg/100g) was found highest while the maximum iron content was observed in CFGPMP (6.6mg/100g), CFGGGDP (5.64mg/100g) and CFGWP (5.36mg/100g), respectively. The lowest 5.06mg/100g iron content was found in choko flavoured soybean powder.

After the above discussion about the proximate composition of food supplements, it can be concluded that all food supplements were a good source of energy, protein, carbohydrate, fat and calcium iron, which were the best supplements for every athlete/sports person. Table:1 indicated that choko flavoured germinated multi grain powder was a highly better food supplement out of six for a supplementation study. Sobana (2016) studied that the developed bar contained high calorific value of 400kcal per 100g. It also contains adequate amount of carbohydrates (72.5g), protein (13.7g) and fat (6.19g). The calcium and iron content were 159.5mg and 2.93 mg, respectively.

Conclusion:

Fact finder found the cost ranged of available food supplements from Rs. 70 to Rs. 100 per 100gm/ ml which was unaffordable by many sports persons in India. Therefore there is an urgent need to formulate innovative low cost food supplements to help the players who cannot afford to buy expensive supplements from the market. All from the above results finding that all food supplements were a good source of energy, protein, carbohydrate, fat and calcium iron with low cost whereas the choko flavoured germinated multi grain powder was a highly better Sports Potential Enhancing Food Supplements.

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