Research Article **ISSN: 2349 – 7106**

Asian Journal of Research in Chemistry and Pharmaceutical Sciences

Journal home page: www.ajrcps.com

ACCEPTABILITY STUDIES OF A PROTEIN SUPPLEMENT DEVELOPED FROM PULSES AND CEREALS

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ABSTRACT

Development of new food product is very difficult process because it requires the information of ingredients, methods and techniques, packaging materials, consumer demands and likes and dislikes. Product development is a method of trade research in its own right. It is a combination and application of nature with the food sciences and processing with the marketing and consumer science into one type of integrated research whose aim is the development of new products. Product development is the important part of the food industry; from clarify an establishing product range to developing completely new products. The challenge for product development is to develop a product which is acceptable to the consumer. The acceptability scores for five developed samples were Sample A had the most preferred taste based on the assessment with a rating of 8.75. Sample B was the next preferred having a score of 8.5. Sample E was next in the line with a score of 7.9. Samples C and Sample D were seen to have the least scores in the Taste category by the subjects who tested. The color category was led by Sample A with a rating of 8.8. This was followed by Sample B having an 8.5 rating and Sample E with 8.1. Sample C and D followed respectively with 7.75 and 7.6. Sample A was accepted to be developed best of all.

KEYWORDS

Protein supplement, Protein, Supplement, Pulses and Cereals.

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INTRODUCTON

A protein supplement is a supplement which is obtain from the food products and is used by the people to satisfy their daily protein requirements. Protein supplements are available in the markets in the form of protein powder, protein bars, whey protein, protein shakes etc. Protein is an important nutrient needed regularly by the human body. There is a condition such as malnutrition and under nutrition in children, or occasions such as

pregnancy with certain medical conditions in which body needs high protein.

Cereals and pulses is the essential part of the human diet since the beginning of agriculture. Cereals belongs to grass family and seed of matured plants and contains some elements such as starch, fat, protein, organic minerals salts and vitamins. There are some cereals which grow in many parts of the world such as rice, wheat, corn, barley, oats and millets.

Pulses belongs to the *Fabaceae* family and a variety of pulse crop grown in India and world. Among the crops, the major ones are gram, pigeon pea, lentil, field beans etc. Pulses are mostly taken as Dal, which is a good source of plant protein. These are taken because of its body building properties due to presence of various amino acids. India is one of highest producer of legumes around the world with an average yield of 10-13 million tons annually[1]. Out of numbers of varieties of pulses the most commonly consumed legumes are Bengal gram, red gram, green gram, moth beans, peas, lentil, soya bean and black gram.

The scientific name of Ragi is *Eleusine coracana*, it is also known as Finger Millet, Madua, Nachni, Rollu or Sattemaw. It is a hardy crop which provides high quality nutrition at low price[2]. Ragi is usually converted to flour and variety of preparations like cheela, ladoo, salty porridge. Traditionally it is used as an infant weaning food in south India[3]. Cereals form an important portion of human diet and it is a rich source of and other dietary carbohydrates, which play an important role in the energy requirement and nutrition of the people. The millets with high dietary fiber, good quality protein contribute significantly to nutritional security of a large section of population living in the millet growing areas[4].

Finger millet or Ragi is one of the important crops in India and occupies highest area under cultivation. Numerous health benefits and also it is a good source of protein and micro nutrients. It is important to develop the value added food products based on Ragi, which is able to increase the nutritional value and also helpful for good health is the current need for the wellbeing of the society[5]. Ragi is considered to be a coarse grain as compared to rice because of its fibrous seed coat.

Finger millet is one of the oldest millets in India. In comparison to other cereals and millets, finger millet has the highest amount of calcium and potassium. It also contains high amount of dietary fiber, minerals and sulfur containing amino acids in comparison to white rice, which is the current major staple food in India. Finger millet contains 7.3 gm of proteins, 1.3 gm of fats, 72.0 gm of carbohydrates, 344 mg of calcium, and 283 mg of phosphorus 3.9 mg of iron and 408 mg of potassium per 100 gm of ragi[6].

The scientific name of kidney bean is *Phaseolus vulgaris*. It is one of the most important legumes in India. It is also known as common bean, French bean, red kidney bean, haricot bean, snap bean, navy bean, chilli bean or Rajmah in hindi and are valued for their protein rich (23%) seeds. Kidney bean is also a rich source of vitamin, calcium, phosphorus and iron. It is a very cheapest form of good protein. The fresh pods and leaves are also used as vegetables. These beans are dark red in color and resemble the shape of kidney.

Some researches shown that consumption of kidney beans can reduce the risk of diabetes mellitus, obesity and cancer. Kidney beans have a low glycemic index as they are digested slowly and produce very slow blood glucose and insulin responses. Diabetes patients are suggested to consume at least half cup of kidney beans daily. Kidney beans delay the return of hunger sensations and feeling of satiety beans may be used in the weight loss diet for obese patients. It can be used in the salads also in the boil form. Kidney beans have great antioxidant activity which is found in the phenolic compounds in seed coats of kidney beans[7] (Beninger, 2003). Kidney beans is a good source of folic acid which is important for adult women as low levels of folic acids leads to neural tube defect in child[8].

The scientific name of Bengal gram is *Cicer arietinum*. Bengal gram is an important food crop in India and it ranks next to rice and wheat. Bengal gram is rich in lysine. Bengal gram occupies an important place in supplementation of cereal rich

Indian diets in alleviating protein malnutrition[9]. The Bengal gram is also known as chick pea or chana in India. It is one of the major pulses cultivated and consumed in India. It is one of the oldest, important and rich sources of protein for the people in India.

Pulses are a low cost vegetarian source of protein and chickpea is one of them. Chickpea contains 22.5 gm protein, 5.2 gm fat, 58.1 gm carbohydrates, 58 mg calcium, 340 mg phosphorus and 9.5 mg iron per 100 gm[6]. The per capita consumption of roasted Bengal gram in India varies across the different regions of the country and it is estimated to be around 6 kg per annum on average[10].

The scientific name of almonds is *Prunus dulcis*. It is also known as Badam in Hindi. The almond is a species of tree native to the Middle East, the Indian subcontinent and North Africa. It belongs to family *Rosaceae.* Almonds are available in the market in many forms such as whole, sliced, flaked, silvered and as flour. It also has the oil content properties which can be used in making butter or milk. These products are used in both sweet and savory dishes. Almonds contain 20.8 gm protein, 58.9 gm fat, 10.5 gm carbohydrates, 230 mg calcium, 490 mg phosphorus and 5.09 mg iron per 100 gm[6]. The almond is a nutritionally dense food and it is a rich source of protein, B vitamins riboflavin and niacin, vitamin E, calcium, iron etc. It is also good source of dietary fiber, mono unsaturated fats and poly unsaturated fats, fats which reduces the levels of LDL cholesterol[11].

The scientific name of dates is *Phoenix dactylifera.* It is commonly known as dates or date palm in English or Khajur in Hindi. It is a flowering plant mainly the species of palm and family *Arecaceae*, cultivated for its edible sweet fruit and it is originated from lands of Iraq[12]. Dates fruits are used as staple food in the Middle East for thousands of years and shows medicinal values in various types in preventing diseases. Dates have antioxidant, anti-inflammatory, anti-bacterial activity[13]. Dates contain 2.5 gm of protein, 0.4 gm of fats, 75.8 gm of carbohydrates, 120 mg calcium, 50 mg phosphorus and 7.3 mg of iron in per 100 gm of dates[6]. Dates are rich in dietary fiber, minerals, carbohydrates, vitamins, fatty acids and amino acids. Dry date's powder is generally sweet in nature and commonly used as sweeteners in many drinks, shakes and desserts, it is also used in non-caffeinated coffee with coffee related flavor.

MATERIAL AND METHODS

Raw Materials

Finger millet, Bengal gram whole and kidney beans were purchased from the grocery stores in Gurgaon, Haryana, India. Besides that the whole Bengal gram is the most common food crop of India and it is easily available at almost all the local vendors on roadside or in the fruits and vegetable markets but it was difficult to purchase the whole Bengal gram from the grocery stores because it is not easily available in every grocery stores. The almonds, dates, cardamom and fennel seeds were also purchased from the grocery stores and vendors.

The ingredients were carefully done to make sure that the best quality and appropriate quantity is being purchased. The cereal, pulses, legumes, dry fruits and condiments are easily available in the local area stores.

METHODOLOGY

All the ingredients were made into powdered forms, the variation of the samples was then carried out using Finger Millet (Ragi) as the key variable and all the other ingredients were kept constant in each variation. Five samples were made, which contains different amounts of the dried ingredients.

Variation of Samples

Sample A

Constituted of 70% finger millet, 7.5% kidney beans, 7.5% Bengal gram whole, 7.5% almonds and 7.5% dates. All of these converted into quantities to be; 7 grams of finger millet, 0.75 grams of kidney beans, 0.75 grams of Bengal gram whole, 0.75 grams of almonds and 0.75 grams of dates, which all together made 10 grams of sample.

Sample B

Constituted of 60% finger millet, 10% kidney beans, 10% Bengal gram whole, 10% almonds and 10% dates. All of these converted into quantities to be; 6 grams of finger millet, 1 gram of kidney beans, 1 gram of Bengal gram whole, 1 gram of

almonds and 1 gram of dates, which all together made 10 grams of sample.

Sample C

Constituted of 50% finger millet, 12.5% kidney beans, 12.5% Bengal gram whole, 12.5% almonds and 12.5% dates. All of these converted into quantities to be; 5 grams of finger millet, 1.25 grams of kidney beans, 1.25 grams of Bengal gram whole, 1.25 grams of almonds and 1.25 grams of dates, which all together made 10 grams of sample.

Sample D

Constituted of 40% finger millet, 15% kidney beans, 15% Bengal gram whole, 15% almonds and 15% dates. All of these converted into quantities to be; 4 grams of finger millet, 1.5 grams of kidney beans, 1.5 grams of Bengal gram whole, 1.5 grams of almonds and 1.5 grams of dates, which all together made 10 grams of sample.

Sample E

Constituted of 30% finger millet, 17.5% kidney beans, 17.5% Bengal gram whole, 17.5% almonds and 17.5% dates. All of these converted into quantities to be; 3 grams of finger millet, 1.75 grams of kidney beans, 1.75 grams of Bengal gram whole, 1.75 grams of almonds and 1.75 grams of dates, which all together made 10 grams of sample.

The food supplement composed of finger millet (*Eleusine coracana)*, kidney beans (*Phaseolus vulgaris*), bengal gram whole (*Cicer arietinum*), almond (*Prunus dulcis*) and dates (*Pheonix dactylifera)* in different proportions.

RESULTS AND DISCUSSION

Sensory Evaluation

After the sensory evaluation was being carried out by using hedonic rating test, the results were then analyzed and calculation of mean and standard deviation is being done for each sample separately.

Number of subjects was 20. All subjects are of different age between 18-25 years old. The mean value and standard deviation of all samples made scoring easy and helped in identifying the most accepted sample based on the ratings style employed.

Interpretation of the Sensory Evaluation Scores

Taste

Sample A had the most preferred taste based on the assessment with a rating of 8.75. Sample B was the next preferred having a score of 8.5. Sample E was next in the line with a score of 7.9. Samples C and Sample D were seen to have the least scores in the Taste category by the subjects who tested.

Color

The color category was led by Sample A with a rating of 8.8. This was followed by Sample B having an 8.5 rating and Sample E with 8.1. Sample C and D followed respectively with 7.75 and 7.6.

Texture

The texture category was led by Sample A with a score of 8.7. Sample B with a rating of 8.15 followed by Sample E with 8.05. Sample C and D had the same Texture having a rating of 7.5 each.

Acceptability

Sample A was most acceptable among all the other samples by the subjects based on the high rating score of 8.7 it secured. Sample B was next with a score of 8.3 followed by Sample E with a score of 8.25. Sample C and D had a slight difference with 7.3 and 7.4.

Table No.1: Sample variations in percentage and grams

Samples Variables	Sample A		Sample B		Sample C		Sample D		Sample E	
	%	Grams	%	Grams	%	Grams	%	Grams	%	Grams
Finger Millet	70%	7g	60%	6g	50%	5g	40%	4g	30%	3g
Kidney Beans	7.5%	0.75g	10%	1g	12.5%	1.25g	15%	1.5g	17.5%	1.75g
Bengal gram whole	7.5%	0.75g	10%	1g	12.5%	1.25g	15%	1.5g	17.5%	1.75g
Almonds	7.5%	0.75g	10%	1g	12.5%	1.25g	15%	1.5g	17.5%	1.75g
Dates	7.5%	0.75g	10%	1g	12.5%	1.25g	15%	1.5g	17.5%	1.75g

Table No.2: Sensory evaluation scores of SAMPLE 'A' done based on different parameters

Parameters Subjects	Taste	Color	Texture	Acceptability
Subject 1	10	10	10	10
2	10	10	10	10
3	8	8	8	7
4	7	8	8	8
5	8	8	8	8
6	8	9	9	7
7	9	9	9	9
8	7	7	8	8
9	9	8	8	8
10	10	9	9	10
11	9	9	9	9
12	8	8	8	8
13	10	9	9	9
14	9	9	9	9
15	10	10	10	10
16	10	10	10	10
17	9	9	10	10
18	9	8	8	9
19	7	8	8	8
20	8	8	8	7
MEAN	8.75	8.7	8.8	8.7
STD DEV.	1.069924	0.864505	0.833509	1.080935

Table No.3: Sensory evaluation scores of SAMPLE 'B' done based on different parameters

Parameters Subjects	Taste	Color	Texture	Acceptability
Subject 1	10	10	10	10
2	9	10	9	9
3	8	8	8	8
4	8	7	7	7
5	9	9	8	8
6	5	8	5	5
7	9	9	10	9
8	7	8	7	8
9	8	8	8	8
10	9	9	8	9
11	8	6	5	8
12	9	9	9	8
13	8	8	8	8
14	9	8	9	8
15	9	9	9	9
16	10	10	9	10
17	9	8	9	8
18	8	8	9	8
19	9	9	8	9
20	9	9	8	9
MEAN	8.5	8.5	8.15	8.3
STD DEV.	1.100239	1	1.348488	1.080935

Table No.4: Sensory evaluation scores of SAMPLE 'C' done based on different parameters

Parameters Subjects	Taste	Color	Texture	Acceptability
Subject 1	9	9	10	9
2	8	9	8	8
3	7	7	7	7
4	6	6	7	6
5	7	8	8	8
6	4	4	4	3
7	8	9	8	8
8	8	7	8	8
9	9	9	8	9
10	6	7	6	6
11	6	6	6	6
12	8	8	8	8
13	8	8	8	8
14	8	8	8	8
15	8	8	8	8
16	7	10	7	7
17	6	7	6	6
18	6	8	8	6
19	9	9	9	9
20	9	8	8	8
MEAN	7.35	7.75	7.5	7.3
STD DEV.	1.348488	1.371707	1.277333	1.454575

Table No.5: Sensory evaluation scores of SAMPLE 'D' done based on different parameters

Parameters Subjects	Taste	Color	Texture	Acceptability
Subject 1	9	9	9	9
2	8	8	9	9
3	8	8	8	8
4	5	6	6	5
5	8	8	8	9
6	5	5	5	5
7	8	9	8	8
8	8	8	9	8
9	9	9	9	9
10	7	7	7	6
11	7	7	7	7
12	7	7	7	7
13	9	9	8	9
14	8	7	9	8
15	7	7	7	7
16	6	10	7	7
17	7	6	6	6
18	7	6	6	5
19	9	8	9	8
20	8	8	7	8
MEAN	7.5	7.6	7.55	7.4
STD DEV.	1.192079	1.273206	1.234376	1.391705

Table No.6: Sensory evaluation scores of SAMPLE 'E' done based on different parameters

Parameters Subjects	Taste	Color	Texture	Acceptability
Subject 1	9	9	9	9
2	9	9	9	9
3	9	9	9	9
4	7	8	8	7
5	7	8	8	9
6	8	7	7	8
7	8	8	8	8
8	7	8	9	8
9	8	9	9	9
10	8	8	7	8
11	9	9	9	9
12	7	7	7	7
13	9	9	9	9
14	9	9	8	9
15	6	7	6	7
16	6	6	5	6
17	5	6	6	6
18	8	8	8	9
19	10	9	10	10
20	9	9	10	9
MEAN	7.9	8.1	8.05	8.25
STD DEV.	1.293709	1.020836	1.356272	1.118034

Table No.7: Compiled mean and standard deviation results of the sensory evaluation carried out

Mean±Std Dev. Number of subjects, n= 20. *a= highest value, e=least value.

S.No	Samples Parameters	Sample A	Sample B	Sample C	Sample D	Sample E
1	Taste	8.75 ± 1.06^{a}	8.5 ± 1.10^{b}	7.35 ± 1.34^{e}	7.5 ± 1.19^{d}	7.9 ± 1.29^{c}
2	Color	8.8 ± 0.83^{a}	8.5 ± 1^{b}	7.75 ± 1.37^{d}	7.6 ± 1.27^{e}	8.1 ± 1.02^{c}
3	Texture	8.7 ± 0.86^{a}	8.15 ± 1.34^{b}	7.5 ± 1.27^{d}	7.5 ± 1.23^{e}	8.05 ± 1.35^{c}
4	Acceptability	8.7 ± 1.08^{a}	8.3 ± 1.08^{b}	7.3 ± 1.45^{e}	7.4 ± 1.39^{d}	8.25 ± 1.11^{c}

Figure No.1: Final Developed Supplement Sample

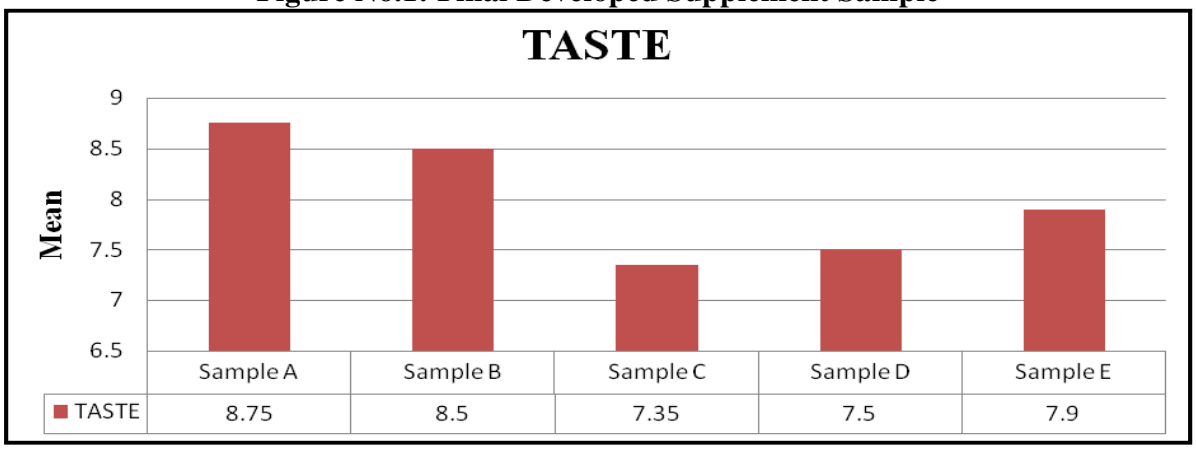

Chart No.1: Showing the mean Taste evaluation of all samples

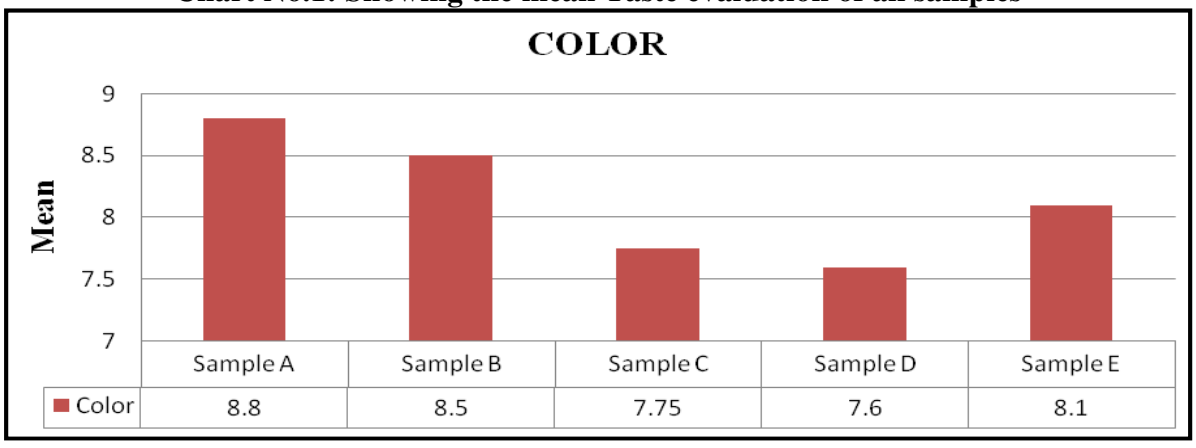

Chart No.2: Showing the mean color evaluation of all samples

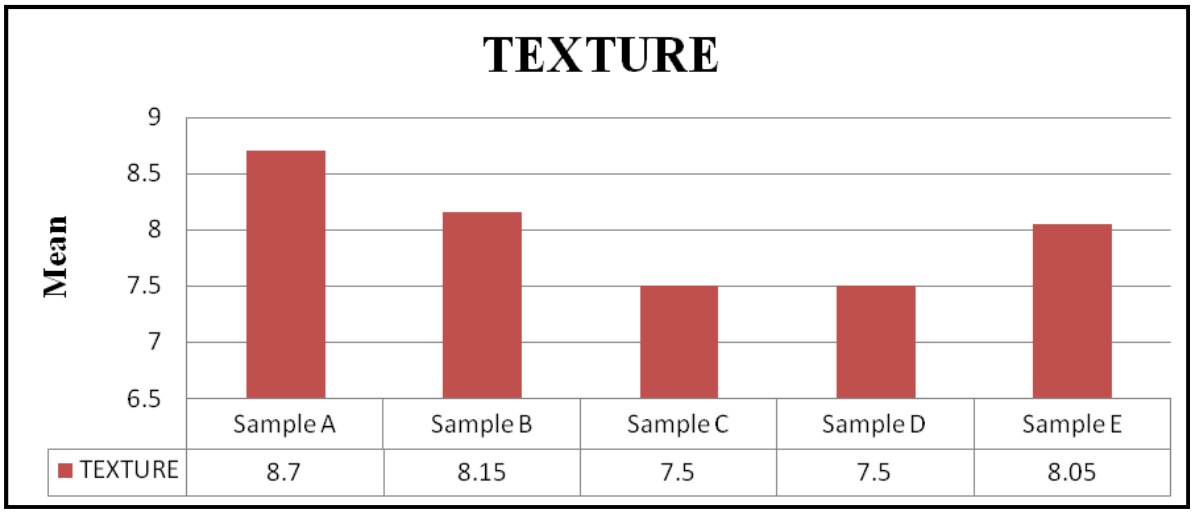

Chart No.3: Showing the mean Texture evaluation of all samples

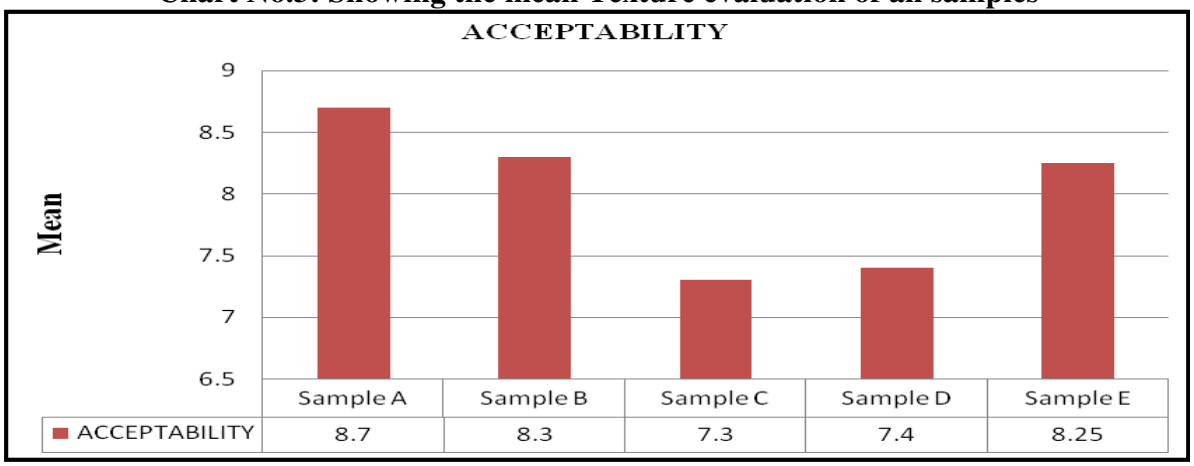

Chart No.4: Showing the mean Acceptability evaluation of all samples

CONCLUSION

In India many people think that protein powder is not safe and that it shouldn't be consumed. Almost 9 out of 10 people have insufficient protein in their diet. Understanding the nutrient to be important as the building block of the body, there are several myths about protein consumption in India. A major feature which distinguishes food product development is the public considerations of producing a large volume of safe foods for human consumption. This is coupled to the fact that food raw materials are liable, unstable and must be stored for prolonged periods of time prior to consumption. The present food supplement development shows the acceptability of protein powder which s made from pulses and cereals.

ACKNOWLEDGEMENT

The author wish to express their sincere gratitude to Department of Dietetics and Applied Nutrition, Amity Medical School, Amity University, Gurgaon, Haryana, India for providing necessary facilities to carry out this research work.

CONFLICT OF INTEREST

We declare that we have no conflict of interest.

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Please cite this article in press as: Sharma Luxita. Acceptability studies of a protein supplement developed from pulses and cereals, *Asian Journal of Research in Chemistry and Pharmaceutical Sciences,* 7(1), 2019, 253-262.