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Preparation of Legume extract blends and Okara from Pinto beans (*Phaselous vulgaris*) and Bovine milk and improvising upon popular recipes using them

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Abstract
Pinto beans were soaked, ground, boiled & filtered for preparation of extract or milk. Pinto beans is a variety of common beans. Scientific name of pinto beans is *Phaselous vulgaris*. Pinto bean is a nutritious legume as it is good source of protein, phosphorus, manganese, dietary fibre and folate. Okara, soy pulp or tofu dregs is a yellow colour pulp comprising of insoluble parts of pinto beans that remain after puree preparation. The objective of the present study was to prepare the legumes extract from pinto beans, to prepare acceptable legume extract - bovine milk blends after making acceptability evaluation study, to prepare curd using acceptable legume extract bovine milk blends and undertake its sensory evaluation, to develop food products using curd and okara obtained by the processing of pinto beans and to undertake acceptability evaluation studies of the products developed. It was assessed in four phases – a. preparation of legume extract, b. preparation of curd, c. product development and d. sensory evaluation. In sensory evaluation tested both the products by panel members using 9 point hedonic scale so which product has more okara that is good in all aspects. The study concluded that the extracts prepared from legumes after appropriate processing steps and their blending with bovine milk could offer an easy way out for a nourishment option with favourable availability and economy and higher nutrition and health care options than those of milk. The illuminating aspects of such foodstuff improvisation are nutritional enrichment and health augmentation, complemented and supplemented through both plant and animal sources. This can also go a long way in providing a direction to cultivation; production and consumption of legumes that are hitherto look down upon as non-conventional food stuffs.

Key words
Pinto beans, value added foods, legumes, bovine milk, popular recipes

Introduction
Legume extract (extract of pinto beans) was prepared after soaking, grinding, boiling and filtering out the beans. It is a emulsion or mixture of water, protein and oil. Its an intermediary product of the tofu manufacturing process. It was originated in East Asia and became popular in Europe and North America in 20th century, especially after the development of many production technologies that gave it a taste and consistency very much similar to dairy milk. It is a good substitute for dairy milk for patients who have lactose intolerance (Wikipedia-soy milk, 2021). It is nutritious and is considered as a cost effective source of protein and energy. The pinto bean protein is very healthy as it contains all the essential amino acids in proportions parallel to those present in bovine milk except sulphur containing amino acids. Pinto bean milk is an excellent source of many vitamins and minerals also like vitamin A, B complex, potassium, calcium, foliate, manganese, phosphorus and chlorine. It's a good source of fibre also. It has been widely recommended as a supplement of bovine milk. It also does not contain cholesterol. The adoption of Legume extract as a substitute for milk, in parts of the world where milk production is low, has been receiving attention as a human nutritional and developmental strategy. Apart from pinto bean extract, extracts of other legumes like cowpea, chickpea, pigeon pea, soybeans, and the like, are also seen as purposeful substitutes to bovine milk (Webmd,

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2021). Scientific name of pinto beans is *Phaselous vulgaris*. This bean has so many different shapes like Plump, oblong, kidney-shaped or ensiform and with different colours like red, pink, white, black, brown, mottled or combination of two colours. It's skin which is very smooth that gives appearance like pinto horse, that is why it is called pinto bean (Arizona, 2021). Pinto beans are not only full of vitamins and minerals but also contains advantage of phytochemicals (Berkheiser, 2019). Soaking pinto beans drastically reduces its cooking time. Unsoaked beans generally take two to three hours to cook. Pressure cooking also reduces cooking time significantly. Cooking time depends on the origin of the bean, hardness of cooking medium and many more factors. Pinto beans are a source of many antioxidants also involving polyphenols and flavonoids (Wikipedia- pinto bean, 2021). Some researchers have been performed on pinto beans (Khavari & Shakarami, 2020; Mirzaei *et al*., 2020; Idoko *et al*., 2020) & bovine milk (Clarke *et al.,* 2019; Zecconi *et al*., 2020) separately, but not much research work has been performed on legume extract – bovine milk blend products. Okara is a yellowish pulp comprising of insoluble parts of the pinto beans remained after being pureed. It is a component of traditional cuisines of Japan, Korea, and China. Since 20th century, it has been a integral part of vegetarian cuisines of Western countries. Commercial use of okara is greatly hampered as it is very much prone to putrefaction due to it high moisture and nutrient content. Nutritive value of Okara shows protein (3.5 to 4.0%), moisture (76 to 80%) and solids (20 to 24%). Dry okara contains fats (8 to 15%), crude fibre (12 to 14.5%) and protein (24%). In the process of okara preparation, pinto bean isoflavones are also left in okara with vitamin B, lecithin, linoleic acid, linolenic acid, phytosterols, tocopherol, and vitamin D. Okra is very good for digestion also after the process of fermentation. Okara is eaten in many countries like Indonesia, China, Japan etc. in the form of red oncom, zha doufu and as an ingredient in vegetarian burger and soysage (Wikipedia – Okara, 2021).

Objectives

- To prepare the legumes extract from pinto beans
- To prepare acceptable legume extract bovine milk blends after making acceptability evaluation study
- To prepare curd using acceptable legume extract bovine milk blends and undertake its sensory evaluation
- To develop food products using curd and Okara obtained by the processing of pinto beans
- To undertake acceptability evaluation studies of the products develop

Research Methodology

The study has been divided into four phases as under:

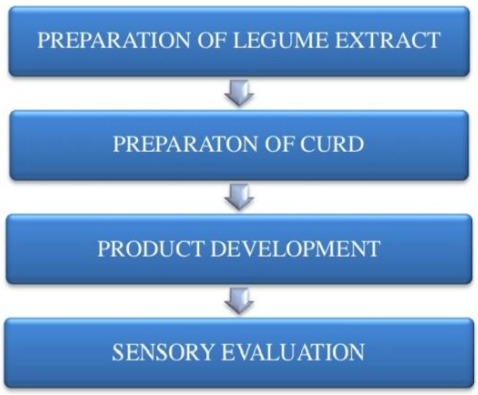

Fig 1: Research Methodology

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1. Preparation of legume extract

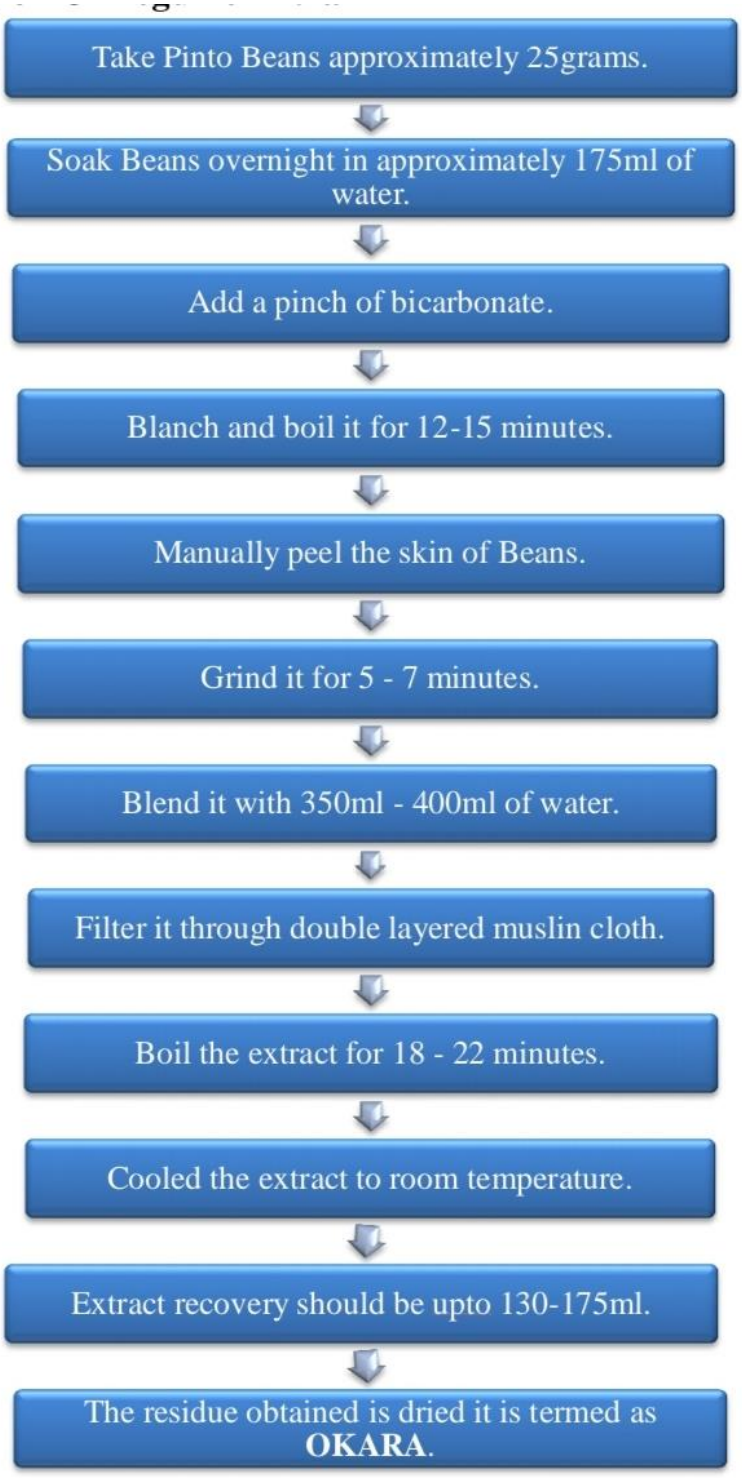

Fig 2: Preparation of legume Extract

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Pic 1: Pinto Beans

Pic 2: Pinto Beans (Without Peel)

Pic 3: Pinto Beans (After Grinding)

Pic 4: Okara

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2. Preparation of curd

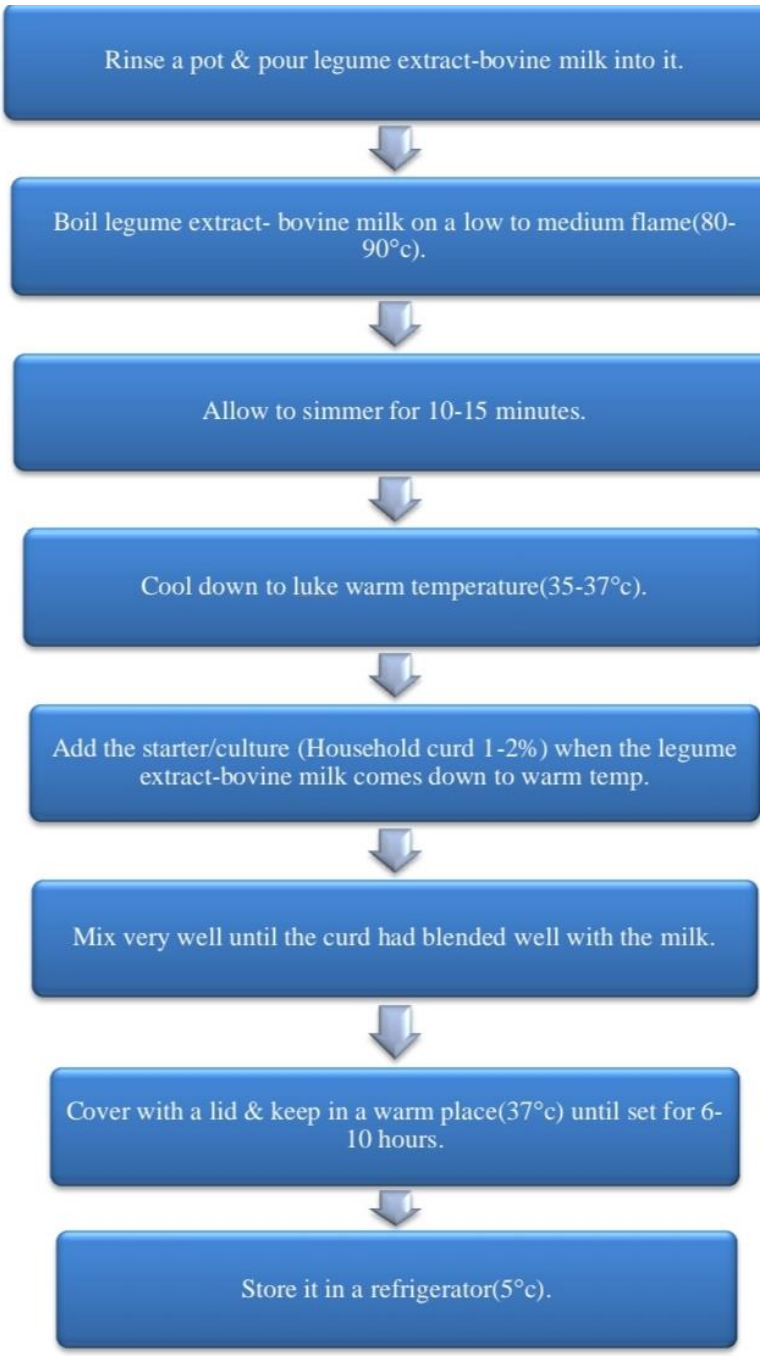

Fig 3: Preparation of Curd

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Pic 5: Legume Extract- Bovine Milk

Pic 6: Curd

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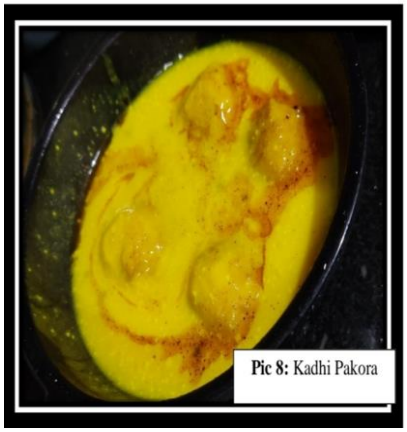
3. Product development

Punjabi Kadhi Pakora: The term Kari was originated from the Tamil language. It is also believed that the yogurt-based Kari was originated from North western India and was a precursor of British curry. It consists of a thick gravy that is made from gram flour and curd (legume extract bovine-milk using in two proportions 70% and 80%) and then made that pakoras using vegetable fritters, gram flour and okara (legume extract used in two proportions 20% and 30%), to used curd (legume extract bovine-milk) was added to develop a sour taste. It was tasted without pakoras with slightly thinner consistency.

Pic 7: Pakoras



Pic 8: Kadhi Pakora

4. Sensory Evaluation

Sensory evaluation is a scientific technique of evaluating a product's appeal to consumers through human senses of sight, smell, taste and touch to analyze product's taste, texture, colour, flavour and overall acceptability. It requires panelists and their responses are recorded in a given format. There are many sensory evaluation tests like triangle test, composite score test, hedonic scale test etc. Hedonic scale test is the majorly used test that is applied to know overall product's acceptability on a 9 point scale ranging from like extremely to dislike extremely as shown below -

Rating scale	Appearance	Taste/ Flavour	Texture/ Consistency	Aroma/ Smell	Overall Acceptability
9 Like extremely					
8 Like very much					
7 Like moderately					
6 Like slightly					
5 Neither like nor dislike					
4 Dislike slightly					
3 Dislike moderately					
2 Dislike very					

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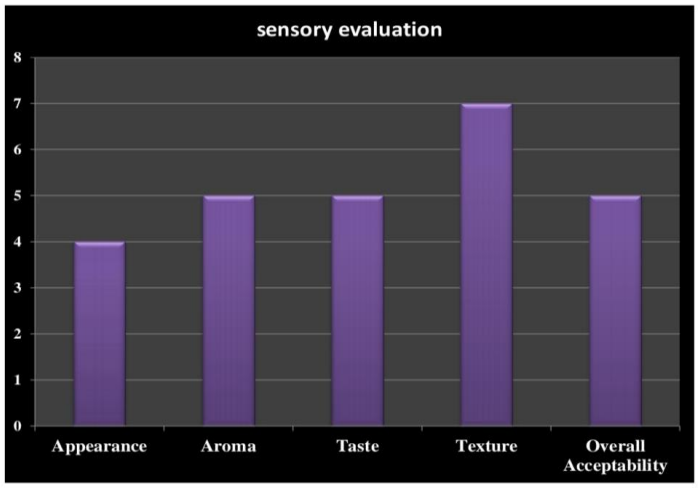

Fig 4: Sensory Evaluation (9 point hedonic) score of PiA.

much					
1 Dislike extremely					

Table1. Sensory Evaluation - 9 point hedonic scale

Criteria for sample selection

Inclusion Criteria

1. People of Punjabi community
2. Willingness to participate in the study

Exclusion Criteria

1. Those who are not having willingness to taste new products
2. Children below 12years because their parents not allowed to taste new products

Duration of the study

The study was conducted over a period of six months in which a period of intervention was of three months.

Results & Discussion

The percentage proportions scheme of legume extracts-bovine milk blends, beginning with a minimum of 20% and extending to a maximum of 30% for legumes (pinto beans) and same as beginning with a minimum of 70% and extending to a maximum of 80% for bovine milk and marked as; PiA & PiB.

Pinto Beans		
Blend Mark	Legume extract	Bovine milk
PiA	20	80
PiB	30	70

Table 2: Percentage Proportion Scheme of Legume Extracts - Bovine Milk Blends

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Nutritive Calculation of PiA

Nutrients	Per Serving
Energy	112.61 Kcal
Carbohydrate	16.63 g
Protein	6.83 g
Fat	1.82 g
Calcium	62.15 g
Iron	1.81 mg
Zinc	0.82 mg

Table 3: Nutritive Calculation of PiA

Nutritive Calculation of PiB

Nutrients	Per Serving
Energy	127.49 Kcal
Carbohydrate	19.07 g
Protein	7.81 g
Fat	1.9 g
Calcium	68.85 g
Iron	2.12 mg
Zinc	0.95 mg

Table 4 : Nutritive Calculation of PiB

According to both the nutritive calculations, protein content is high in PiB because of using more proportion of okara. Bovine milk- legume extract blends have been prepared using pinto beans (*Phaselous vulgaris*) by blending them in appropriate proportions to become acceptable as milk substitutes and their proximate composition determined, tailor making them foodstuffs of better nutritive and health enhancing nature with a lower price tag. As a matter of fact, protein of vegetable origin in legume extracts when combined with animal protein (milk protein) in bovine milk - legume extract blends, acquire quality characteristic to make provision for all essential amino acids in an assured manner. In the same way, the results of nutrient analysis and acceptability studies shed ample light on the various quality aspects of legume extract-bovine milk blends prepared in the study, pointing towards their nourishing and health augmenting potential vice-versa bovine milk.

Sensory evaluation of both the samples

Sensory evaluation of sample 1 - PiA

According to above bar graph they represented that we have taken in this sensory evaluation the proportion of legume extract is 20% as well as the proportion of bovine milk is 80%. In this proportion, our semi trained panellists. They didn‘t like the appearance but they slightly like the aroma and taste and texture of the dish is very good so smooth and about the overall acceptability of the dish is sometimes accepts but as well as sometimes not as we have seen in the above bars of the graph. This was checked through sensory evaluation. Scores for appearance got only 4 and for aroma, taste and overall acceptability

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were obtained 5 only but for texture, 7 marks were given. That is very good score but overall acceptability score was not very good according to the panelists.

Sensory evaluation of sample 2 - PiB

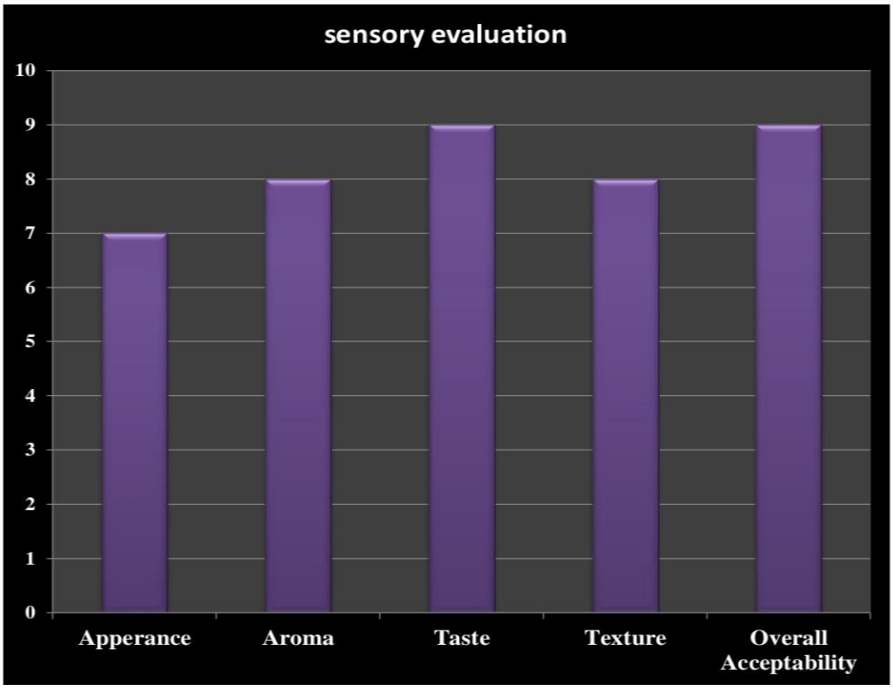

Fig 5: Sensory Evaluation (9 point hedonic) score of PiB

According to above bar graph it was represented that the proportion of legume extract is 30% as well as the proportion of bovine milk is 70%. In this proportion, our semi trained panelist liked the appearance but they more like the aroma, taste and texture of the dish is very good so smooth and about the overall acceptability of the dish is very much likely to the panelist as we have seen in the above bars of the graph. These check through sensory evaluation so scores for appearance got 7. That is very good and for aroma and texture is got 8 very much likely but for taste and overall acceptability is got 9 that is extremely likely score for this product according to the panellist.

Comparison of sensory evaluation of both the samples

It is mentioned in figure 6. As it can be seen in above bar graph the comparison between PiA and PiB so according to this graph in all the aspects PiB is getting scores higher than the PiA so it means that the proportion of 20% and 80% it is not acceptable but the proportion of 30% and 70% it is acceptable in all the aspects like appearance, aroma, taste, texture and overall acceptability. In this proportion members said that there is a big difference in both the products due to the proportions of the bovine milk and legume extracts (okara). So that PiB is good in the all aspects. This is in consonance with the results of Simons, 2018.

Limitations of the study

This intervention could have been implemented for longer period of time.

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Conclusion

Legumes are drought resistant, have high nitrogen fixation ability and help soil conservation, besides being good sources of nutrients and antioxidant phytochemicals. Milk, though seemingly complete food has not been able to fulfil the demand - supply gap due to economic constraints in the developing countries. Besides, environmental cost of raising animals for milk and other food stuff supply is enormously exorbitant in terms of cattle feed requirement and methane emission from their excretory materials. The extracts prepared from legumes after appropriate processing steps and their blending with bovine milk could offer an easy way out for a nourishment option with favourable availability and economy and higher nutrition and health care options than those of milk. The illuminating aspects of such foodstuff improvisation are nutritional enrichment and health augmentation, complemented and supplemented through both plant and animal sources. This can also go a long way in providing a Philip to cultivation; production and consumption of legumes that are hitherto look down upon as non-conventional food stuffs.

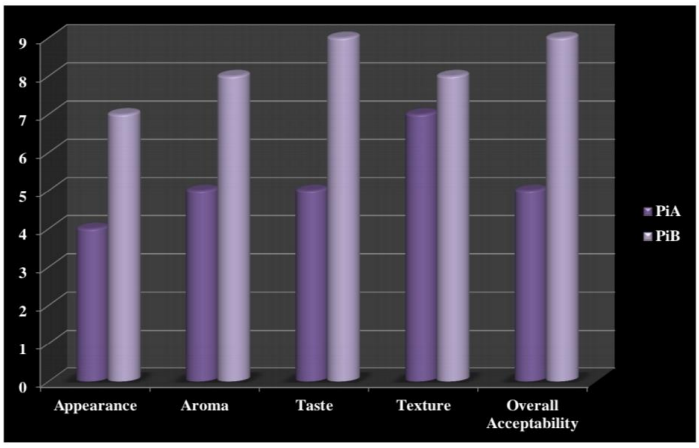

Fig 6: Comparison between PiA and PiB.

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