

## **STUDY ON CHARACTERISTICS OF PROCESSED POONYIGYI FROM HORSE GRAM BEANS**

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### **Abstract**

Poonyigyí is one of the curries in Myanmar meal. Poonyigyí has been produced in Bagan-NyaungU, Salay and Myingyan Environs. Poonyigyí can be produced by fermentation of various cooked beans. Beans were an important source of protein. Horse gram beans are grown mostly in Myingyan, NyaungU, Taungtha and Pakokku townships. The edible seeds are highly nutritious and are used for numerous culinary purposes and some medicinal uses. In the present work, poonyigyis was prepared from horse gram beans by cooking and fermentation. The effect of cooking, fermentation time, amount of salt and volume of water on the nutritional value of prepared poonyigyí such as carbohydrate, protein, fiber and ash contents were determined. Elemental compositions of beans, poonyigyí and beans residue were analyzed by EDXRF. Changes in physico-chemical properties of poonyigyí during storage were also studied. According to the results of chemical analysis, for (100)g of horse gram beans, 6L of water, cooking temperature 100°C for 5 hours (before fermentation), 12 hour fermentation time and 0.2g of salt were suitable for the preparation of poonyigyí. It can also study that prepared and commercial poonyigyí samples are close in organoleptic properties but prepared poonyigyí had higher nutritional value than that of commercial product.

**Keywords:** Poonyigyí, fermentation, horse gram beans, nutritional value

### **Introduction**

Fermentation improved cooking and processing properties and fermented foods are palatable and wholesome. Fermented foods can be enhanced nutritionally with the liberation of nutrients locked in cells grains and seeds. Fermented foods are more nutritious than their unfermented counterparts (Sivasankar 2013). There are many traditional fermented food

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products which are extremely important in meeting the nutritional requirements of a large proportion of the global population. Fermentations can only be optimized when conditions like time, temperature, pH, substrate pretreatment, inoculum-substrate ratio, and so forth, are controlled. The main advantage of natural fermentation processes is that they are fitting to the rural situation (Elaine Marshall et., al 2011).

Poonyigyí is one of the Myanmar traditional fermented foods which is being made from horse-gram beans. It is consumed as a side-dish all over Myanmar. It is reddish brown in colour and quite viscous. Horse gram beans (*Macrotyloma Uniflorum* (Lam.) Verdc ) is known as Pebizat in Myanmar. The preliminary study has been reported that horse gram beans contain large numbers of bioactive molecules such as polyphenols, alkaloids, steroids, saponins and tannins (Kadam 1985).

In the present research, poonyigyí was prepared by fermentation of cooked horse gram beans. The effect of cooking, fermentation time, amount of salt and volume of water on the nutritional value of fermented poonyigyí were also evaluated. Beside this, elemental compositions of beans, poonyigyí and beans residue were analyzed by EDXRF.

## **Materials and Methods**

### **Raw Materials**

Horse gram beans (HGB) were collected from NyaungU Township, Mandalay Region. Sodium bicarbonate and potassium sorbate were purchased from Golden Lady Chemical Sale Centre, Pabedan Township, Yangon Region.

### **Methods**

#### **Investigation of Phytochemicals of Beans**

The horse gram beans were washed with water and dried in an oven at 50°C. The dried beans were made into powder by using grinding machine and separately stored in air-tight container. The characteristics of powdered HGB were studied by chemical and biological investigations. Moreover, alkaloids, carbohydrate, glucoside, phenol,  $\alpha$ -amino acid, saponin, tannin, flavonoid,

steroids, reducing sugar and starch were investigated according to Harborne (1973).

### **Determination of Quality Parameters of Poonyigy**

Physico-chemical properties like moisture, ash and total solid content of beans, poonyigy and beans residue were determined. Nutritional value of beans, poonyigy and beans residue were determined by (AOAC 2000) methods. Elemental composition of beans, poonyigy and beans residue were analyzed by EDXRF. EDXRF analysis was carried out at Universities' Research Center, University of Yangon.

### **Preparation of Poonyigy from Horse Gram Beans**

Firstly, horse gram beans were sifted to remove dirt and undesirable matter. Then, the beans were washed and boiled with water. Sodium bicarbonate was added during boiling to soften the beans. After 5 hours, supernatant liquid was filtered and insoluble residue was left. The latter was mashed to obtain the soluble residue. The resultant liquid was fermented for 6 hours and then cooked at 100°C for 3 hours. During heating, the liquid was stirred until it become paste. After the resultant mass was cooling, poonyigy was obtained. The experiments were also conducted by varying cooking temperature (85°C, 90°C, 95°C and 105°C).

### **Effect of Fermentation Time on the Characteristics of Poonyigy**

The same procedure as described in above experiment was carried out at the various fermentation times of 9hr, 12hr, 15hr, 18hr and 21hr.

### **Effect of Amount of Salt on the Characteristics of Poonyigy**

The effect of amount of salt on the properties of poonyigy was studied.

### **Effect of Volume of Water on the Characteristics of Poonyigy**

Effect of volume of water on the nutritional value of poonyigy was also studied.

## **Results and Discussion**

From Table (1), it can be observed that most of the phytochemicals such as alkaloids, carbohydrate, glucoside, phenol,  $\alpha$ -amino acid, saponin, tannin, flavonoid, steroids, reducing sugar and starch are present in beans. Cyanogenic glycoside present mostly in lima beans. The phytoconstituents of the sample beans indicates that it is a good source of secondary metabolites. So, horse gram beans are rich in phytochemicals, which are vital in health and disease prevention.

The nutritional values of beans and beans residue from poonyigyi process are shown in Table (2). From the results in Table (2), it can be seen that the nutritional value of beans are compatible well with the literature value. According to the phytochemical and nutritional results, beans used in this research were suitable for processing of poonyigyis.

**Table 1: Phytochemicals Investigation of Horse Gram Beans**

No.	Type of compound	Extract	Reagent used	Observation	Results
1.	Alkaloid	1% HCl	Mayer's reagent	White ppt.	+
			Wagner's reagent	Brown ppt.	
			Dragendorff's reagent	Reddish brown ppt.	
			Hager's reagent	Yellow ppt.	
2.	Carbohydrate	H <sub>2</sub> O	10% α-naphthol & H <sub>2</sub> SO <sub>4</sub> (Conc.)	Red ring	+
3.	Glycoside	H <sub>2</sub> O	10% Lead acetate solution	White ppt.	+
4.	Phenol	H <sub>2</sub> O	1% FeCl <sub>3</sub> solution	Black ppt.	+
5.	α-amino acid	H <sub>2</sub> O	Ninhydrin reagent	Pink colour	+
6.	Saponin	H <sub>2</sub> O	--	Stable foam	+
7.	Tannin	H <sub>2</sub> O	1% Gelatin & 10% NaCl solution	ppt.	Trace
8.	Flavonoid	70% EtOH	Mg ribbon & Conc; HCl	Pink colour.	+
9.	Steroid	Petroleum ether	Acetic anhydride & Conc; H <sub>2</sub> SO <sub>4</sub>	Bluish green colour	+
10.	Terpenoid	Petroleum ether	Acetic anhydride & Conc: H <sub>2</sub> SO <sub>4</sub>	Pink colour	+
11.	Reducing sugar	H <sub>2</sub> O	Fehling's solution	Brick red ppt.	+
12.	Starch	H <sub>2</sub> O	Iodine solution	Reddish pink ppt.	+
13.	Cyanogenic glycoside	powder	H <sub>2</sub> O Conc: H <sub>2</sub> SO <sub>4</sub> , sodium picrate paper	No colour change	-

(+) = presence

(-) = absence

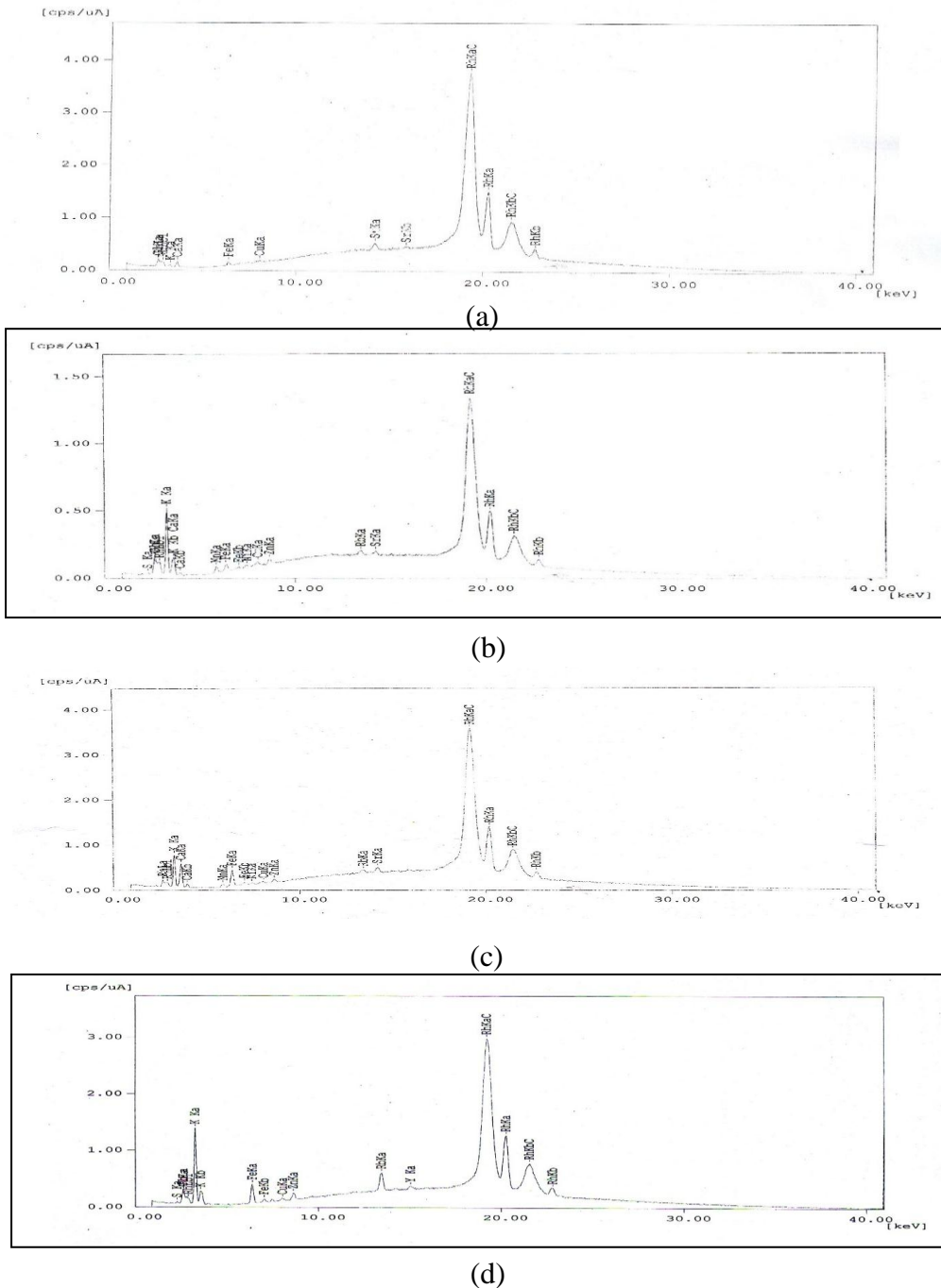
**Table 2:** Nutritional Value of Horse Gram Beans and Residue from Poonyigy Process

Sr. No.	Nutritional Value	Horse Gram Beans		Horse Gram Beans Residue	
		Experimental Value	*Literature Value	Experimental Value	*Literature Value
1	Ash (%w/ w )	3.86	2.24	8.28	15.86
2	Fat (%w/ w )	1.08	0.5	0.7	-
3	Protein (%w/ w )	21.53	22	19.1	11.75
4	Fiber (%w/ w )	6.02	5	6.84	21.55
5	Carbohydrate (%w/ w )	56.95	57.2	55.23	-
6	Energy (Kcal/100g)	352	321	305	-

\* Gopalan C., Rama Sastri B.V. and Balasubramanian S.C., 1991.

EDXRF spectra for elemental composition of beans and beans residue are illustrated in Figures (1 (a) and (b)). Table (3) shows estimated elemental composition of beans and beans residue analyzed by EDXRF. Horse gram beans and its residue had high nutritional values and macro mineral content (Ca, K etc.). Calcium is an essential mineral for healthy bones, gums and teeth. Calcium can also assist in regulating blood pressure which is important in reducing the likelihood of cardiovascular disease. Potassium is essential in building strong bones and muscle and may help prevent bone loss from osteoporosis. Macro-minerals are also good source of animal feed. Therefore, not only horse gram beans but also its residue can be used for food and animal feed.

From Table (4), it can be observed that the cooking temperature 100°C for 5 hours (before fermentation) was suitable for preparation of poonyigy from horse gram beans due to its nutritional value and shelf-life. Cooking temperatures like 85°C for 9 hours and 105°C for 4 hours were not suitable for poonyigy cooking (before fermentation) due to the characteristics of poonyigy such as colour, taste and total solids content.



**Figure 1:** EDXRF Spectrum for Elemental Composition (a) Horse Gram Beans (b) Horse Gram Beans Residue (c) Prepared Poonyigy (d) Commercial Poonyigy (MyinPyan Brand)

**Table 3: Estimated Elemental Composition of Beans, Poonyigis and Beans Residue analysed by EDXRF**

<b>Sr. No.</b>	<b>Element</b>	<b>Horse Gram Beans (%w/ w)</b>	<b>Horse Gram Beans Residue (%w/ w)</b>	<b>Prepared Poonyigyi (%w/ w)</b>	<b>Commercial Poonyigyi (%w/ w)</b>
1	Ca	0.261	0.291	-	-
2	K	0.098	0.039	0.313	0.186
3	Fe	0.002	0.002	0.008	0.004
4	Mn	0.001	-	0.003	0.001
5	Zn	0.001	-	0.002	0.000
6	Sr	0.001	0.001	0.002	-
7	Ni	0.001	-	-	-
8	Rb	0.000	-	0.000	0.000
9	Cu	0.000	0.000	0.000	0.000
10	Cl	-	-	-	0.183
11	S	-	-	0.001	0.028
12	Br	-	-	0.000	-
13	CH	99.635	99.667	99.671	99.598
	<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>



**Table 4: Effect of Cooking Temperature on the Characteristics of Poonyigyí**

Weight of Horse Gram Bean = 100g    Amount of salt = 0.2g  
 Volume of water = 6L    Amount of potassium sorbate = 0.25g  
 Amount of sodium bicarbonate = 0.3g    Fermentation temperature = (30-32°C) for 12hr  
 pH of HGP = 6

Sample	Cooking Temperature (°C)	Cooking Time (before fermentation) (hr.)	Cooking Time (after 12 hr fermentation) (hr.)	Physico-chemical Properties of HGP				Nutritional Value of HGP							
				Weight of HGP (g)	Moisture (%w/w)	Colour	Taste	Total solids content (°Brix)	Shelf-life (week)	Fat (%w/w)	Protein (%w/w)	Fiber (%w/w)	Ash (%w/w)	Carbohydrate (%w/w)	Energy (Kcal/100g)
HGP1	85	9	6	107	26.23	reddish brown	bitter	65	8	0.3	12.95	0.15	9.39	57.52	258
HGP2	90	8.5	5	125	55.35	brown	slightly sweet	45	6	0.38	10.9	0.44	2.48	30.45	168
HGP3	95	8	4	150	54.28	brown	slightly sweet	35	4	0.48	10.15	0.51	2.96	32.12	171
HGP4	100*	5	3	180	52.8	brown	slightly sweet	25	4	0.35	12.6	0.67	2.76	30.82	177
HGP5	105	4	1	100	55.99	dark brown	bitter	5	2	0.39	10.5	0.82	2.59	29.71	164

HGP = Horse gram beans poonyigyí

\*suitable condition

**Table 5: Effect of Fermentation Time on the Characteristics of Poonyigyi**

Weight of Horse Gram Bean = 100g Amount of sodium bicarbonate = 0.3g Cooking temperature = 100°C for 5hr  
 Amount of salt = 0.2g Volume of water = 6L Amount of potassium sorbate = 0.25g  
 Fermentation temperature = (30-32°C)

Sample	Fermentation time (hr.)	pH	Physico-chemical Properties of HGP					Nutritional Value of HGP					
			Moisture (%w/w)	Colour	Taste	Total solids content (Brix)	Shelf-life (week)	Fat (%w/w)	Protein (%w/w)	Fiber (%w/w)	Ash (%w/w)	Carbohydrate (%w/w)	Energy (Kcal/100g)
HGP1	9	6.6	59.5	brown	slightly sweet	30	2	0.23	8.72	0.65	2.03	28.87	154
HGP2	12*	6	52.8	brown	slightly sweet	25	4	0.35	12.6	0.67	2.76	30.82	177
HGP3	15	5.6	56.92	brown	slightly sour	25	4	0.16	13.2	0.31	2.44	26.97	162
HGP4	18	5.4	61.16	reddish brown	sour	25	5	0.12	13.9	0.74	1.93	22.15	145
HGP5	21	5	61.82	reddish brown	very sour	25	7	0.18	14.5	0.94	1.94	20.62	142

HGP = Horse gram beans poonyigyi

Weight of HGP = 180g

Amount of beans residue = 40 g

\* suitable condition

**Table 6: Effect of Amount of Salt on the Characteristics of Poonyigygi**

Weight of Horse gram beans = 100g Amount of sodium bicarbonate = 0.3g Cooking temperature = 100°C for 5hr  
 Volume of water = 6L Amount of potassium sorbate = 0.25g Fermentation temperature=(30-32°C) for 12hr  
 pH of HGP = 6

Sample	Amount of Salt (g)	Physico-chemical Properties of HGP						Nutritional Value of HGP				
		Moisture %w/w	Colour	Taste	Total solids content (°Brix)	Shelf-life (week)	Fat %w/w	Protein %w/w	Fiber %w/w	Ash %w/w	Carbo-hydrate %w/w	Energy (Kcal/100g)
HGP1	-	60.11	brown	bland	25	1	0.12	8.2	0.98	2.1	28.49	145
HGP2	0.1	52.8	brown	bland	25	2	0.24	8.7	0.52	2.37	31.9	166
HGP3	0.2*	60.27	brown	slightly sweet	25	4	0.35	12.6	0.67	2.76	30.82	177
HGP4	0.3	62.35	brown	slightly salty	25	4	0.25	7.6	0.74	2.48	26.58	139
HGP5	0.4	62.65	brown	salty	20	6	0.21	7.4	0.78	2.58	26.38	137

HGP = Horse gram beans poonyigygi HGP yield = 180 g Amount of beans residue = 40 g \*suitable condition

**Table 7: Effect of Volume of Water on the Characteristics of Poonyigyí**

Weight of Horse gram beans = 100g    Amount of salt = 0.2g    Amount of sodium bicarbonate = 0.3g  
 Cooking temperature = 100°C    Amount of potassium sorbate = 0.25g    Fermentation temperature= (30-32°C) for 12hr  
 pH of HGP = 6

Sample	Volume of Water (L)	Cooking Time (before fermentation) (hr)	Cooking Time (after 15hr fermentation) (hr)	Physico-chemical Properties of HGP				Nutritional Value of HGP							
				Weight of HGP (g)	Moisture % <sub>ov/w</sub>	Colour	Taste	Total solids content (°Brix)	Shelf-life (week)	Fat % <sub>ov/w</sub>	Protein % <sub>ov/w</sub>	Fiber % <sub>ov/w</sub>	Ash % <sub>ov/w</sub>	Carbo-hydrate % <sub>ov/w</sub>	Energy (Kcal/100g)
HGP1	2	2	0.5	75	36.82	reddish brown	bitter	20	6	0.25	8.08	0.61	2.6	51.64	241
HGP2	4	2.5	1	125	45.8	brown	slightly sweet	25	5	0.38	8.39	0.72	2.7	42.01	205
HGP3	6*	5	3	180	52.8	brown	slightly sweet	25	4	0.35	12.6	0.67	2.76	30.82	177
HGP4	8	6	3.5	250	59.38	brown	slightly sweet	25	2	0.11	8.76	0.53	3.35	27.87	148
HGP5	10	8.5	4	300	60.87	brown	slightly sweet	25	2	0.29	8.05	0.48	3.58	26.73	142

HGP = Horse gram beans poonyigyí

\*suitable condition

**Table 8: Comparison of Physico-chemical Properties and Nutritional Values of Prepared and Commercial Poonyigy Samples**

Weight of horse gram beans = 100g    Volume of water = 6L    Amount of salt = 0.2g  
 Date of sample preparation = 1.5.2018    Amount of potassium sorbate = 0.25g    Amount of sodium bicarbonate = .2g  
 Date of commercial product preparation = 3.5.2018    Cooking temperature before fermentation = 100°C for 5hr  
 Cooking temperature after fermentation = 100°C for 3hr    Fermentation temperature= (30-32°C) for 12hr  
 pH of HGP = 6    Poonyigy storage temperature = 30-32°C

Sample	Physico-chemical Properties					Nutritional Values				
	Moisture (%w/w)	Colour	Taste	Shelf-life (months)	Fat %w/w	Protein %w/w	Fiber %w/w	Ash %w/w	Carbo-hydrate %w/w	Energy (Kcal/100g)
HGP	53.15±0.92	brown	slightly sweet	4	0.3±0.11	12.9 ± 0.42	0.62 ± 0.06	2.49 ± 0.21	28.00 ± 1.72	166 ± 5.38
*Myin Pyan Brand	56.87	brown	slightly sweet	2	0.06	10.05	0.78	3.58	28.66	155

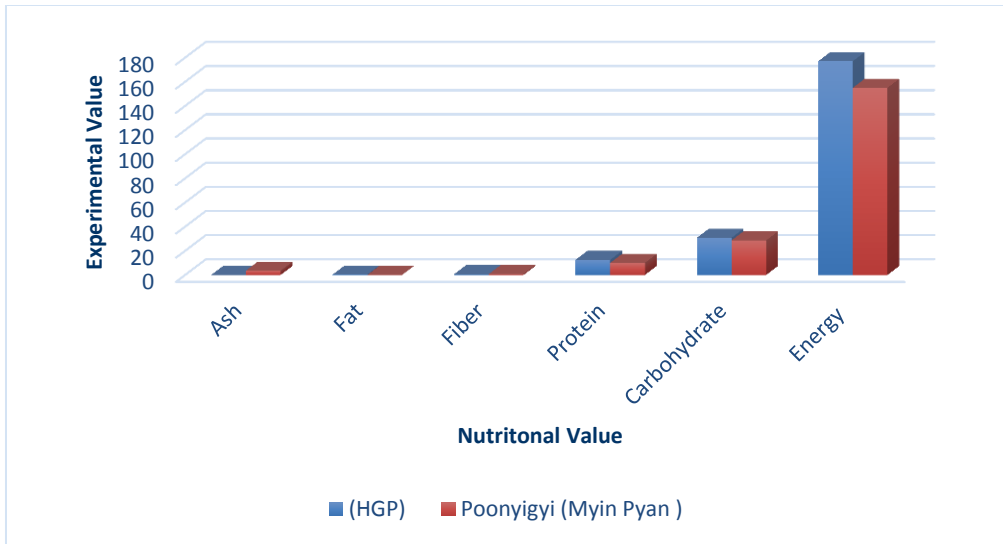
HGP = horse gram beans poonyigy    \*Purchased from Nyaung Oo Township, Mandalay Region.

According to the results in Table (5), 12 hours was the most suitable fermentation time for poonyigyi process due to the highest protein content and energy value of the product. It can also be observed that the product with 21 hours fermentation time had the longest shelf-life (7 weeks) but had a sour taste.

From Table (6), it can be seen that the product with 0.2g of salt had the highest protein and energy value among the other samples. The products with 0.1g and 0.4g of salt had bland and salty tastes. From the results in Table (7), it can be observed that the volume of water also affected the characteristics and nutritional value of poonyigyi. Water 6 liters was suitable for 100g of horse gram beans to prepare poonyigyi.

Elemental compositions of prepared poonyigyi and commercial product were analyzed by EDXRF and the results are mentioned in Figures (1 (c) and (d)) and Table (3). It can be observed that both types of poonyigyi contain high potassium content and only HGP had strontium which is good for bone health. According to the results in Table (8), prepared poonyigyi was more nutritious than the commercial product. It was also observed that the prepared and commercial poonyigyis possessed the same texture, taste and colour.

Although traditional and processed poonyigyis had the same preparation method, the quality of poonyigyi could be affected by different process parameters such as amount of cooking, fermentation period, amount of salt and volume of water.



**Figure 2:** Comparison of Nutritional Value of Prepared and Commercial Poonyigyi

### Conclusion

To improve the quality of poonyigyi, the right proportion of constituents like salt, water, sodium bicarbonate and potassium sorbate have to be used. Cooking time 100°C for 5 hours (before fermentation) and 12 hours fermentation time was the most suitable parameters for poonyigyi process due to the nutritional value of product. Horse gram beans residue had high nutritional values and macro mineral content (Ca, K etc.). Macro-minerals are also good source of animal feed. Therefore, not only horse gram beans but also its residue can be used for food and animal feed. From this study, it can be concluded that prepared and commercial poonyigyi samples had close in physico-chemical properties but prepared poonyigyi was more nutritious than the commercial product.

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