

## Comparative Study on the Characteristics of Traditionally and Enzymatically Fermented Poonyigyí from Horse Gram Beans

Moe Moe Aye<sup>1</sup>, Nwe Nwe Aung<sup>2</sup>, Khin Thet Ni<sup>3</sup>

### Abstract

Poonyigyí is one of the curries in Myanmar meal. Poonyigyí can be produced by fermentation of various cooked beans. In many developing countries, village-art methods and age-old techniques are still used for food processing. The art of traditional processes needs to be transformed into a technology to incorporate objective methods of process control and optimization in order to standardize quality of the end products without losing their desirable attributes. In the present work, poonyigyí was prepared from horse gram beans by different types of fermentation. In the preparation of enzymatically fermented poonyigyí (EHGP), effects of fermentation period, amount of salt and amount of  $\alpha$ -amylases enzyme on the characteristics of poonyigyí were studied. Elemental compositions of different types of poonyigyí were analyzed by EDXRF. Yeasts and moulds contamination in these products during storage time was determined. According to the physical and chemical analyses results, EHGP had significant protein and ash content than the traditional fermented poonyigyí and thus EHGP enhanced more health benefits. It can also be observed that EHGP had high potassium content and longer shelf-life than the other.

Key words: poonyigyí, fermentation, nutritional value

### Introduction

There are many traditional fermented food 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 (Elaine Marshall et., al 2011).

Food processing through the use of biological agents is historically a well-established approach. Not only microorganisms but also enzymes play an important role in the manufacture of traditional fermentation processes.  $\alpha$ -amylase is a protein enzyme that hydrolyses alpha bonds of large, alpha-linked polysaccharides, such as starch and glycogen, yielding glucose and maltose (Kadziola, 1998). Poonyigyí is one of the Myanmar traditional fermented foods which is being made from horse-gram beans.

<sup>1</sup> Assistant Lecturer, Dr., Department of Industrial Chemistry, Dagon University

<sup>2</sup> Professor, Dr., Department of Industrial Chemistry, Yadanabon University

<sup>3</sup> Professor and Head (Retired), Dr., Department of Industrial Chemistry, University of Yangon

This research work concerned with the quality improvement of traditional fermented beans paste (poonyigyí) from horse gram beans. The beans were abundantly obtained in the dry zone of central Myanmar and were collected from NyaungU Township, Mandalay Region. Poonyigyí was prepared from horse gram beans by natural and enzymatic fermentation.

In the preparation of enzymatically fermented poonyigyí, effects of fermentation period, amount of salt and amount of  $\alpha$ -amylases on the characteristics of poonyigyí were carried out. Properties of these products like moisture, ash and total solids content were studied. The nutritional facts of processed poonyigyí such as energy value, protein, fat and

fiber content were also determined by AOAC (2002) methods. Moreover, elemental compositions of poonyigyí were analyzed by EDXRF Spectrometry. Besides this, organoleptic properties of both types of poonyigyí were studied.

## **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.  $\alpha$ -amylases was purchased from MY Associates Co., LTD, Myaynigone, Sanchaung Township.

## **Methods**

### **Preparation of Enzymatically Fermented Poonyigyí 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. 0.3% of sodium bicarbonate was added during boiling to soften the beans. After boiling for 5 hours, supernatant liquid was filtered. The residue was kneaded to obtain the beans residue. The resultant slurry was fermented with 0.03 % of  $\alpha$ -amylases for 12 hours and then heated at 100°C for 3 hours. 0.2% of salt and 0.04% of potassium sorbate were added during heating. The slurry was stirred until it become a paste. After the paste was cooled, poonyigyí was obtained. The experiments were also conducted by varying amount of  $\alpha$ -amylases (0.01%, 0.02%, 0.04% and 0.05%). The results are shown in Table (1).

### **Preparation of Enzymatically Fermented Poonyigyí from Horse Gram Beans by using Different Fermentation Time**

The same procedure as described in above experiment was carried out at the various fermentation times of 9hr, 12hr, 15hr, 18hr and 21hr. The results are shown in Table (2).

### **Preparation of Enzymatically Fermented Poonyigyí from Horse Gram Beans by using Different Amounts of Sodium Chloride**

The same procedure as described in Section 3.3.1 was carried out by using the various amounts of salt (0.1%, 0.2%, 0.3%, 0.4% and 0.5%). The results are shown in Table (3).

## **Results and Discussion**

According to Table (1), 0.03% of  $\alpha$ -amylase was suitable for the preparation of horse gram beans poonyigyí due to its nutritional value and physico-chemical properties. When the amount of enzyme were increased ( $>0.03\%$ ), the poonyigyí had sweet taste and black colour. The effect of fermentation time on the nutritional values of enzymatically fermented poonyigyí from horse gram beans (EHGP) are shown in Table (2), fermentation time (12hr) was the most suitable for poonyigyí from horse gram bean due to its highest protein content. From the results in Table (2), the product with 21hr fermentation time had the longest shelf-life (14 weeks) but had a sour taste.

From Table (3), the product with 0.1% of sodium chloride had the highest protein and energy value among other samples but its taste was bland. According to the Table (3), 0.2% sodium chloride was suitable for the preparation of horse gram beans poonyigyi by using enzymatic fermentation because of its protein content. Table (4) shows that the comparison of physico-chemical and nutritional values of HGP and EHGP. According to these results, EHGP had significant protein content and ash value than the HGP and thus EHGP enhanced more health benefits. Elemental compositions of HGP and EHGP analysed by EDXRF Spectrometry are mentioned in Table (5). It can be observed that EHGP had high potassium content than the other.

Organoleptic properties of poonyigyi are shown in Table (6). It was observed that the HGP, EHGP and commercial poonyigyi possessed the same texture and taste but EHGP had the black colour. From sensory test, it can be seen that the score of the products was greater than 7. Thus the products had good quality and fit for consumption.

Table(1) Effect of Amount of  $\alpha$ -amylase on the Characteristics of Enzymatically Fermented Poonyigyí from Horse Gram Beans

Weight of Horse Gram Bean = 100g    Amount of sodium chloride = 0.2%    Fermentation temperature= (28-32°C) for 12hr

Amount of potassium sorbate = 0.04%    Volume of water = 6L    Amount of sodium bicarbonate = 0.3%    Initial pH of beans slurry = 7.1

pH of EHGP = 6.6

Sample	Amount of $\alpha$ -amylase (%)	**Physico-chemical Properties					***Nutritional Value					
		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)
EHGP1	0.01	56.8	dark brown	slightly sweet	25	8	0.42	18.24	1.35	9.86	13.33	130
EHGP2	0.02	55.8	dark brown	slightly sweet	30	10	0.86	18.77	1.88	8.62	14.15	139
EHGP3	0.03*	53.85	dark brown	slightly sweet	30	12	1.28	20.06	2.51	8.11	14.19	149
EHGP4	0.04	53. 59	black	sweet	35	14	1.49	15.44	2.77	7.43	19.28	152
EHGP5	0.05	52.62	black	sweet	35	14	1.74	14.1	2.91	7.21	21.42	158

EHGP=Enzymatically fermented horse gram beans poonyigyí    Weight of EHGP = 180 g    #Paula Monteiro (2010)    \* suitable condition

\*\*The parameters were determined at the Department of Industrial Chemistry, University of Yangon.

\*\*\* The experiments were determined at the Small Scale Industries Department, North Okkalapa Township, Yangon Region.

Table (2) Effect of Fermentation Time on the Characteristics of Enzymatically Fermented Poonyigy from Horse Gram Beans

Weight of Horse Gram Bean = 100g      Amount of  $\alpha$ -amylase = 0.03%

Volume of water = 6L

Amount of potassium sorbate = 0.04%      Amount of sodium chloride = 0.2%

Cooking temperature = 100°C

Amount of sodium bicarbonate = 0.3%

Fermentation temperature= (28-32°C)

Initial pH of beans slurry = 7.1

Sample	Fermentation time (hr.)	pH of beans slurry	**Physico-chemical Properties					***Nutritional Value					
			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)
EHGP1	9	7.1	52.25	dark brown	slightly sweet	30	4	1.86	17.81	1.82	8.64	17.62	158
EHGP2	12*	6.6	53.85	dark brown	slightly sweet	30	12	1.28	20.06	2.51	8.11	14.19	149
EHGP3	15	6	54.08	dark brown	slightly sweet	30	12	1.05	18.77	3.14	7.67	15.29	148
EHGP4	18	5.7	52.72	brown	slightly sweet	30	14	0.47	17.54	3.47	7.43	16.37	140
EHGP5	21	5	51.62	brown	sour	25	14	0.35	16.01	3.93	7.06	16.99	135

EHGP =Enzymatically fermented horse gram bean poonyigy      Weight of EHGP = 180 g      Amount of beans residue = 40 g      \*suitable condition

\*\*The parameters were determined at the Department of Industrial Chemistry, University of Yangon.

\*\*\* The experiments were determined at the Small Scale Industries Department, North Okkalapa Township, Yangon Region.

Table (3) Effect of Amount of Sodium Chloride on the Characteristics of Enzymatically Fermented Poonyigyi from Horse Gram Beans

Sample	Amount of Sodium Chloride (%)	Physico-chemical Properties					Nutritional Value					
		Moisture (% w/w)	Colour	Taste	Total solid content (Brix)	Shelf-life (week)	Fat (% w/w )	Protein (% w/w)	Fiber (% w/w )	Ash (% w/w)	Carbo-hydrate (% w/w)	Energy (Kcal/ 100g)
EHGP1	0.1	52.88	dark brown	bland	30	8	1.74	20.55	1.82	7.86	15.15	158
EHGP2	0.2*	53.85	dark brown	slightly sweet	30	12	1.28	20.06	2.51	8.11	14.19	149
EHGP3	0.3	55.09	dark brown	slightly sweet	30	12	0.38	18.41	2.64	8.57	14.91	137
EHGP4	0.4	55.98	dark brown	slightly salty	30	13	0.27	15.75	2.83	9.78	15.39	127
EHGP5	0.5	56.42	dark brown	salty	25	15	0.04	14.16	3.14	10.01	16.23	122

\*suitable condition

Table (4) Comparison of Characteristics of Natural and Enzymatically Fermented Poonyigyi from Horse Gram Beans

Sample	Physico-chemical Properties				Nutritional Values					
	Moisture (% w/w)	Colour	Taste	Shelf-life (weeks)	Fat (% w/w )	Protein (% w/w)	Fiber (% w/w )	Ash (% w/w)	Carbohydrate (% 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
EHGP	53.84±0.35	dark brown	slightly sweet	12	1.06 ± 0.29	20.13 ± 0.52	2.66 ± 0.23	8.48 ± 0.48	13.82 ± 0.56	146 ± 4.12

Table (5) Comparison of Elemental Composition of Natural and Enzymatically Fermented Poonyigyi from Horse Gram Beans

Analysis method = EDXRF

Sr. No.	Element	Horse Gram Beans Poonyigyi (% w/ w)	Enzymatically Fermented Horse Gram Beans Poonyigyi (% w/ w)
1	K	0.201	0.223
2	Cl	-	-
3	S	0.005	-
4	Fe	0.002	0.001
5.	Mn	0.001	-
6.	Ni	0.001	-
7.	Cu	0.001	-
8.	Zn	0.000	-
9.	Rb	0.000	0.001
10.	Br	0.000	-
11.	Sr	0.000	-
12.	CH	97.938	99.971
	Total	100	100

Table (6) Organoleptic Properties of Natural and Enzymatically Fermented Poonyigyi Assessed by 9-point Hedonic Scale Rating Test

Poonyigyi	Texture	Flavour	Appearance	*Overall acceptability
Horse gram beans poonyigyi (HGP)	7.7	8.2	8.4	8.1
Enzymatically fermented horse gram beans poonyigyi (EHGP)	7.5	7.6	8.1	7.7

A total of 15 people participated in the Sensory Evaluation; 10 were female, ranging from the age 19 to 35 years old.

\* Score above 7 indicated the good quality product.

## Conclusion

The effect of amount of  $\alpha$ -amylase, fermentation time and amount of sodium chloride on the nutritional value of enzymatically fermented poonyigyi (EHGP) were studied. 0.03% of  $\alpha$ -amylases, 0.2% of sodium chloride and pH 6.6 were suitable parameters for preparation of EHGP. From this study, it can be concluded that naturally and enzymatically fermented poonyigyi had close in physico-chemical properties but EHGP poonyigyi was more nutritious and longer shelf-life than the natural one.

## Acknowledgements

I would like to thank Professor and Head Dr. Khin Hla Mon, Department of Industrial Chemistry, Dagon University, for giving me permission to present this research paper at 3rd Myanmar-Korea Conference on Useful Plants. I would also like to express my gratitude to Professor and Head Dr. Myat Myat Moe, Department of Botany, Dagon University, for allowing me to submit this article.

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