

## **Development, Microbial Analysis and Storage Studies Of Vegan Muffins By Incorporating Lotus Seed**

**Vishali A<sup>1</sup>, Renu Agarwal<sup>2</sup>**

**<sup>1</sup>PG Student, Department Of Home Science – M Sc. - Foods Science Nutrition And Dietetics, Shrimathi DevkunvarNanalal Bhatt Vaishnav College For Women, Chromepet, Chennai – 44**

**<sup>2</sup>Assistant Professor, Department Of Home Science – Foods Science Nutrition And Dietetics, ShrimathiDevkunvarNanalal Bhatt Vaishnav College For Women,Chromepet, Chennai – 44**  
**[vishvish.A2218@gmail.com](mailto:vishvish.A2218@gmail.com), [Goldie\\_agarwal2002@yahoo.com](mailto:Goldie_agarwal2002@yahoo.com)**

### **ABSTRACT**

*This present research study aids vegan people in compensating their taste which is proven to be a nutrient-dense product. The major aim of this study is to formulate and evaluate the organoleptic characteristics, microbial analysis and the storage studies on the impact of vegan muffins incorporated by Lotus seed. The highly acceptable sample and control group were evaluated for total bacterial count and total yeast and mould count on 0<sup>th</sup>, 3<sup>rd</sup> and 5<sup>th</sup> day. Low microbial activity was seen when compared to other research studies. Different packaging materials such as Polypropylene, Aluminium, Paperboard and LDPE pouch packaging was used for the storage study. The incorporation of lotus seed flour in the muffins helps to improve the storage life when compared to the other muffins. among all packaging, Aluminium packaging shows the greater result. As the conclusion, Lotus seed incorporated vegan muffins provides scrumptious taste and safe for consumption.*

*Key words : muffins, lotus seeds, nutritional property, formulation*

### **INTRODUCTION**

Muffins are highly acknowledged by the consumer due to their soft texture and the distinctive taste. Muffins comes under the category of sweet and savoury bread. It lacks frosting when compared to the cupcakes(Ureta, M. M et.al,2014). Generally, muffins are made using ingredients such as egg, whole milk, refined wheat flour etc. In this study, vegan muffins are formulated. A vegan diet is the avoidance of animal foods and the inclusion of plant-derived foods. In this research, soymilk has been used as an alternate for whole milk and egg is avoided. The health advantages of the vegan diet have been increased recently. So, this research helps to analyse and to promote the seeds of *Nelumbo nucifera* as a food product and to promote the vegan diet meal by developing vegan muffins.

Lotus seed is high in carbohydrates, proteins, and fats, as well as micronutrients such as phosphorus, calcium, vitamin C, and iron in significant amounts. Lotus seed also includes alkaloids and biologically active ingredients such as rutin and flavonoids. The lotus seed has a high protein content and



is rich in a mixture of semi-essential, essential and non-essential amino acids.

Polysaccharides, oligosaccharides, and starch were the main carbohydrates contained in lotus seeds. Vitamin B1, Vitamin B2, Vitamin C, Vitamin E, and Vitamin B6 were the most abundant vitamins in the lotus seed, all of which contribute to good physiological function. Potassium, phosphorus, and magnesium were abundant in Lotus seeds(Zhang, Y.et.al ,2015)

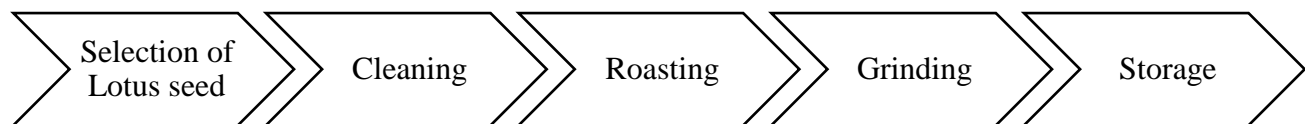
## **OBJECTIVES**

- To formulate the Vegan muffins incorporated with *Nelumbo nucifera* (Lotus) seeds flour with wheat flour and soymilk in different proportions.
- To evaluate the organoleptic characteristics of the muffins.
- To analyse the microbial growth and the shelf-life storage study of the developed products.

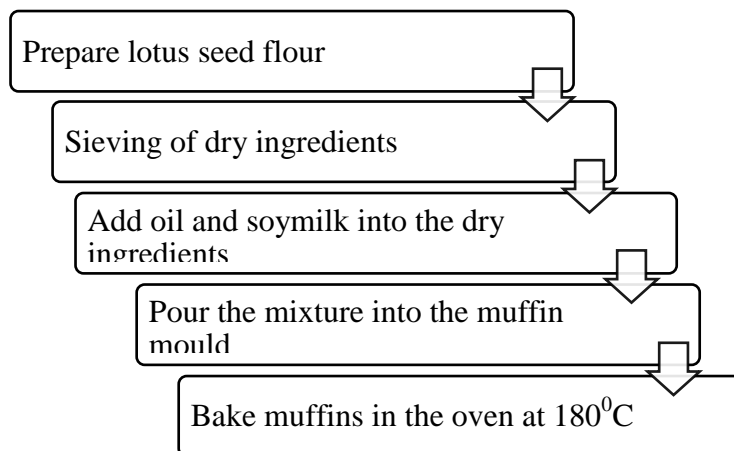
## **MATERIALS AND METHODS**

### **DEVELOPMENT OF VEGAN MUFFINS**

Control group muffins were made with 100% of wheat flour without the inclusion of Lotus seed flour. Five different proportions of wheat flour and lotus seed flour (90:10, 80:20, 70:30, 60:40 and 50:50) were developed and standardised. Soymilk (150ml) was added as an alternative to cow's milk. Palm sugar(75g), oil (20g), Baking powder (2.5g), salt and vanilla essence were added as an essential ingredient. The below flow chart explains the pre-preparation of lotus seed flour and the preparation of vegan muffins.



**Figure 1.1 Pre-preparation of Lotus seed flour**



**Figure 1.2 Preparation of vegan muffins**

**ORGANOLEPTIC EVALUATION:** Five different proportions of sample and control group were evaluated for organoleptic characteristics by 25 untrained panellists. The muffins were evaluated by its appearance, colour, texture, taste, flavour and overall acceptability. The organoleptic evaluation of the vegan muffins was recorded by 9-point hedonic scale. Each 6 different muffins were tested and the mean scores were evaluated. The higher acceptable group along with the control group is processed for further analysis.

**MICROBIAL ANALYSIS:** The highly acceptable sample and control group were analysed for total bacterial count, yeast and mould count during 0<sup>th</sup>, 3<sup>rd</sup> and 5<sup>th</sup> day. The methods used for yeast and mould count and total bacterial count is AOAC., 2000 method.

**STORAGE STUDIES:** The shelf life of the muffins was determined by microbial growth. The muffins (control and sample 2) were kept in a refrigerator and at room temperature to study their quality during the storage period (0<sup>th</sup> day, 3<sup>rd</sup> day and 5<sup>th</sup> day). The muffins were stored in different packaging materials to investigate the visible growth of microbes. The different packaging materials includes Aluminium box packaging, Polypropylene packaging, LDPE pouch packaging and paperboard packaging.

## RESULTS AND DISCUSSION

**ORGANOLEPTIC EVALAUTION:** Six different proportions of muffins were prepared and evaluated by 9-Point Hedonic scale. Wheat flour is used as a control group whereas a mixture of wheat flour and lotus seed flour was prepared in different proportions. The incorporation of lotus seed flour at the different proportions in the test sample includes 10%, 20%, 30%, 40% and 50% respectively. The mean scores of the organoleptic evaluation were presented in the below table.

**Table:1.1 MEAN ACCEPTABILITY AND STANDARD DEVIATION SCORES OF MUFFINS**

	Appearance	Colour	Taste	Texture	Flavour	Overall acceptability
<b>Control</b>	7.58±0.50	7.23±0.44	7.73±0.44	7.48±0.51	7.48±0.51	7.28±0.47
<b>S1</b>	7.09±0.30	7.08±0.44	7.27±0.57	7.12±0.58	7.23±0.44	7.28±0.47
<b>S2</b>	<b>8.23±0.55</b>	<b>8.28±0.47</b>	<b>8.48±0.47</b>	<b>8.04±0.22</b>	<b>8.33±0.58</b>	<b>8.53±0.51</b>
<b>S3</b>	7.33±0.48	7.23±0.44	7.23±0.44	7.08±0.44	7.01±0.68	7.17±0.61
<b>S4</b>	7.04±0.22	7.07±0.55	7.07±0.51	7.03±0.51	7.0±0	7.04±0.22
<b>S5</b>	7.04±0.22	7.09±0.30	7.09±0.30	7.09±0.30	7.13±0.48	7.33±0.48

NOTE: Mean ± Standard deviation

Inference: 9- Extremely good; 8- very good; 7- Good;

Control – 100% of wheat flour

Sample 1- 90% of wheat flour and 10% of lotus seed flour

Sample 2 – 80% of wheat flour and 20% of lotus seed flour

Sample 3 – 70% of wheat flour and 30% of lotus seed flour

Sample 4 – 60% of wheat flour and 40% of lotus seed flour

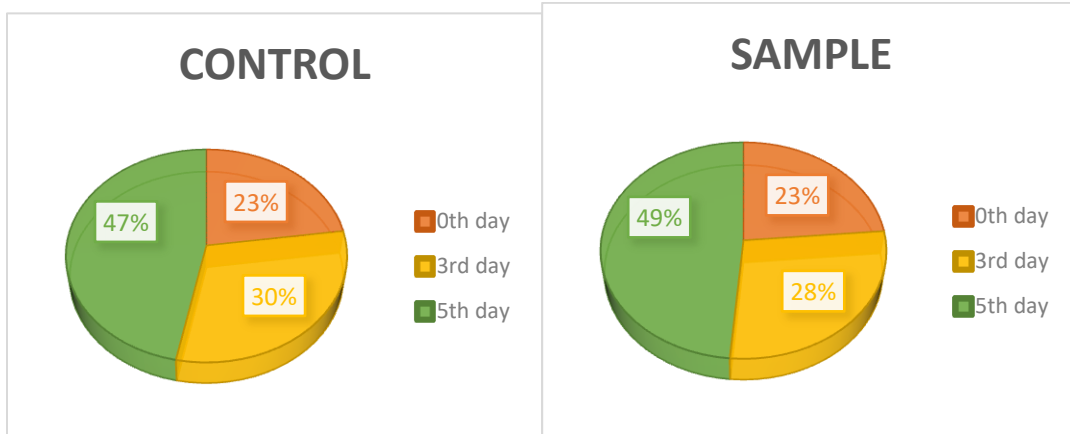
Sample 5 – 50% of wheat flour an 50% of lotus seed flour

The above table 1.1 clearly shows that the highly acceptable scores for all the sensory attributes were obtained by Sample 2 (80% of wheat flour and 20% of lotus seed flour) and it was followed by Sample 1 (90% wheat flour and 10% lotus seed flour) and Sample 3 found similar. The overall acceptability of Sample 4 (60% of wheat flour and 40% of lotus seed flour) was found to be lower than all the proportions. The results of mean and standard deviation scores show that the subjects liked Sample 2 very much on a 9-point hedonic scale (and the control group moderately. Therefore, Control and Sample 2 were selected for further analysis.



**MICROBIAL ANALYSIS:** In this research study, the microbial analysis includes the segments of total bacterial count and total yeast and mould count and the sample 2 (20% of lotus seed flour) and control group was discussed below:

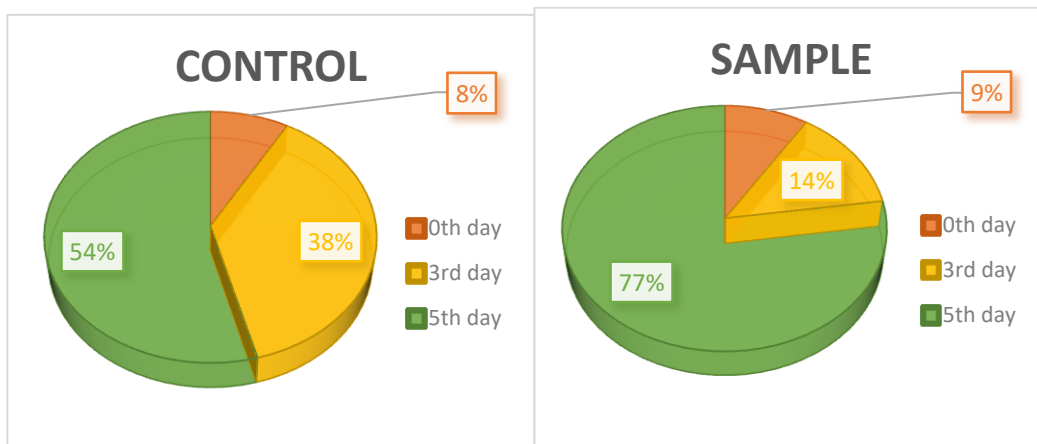
**TOTAL BACTERIAL COUNT**



**Figure: 1.3 PIE CHART FOR TOTAL BACTERIAL COUNT**

The above values of total bacterial count are comparatively low when compared to study done by (Ijah et.al,2014). He has formulated and evaluated the wheat bread. The total bacterial count of the wheat bread ranges from  $3.0 \times 10^5$ cfu/gm to  $1.09 \times 10^6$ cfu/gm. This count was comparatively higher than control group and Sample 2(20% of lotus seed flour).

**TOTAL YEAST AND MOULD COUNT**



**Figure: 1.4 PIE CHART FOR TOTAL YEAST AND MOULD COUNT**

The growth of yeast and mould in the control group and Sample 2 (20% of lotus seed flour) was comparatively similar to the study done by (Essra et al, 2019). They formulated gluten free cakes form chia gel and quinoa flour. This showed the results that the yeast and mould growth should not exceed  $10^2$ cfu/gm. Another study by (Ijah et.al,2014) shows the fungal growth ranged from  $8.0 \times 10$  cfu/gm to  $1.2 \times 10^3$ cfu/gm of the sample.

From the above studies, the results were found that the yeast and mould growth of the control and Sample 2(20% of lotus seed flour) was up to the limited rate per day. The microbial growth of the control group was found to be slightly higher than the Sample 2(20% of lotus seed flour).

**STORAGE STUDIES:** The muffins were kept in the refrigerator and room temperature to study their quality aspects like colour, texture, flavour and appearance during the storage period. The muffins were stored in different packaging materials like paperboard packaging, Polypropylene packaging, LDPE pouch and Aluminium box packaging. The results were given in the below table 1.2

**Table 1.2 STORAGE LIFE COMPARISON BETWEEN CONTROL AND SAMPLE 2 MUFFIN**

PACKAGING	SAMPLE/ CONTROL	REFRIGERATOR (4 <sup>0</sup> C – 5 <sup>0</sup> C)			ROOM TEMPERATURE (28 <sup>0</sup> C – 30 <sup>0</sup> C)		
		0 <sup>th</sup> day	3 <sup>rd</sup> day	5 <sup>th</sup> day	0 <sup>th</sup> day	3 <sup>rd</sup> day	5 <sup>th</sup> day
<b>PAPERBOARD PACKAGING</b>	Control	Nil growth	Nil growth	Nil growth	Nil growth	Rancid smell*	Visible growth
	Sample	Nil growth	Nil growth	Nil growth	Nil growth	Rancid smell*	Visible growth
<b>POLYPROPYLENE PACKAGING</b>	Control	Nil growth	Nil growth	Nil growth	Nil growth	Rancid smell*	Visible growth
	Sample	Nil growth	Nil growth	Nil growth	Nil growth	Rancid smell*	Visible growth
<b>LDPE POUCH PACKAGING</b>	Control	Nil growth	Nil growth	Nil growth	Nil growth	Rancid smell*	Visible growth
	Sample	Nil growth	Nil growth	Nil growth	Nil growth	Rancid smell*	Visible growth
<b>ALUMINIUM BOX PACKAGING</b>	Control	Nil growth	Nil growth	Nil growth	Nil growth	Nil growth*	Visible growth
	Sample	Nil growth	Nil growth	Nil growth	Nil growth	Nil growth*	Visible growth

The above table (1.2) shows that the shelf life of the muffins on the basis of microbial growth from 0<sup>th</sup> day to 5<sup>th</sup> day. After the observation, it was concluded that the muffins packed in paperboard and polypropylene packaging shows no visible growth and no changes in the organoleptic properties upto 5 days at refrigeration temperature and upto 2 days in room temperature. Rancid smell of muffins occurs in both the packaging on the 3<sup>rd</sup> day. During 4<sup>th</sup> day, the visible growth of microbes is seen in control and Sample 2 in both the packaging. At day 5, the control and Sample 2 in both the packaging were spoiled completely.

The above results shows that the shelf life of the muffins stored in the LDPE pouch and Aluminium box on the basis of visible microbial growth from 0<sup>th</sup> day till 5<sup>th</sup> day. After observation of muffin, we conclude that the muffins in the LDPE pouch have no changes in the sensory attributes upto 5 days at refrigeration temperature and upto 2 days at room temperature. The texture become soggy and rancid smell occurs on 3<sup>rd</sup> day. On day 4, visible growth of microbes occurs. The muffins were spoiled completely on 5<sup>th</sup> day when stored at LDPE pouch. Muffin stored in aluminium box have no changes upto 5 days at refrigeration temperature and upto 3 days at room temperature. At day 4, there is a visible growth of microbes in the muffins. The muffins were spoiled completely on 5<sup>th</sup> day.

While comparing the different packaging materials, the aluminium packaging promotes and enhances the product's shelf life than paperboard, polypropylene and LDPE pouch packaging. The results were similar to the study done by (Landge et al., 2009). He compared the different packaging materials and concluded that aluminium packaging enhances the shelf-life.

## CONCLUSION

This research study concluded that developed Lotus seed incorporated vegan muffins contains bunch of nutrients. The results of total bacterial count and yeast and mould count shows that it is considered as microbially safe for consumption. It can be recommended for lactose intolerance patients. Among the different packaging materials, Aluminium packaging shows the greater shelf life. Hence, it is concluded that the Lotus seed incorporated Vegan muffins provides a scrumptious taste and proven to be safe for consumption.



## **REFERENCES**

- Ureta, M. M., Olivera, D. F., & Salvadori, V. O. (2014). Quality attributes of muffins: Effect of baking operative conditions. *Food and Bioprocess Technology*, 7(2), 463-470.
- Zhang, Y., Lu, X., Zeng, S., Huang, X., Guo, Z., Zheng, Y., ... & Zheng, B. (2015). Nutritional composition, physiological functions and processing of lotus (*Nelumbo nucifera* Gaertn.) seeds: a review. *Phytochemistry Reviews*, 14(3), 321-334
- Ijah, U. J. J., Auta, H. S., Aduloju, M. O., & Aransiola, S. A. (2014). Microbiological, nutritional, and sensory quality of bread produced from wheat and potato flour blends. *International journal of food science*, 2014.
- Essra Khaled Feddah " Shelf-stability of Gluten Free Cakes Produced from Quinoa Flour and Chia Gel" *IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS)* 14.3 (2019): 07-12
- Landge, S. N., Chavan, B. R., Kulkarni, D. N., & Khedkar, C. D. (2009). Effect of packaging materials, storage period and temperature on acceptability of milk cake. *Journal of Dairying, Foods and Home Sciences*, 28(1), 20-25.