Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.7448

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **2 (6):** 334-340 (2014)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Effect of Different Levels of *Paneer* Whey on Loaf Volume and Textural Characteristics of Milk Bread

Aaditi Kakan[1], Changade, S. P.[2], Meshram B. D.[2], Shaikh Adil[2] and Rupesh Datir[3*]

[1]M.Tech Student, Department of Dairy Technology, College of Dairy Technology, Pusad, 445204, Maharashtra

[2]Department of Dairy Technology, College of Dairy Technology, Pusad, 445204, Maharashtra

[3]Department of Dairy Engineering, College of Dairy Technology, Pusad, 445204, Maharashtra

*Corresponding Author E-mail: bdmeshram@gmail.com

Received: 25.10.2014 | Revised: 30.11.2014 | Accepted: 8.12.2014

ABSTRACT

The aim of the study was to investigate the effect of addition of five different percentages (control (0%), 25%, 50%, 75% and 100%) of paneer whey on loaf volume and textural characteristics milk bread. Paneer whey testing (6.36% Total Solids) was utilized and milk bread samples were prepared by the straight dough method. The increase in level of paneer whey significantly increased the loaf weight among treatments. Paneer whey addition up to 25 per cent level only increased the loaf volume of milk bread. The values of specific volume for various treatments decreased with the increase in level of paneer whey. The texture profile analysis (TPA) revealed a significant difference among crumb hardness values of all treatments. The highest value was highest for T5 (0w:100pw). Gumminess increased significantly with an increased quantity of paneer whey in milk bread thus the highest value (6.86) was noted for T5.

Key words: *Paneer, Chakka, Channa, Cheese*

INTRODUCTION

Whey is the serum or watery part of the milk that separates from the curd in the manufacturing process of chakka, channa, cheese and paneer. It is rich in degradable materials and exerts a high oxygen demand. Data says that, about 2.5 million tones of milk is being processed in nearly 200 dairy plants in India and processing of 1 litre of milk generates about 8 to 10 litres of whey water depending upon the type of products manufactures[12]. Whey contains more than half of the total solids present in the whole milk. Whey is the largest by-product of the world dairy industry, generated during the manufacturing of cheese, paneer, chhana, chakka, casein, etc. The current world production of whey is estimated about 185 million tons per annum[7]. It is estimated that about 2% of total milk produced in India is converted to paneer and chhana[3] and production of whey due to this is estimated at around 270 million kg per annum, which contains about 16.2 million kg of valuable milk solids. The disposal of whey possess a serious pollution problem to the dairy industry because of the high organic content.

Cite this article: Kakan, A., Changade, S. P., Meshram B. D., Adil, S. and Datir, R., Effect of Different Levels of *Paneer* Whey on Loaf Volume and Textural Characteristics of Milk Bread, *Int. J. Pure App. Biosci.* **2(6):** 334-340 (2014). doi: http://dx.doi.org/10.18782/2320-7051.7448

It has been estimated that the biological oxygen demand (BOD) of whey ranges from 38,000 to 46,000 ppm[11]. Therfore, the disposal of whey is a costly proposition.

Several methods have been suggested for efficient disposal of whey. Whey has been very efficiently utilized in the production of whey powder, whey paste, lactose and lactic acid, ice-cream mix, milk biscuits, cheese spreads, infant food formulations, vinegar production, soft and alcoholic beverages etc. But still the potential of whey has not been fully exploited Thus utilization of whey through economical processes at cottage level is the demand of the day.

Bread is a bakery product priced for its taste, aroma and texture. It is a staple food prepared by baking dough of flour and water. Salt, fat and yeast, are common ingredients, in addition to a wide range of other ingredients, namely, milk, egg, sugar, spice, fruits, vegetables, nuts and seeds. The popularity of bakery products has contributed to increased demand for ready-to-eat, convenience food products, such as bread, biscuits and other pastry products. The use of different additives has become a common practice in the business of baking. The proteins from dairy sources, like whey proteins, are safe and natural food additives that exhibit thickening functions similar to hydrocolloids, starches, and other thickeners in food systems[8]. Incorporation of dairy ingredients into the dough improves the baking quality and can be more beneficial than chemical additives because of its high nutritional value and natural origin.

The use of whey solids in the appropriate manner is likely to provide low cost solids to the bakers besides resulting in newer/high nutritional value products. Therefore, the present study was designed to utilize *paneer* whey from the dairy sector in the production of milk bread and to study its effect on loaf volume and textural characteristics of milk bread.

MATERIAL AND METHODS

A composite sample of fresh *paneer* whey was obtained from the Department of Dairy Technology and used during the research work. The whey was prepared using citric acid of commercial grade @ one per cent as a coagulant. The whey collected was clarified and separated twice at 40 ± 5°C using power operated centrifugal separator and filtered through double layered muslin cloth. The *paneer* whey obtained was used in place of water for dough making at four different levels viz., 25, 50, 75 and 100 per cent. Refined wheat flour, sugar, hydrogenated fat, salt, baker's yeast, vanilla essence were procured from local market of Pusad, MS, India.

Method for Milk Bread Making

The milk bread was prepared by following "Straight dough process", AACC[1]. During each replication, 1500 g refined wheat flour was taken and divided into five lots of 300 g each to apply five different treatments.

Control (T1) = 100 per cent water

T2 = 75 per cent water + 25 per cent *paneer* whey

T3 = 50 per cent water + 50 per cent *paneer* whey

T4 = 25 per cent water + 75 per cent *paneer* whey

T5 = 100 per cent *paneer* whey

Each treatment was replicated five times.

For making the dough, 1500 g cleaned refined wheat flour was taken in the trough along with all the dry ingredients and mixed uniformly followed by addition of molten fat. The mixture was then divided into five lots for five different treatments. The dried mix was thoroughly blended together with the various proportions of whey and water as shown in the Table 2 using food processor for 10 minutes for formation of dough. The proofing of dough obtained from each treatment was done in two steps. The baking of the proofed dough in G.I moulds was done at 230 ± 5°C for 30 ± 2 min to achieve light brown color of the crust. After baking the milk bread samples were taken out from baking oven and allowed to cool at ambient temperature for 30 ± 2 minutes in the mould itself. The cooled milk bread samples were taken out in the stainless steel tray for further studies.

Chemical Composition of Raw Materials

Sieved refined wheat flour was analyzed for moisture, total ash, acid insoluble ash, gluten contents and alcoholic acidity. The moisture content was determined as per method prescribed by BIS (I.S 1155:1968). Total ash, acid insoluble ash, gluten content and alcoholic acidity of the refined wheat flour were determined as per methods described by BIS (I.S. 1155-1968, Part IV). The total protein content was estimated by AOAC[4]. method 920.87.

Pretreated *paneer* whey was analyzed for total solids, pH, titrable acidity and protein content. The total solid was estimated using hand refractometer as described in SP: 18 Part XI. Titrable acidity, pH and protein were analyzed as described in SP: 18 Part XI.

Evaluation of the physical properties of bread samples

Loaf weight: Bread loaves were weighed 20 min after baking, using a laboratory scale and the readings recorded in grammes.

Loaf volume: The loaf volume was determined determined by rape seed displacement method specified in SP: 18 Part V.

Specific volume: Bread height and diameter was measured using a measuring ruler. Loaf shape was measured in terms of height to diameter ratio while specific volume was thereafter calculated as volume to mass ratio (cm^3/g)

Texture Profile Analysis

The experimental milk bread was analyzed for its textural properties. Analyzer (TA.XT.2i plus) with temperature control cabinet of Stable Microsystem, England was used. The method prescribed in American Association of Cereal Chemists 74-09 was implemented.

RESULTS AND DISCUSSION

Physical Properties of Milk Bread

The milk bread loaves were weighed after cooling and the results are presented in Table 2. It can be seen from the results that the increase in level of *paneer* whey (0-100 %) significantly ($p<0.05$) increases the weight of loaf among treatments. The milk bread loaf weights recorded varied between 251.45 ± 0.21 g and 260.37 ± 0.14 g. The highest weight (260.37 g) was recorded for milk bread testing 100 per cent *paneer* whey (T5) and the lowest weight (251.45 g) was recorded for the control (T1). This might be attributed to total solid content of the *paneer* whey (6.36 %) used during the study. The observations recorded for loaf volume during present investigation revealed that *paneer* whey addition up to 25 per cent level only increases the volume of milk bread. Loaf volume of treatment T2 (911.50 ml) was found superior over T1, T3, T4 and T5. Treatment T5 (838.44 ml) was found to be inferior to all other treatments.

The values recorded for milk bread loaf volume differ significantly between the treatments and are ranging from 838.44 ± 0.36 ml to 911.50 ± 0.71 ml. See *et al.*[15], reported that the moisture content of breads is a major factor affecting loaf volume of milk bread. In the present study it was observed that with the increase in level of *paneer* whey there was decrease in moisture content of milk bread. According to Roberts[14], the depression in loaf volume could have been caused by a combination of factors such as the dilution of gluten, disruption of gluten network and the binding of water. These factors result in less water available for gluten network formation. The reduction in loaf volume is due to the binding effect of milk solids on the flour proteins[6]. The specific volume of bread is a characteristic quality parameter as it indicates dough inflating ability. In bakery products there is an ideal relation between dough weight and loaf volume that yields the most desirable texture and grain[13]. The mean values of five replications for specific volume are presented in Table. The values recorded for specific volume of milk breads from all treatments show statistically significant differences among the treatments. The values noted are ranging from 3.22 ± 0.05 ml/g to 3.61 ± 0.04 ml/g. The specific volume of milk bread gradually decreased with the increase in level of *paneer* whey. However, the values observed for T3 are slightly lower for T4 and

T5. This may be due to replacement of water with *paneer* whey > 50 per cent for milk bread making.

Texture Profile Analysis of Milk Bread Samples

The results pertaining to the analysis of variance regarding instrumental texture parameters of milk bread are shown in Table and graphically illustrated in figure. Hardness is an important parameter of bakery products and is strongly related with the consumer's perception of bread freshness[2]. The crumb hardness values were between 5.12 ± 0.68 and 11.23 ± 0.83 N. It can be observed from Table that there was a significant difference among different treatments of milk bread. The lowest value for hardness (5.12 N) was noted for control (100w:0pw) and the highest (11.23) value was noted for T5 (0w:100pw). The results recorded revealed that, as the amount of *paneer* whey increased, the hardness of bread crumb was increased. Calderon *et al.*[5], reported that when bread volume decreased as result of the more compact crumb with smaller pores and lesser void spaces, the hardness was increased. Similar results were recorded during present investigation. Springiness indicates the rate at which a deformed material goes back to its undeformed condition after the deforming force is removed. The mean values for springiness of milk breads obtained from different treatments are presented in Table. It can be seen from the results that the values of springiness ranged from 0.89 ± 0.03 to 1.37 ± 0.53. The statistical difference among the treatments was non-significant. The springiness values decreased as the level of *paneer* whey increased. The highest value (1.37) was noted for control (T1). From Table, it can be noted that the statistical difference between the values of cohesiveness for various treatments was non-significant. The values varied between 0.61 ± 0.01and 0.63 ± 0.05. Thus it can be inferred that the addition of *paneer* whey at different level did not affect the cohesiveness of milk breads. The average values for gumminess of milk breads obtained from different treatments are given in Table 3 and a significant statistical difference was recorded among the treatments. The values ranged from 3.24 ± 0.54 to 6.86 ± 0.42. The results showed that gumminess increased with an increased quantity of *paneer* whey in milk bread. There was increase in values of gumminess with increase in level of *paneer* whey. This action may be caused by increase in hardness of milk breads. There was no significant difference between control (100w:0pw) and T2 (25pw:75w). The statistical difference between treatments T2 and T3; T4 and T5 was found significant. This might be due to increase in proportion of *paneer* whey in milk bread. The values noted were between 3.66 ± 0.62 and 6.57 ± 0.42. Chewiness is secondary parameter and depends on gumminess and springiness. In existing study, the chewiness values increased with increase in gumminess values. There was no significant difference among the treatments of milk bread for resilience values. The values ranged from 0.28 ± 0.04 to 0.31 ± 0.02.

Table 1: Composition of Raw Materials

Parameters	Refined wheat flour	*Paneer* whey
Moisture (%)	12.09 ± 0.08	93.64 ± 0.01
Total solids (%)	87.90 ± 0.08	6.36 ± 0.01
Protein (%)	10.06 ± 0.01	0.35 ± 0.02
Total ash (%)	0.94 ± 0.02	0.61 ± 0.11
Acid insoluble ash (%)	0.11 ± 0.01	--
Wet gluten (%)	29.28 ± 0.64	--
Dry gluten (%)	9.72 ± 0.17	--
Alcoholic acidity(%H_2SO_4)	0.10 ± 0.22	--
Acidity (% L.A)	--	0.38 ± 0.01
pH	--	5.61 ± 0.25

Table 2: Effect of different levels of *paneer* whey on loaf weight, loaf volume and specific volume of milk bread

Sr. No.	Treatments	Loaf weight (g)	Loaf volume(ml)	Specific volume (ml/g)
1	Control(T1)	251.45 ± 0.21^{e}	901.00 ± 1.41^{b}	3.58 ± 0.01^{b}
2	T2	253.25 ± 0.64^{d}	911.50 ± 0.71^{a}	3.61 ± 0.04^{a}
3	T3	255.95 ± 0.21^{c}	883.46 ± 0.71^{c}	3.47 ± 0.01^{c}
4	T4	257.45 ± 0.21^{b}	867.50 ± 0.41^{d}	3.36 ± 0.01^{d}
5	T5	260.37 ± 0.14^{a}	838.44 ± 0.36^{e}	3.22 ± 0.05^{e}

Means in a row with similar superscript are not significant different at α=0.05.
Values are Means± SD and n=5 for each group

Table 3: Effect of different levels of *paneer* whey on textural properties of milk bread

Sr. No.	Treatments	Hardness (N)	Springiness	Cohesiveness	Gumminess	Chewiness	Resilience
1	Control(T1)	5.12 ± 0.68^{e}	1.37 ± 0.53^{a}	0.63 ± 0.05^{a}	3.24 ± 0.54^{e}	3.66 ± 0.62^{c}	0.28 ± 0.04^{a}
2	T2	7.10 ± 0.39^{d}	0.96 ± 0.02^{a}	0.63 ± 0.01^{a}	4.47 ± 0.28^{d}	4.27 ± 0.32^{c}	0.30 ± 0.01^{a}
3	T3	8.80 ± 0.68^{c}	0.95 ± 0.02^{a}	0.61 ± 0.01^{a}	5.42 ± 0.52^{c}	5.15 ± 0.48^{b}	0.29 ± 0.01^{a}
4	T4	9.90 ± 0.70^{b}	0.95 ± 0.01^{a}	0.62 ± 0.02^{a}	6.14 ± 0.60^{b}	5.44 ± 0.55^{b}	0.31 ± 0.02^{a}
5	T5	11.23 ± 0.83^{a}	0.89 ± 0.53^{a}	0.61 ± 0.01^{a}	6.86 ± 0.42^{a}	6.57 ± 0.42^{a}	0.29 ± 0.03^{a}

Means in a row with similar superscript are not significant different at α=0.05.
Values are Means± SD and n=5 for each group

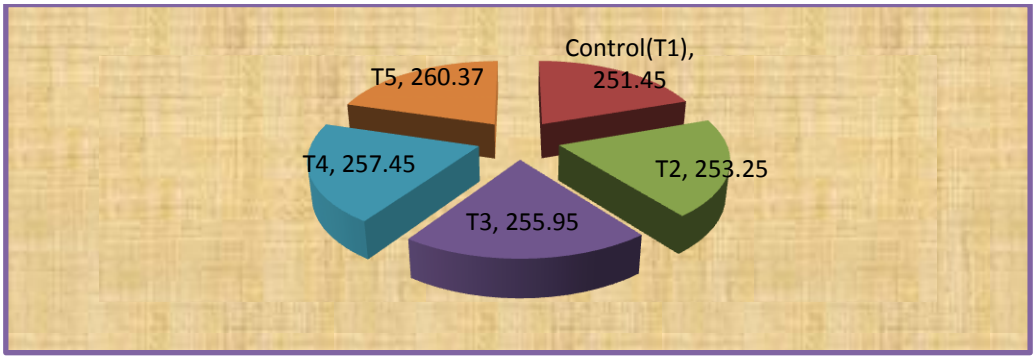

Fig. 1: Effect of different levels of *paneer* whey on loaf weight (g) of milk bread

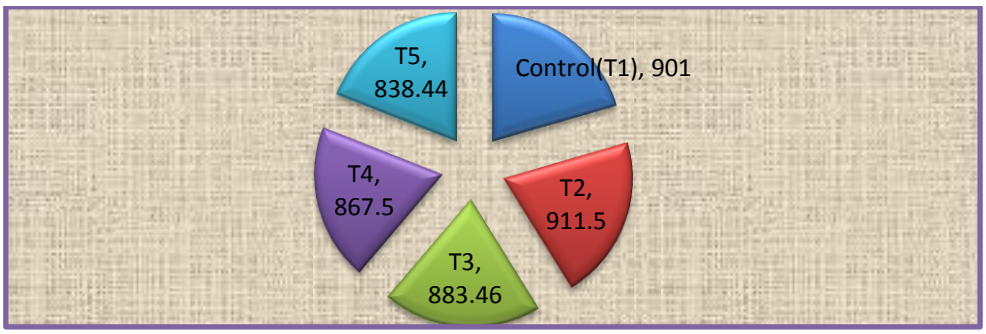

Fig. 2: Effect of different levels of *paneer* whey on loaf volume (ml) of milk bread

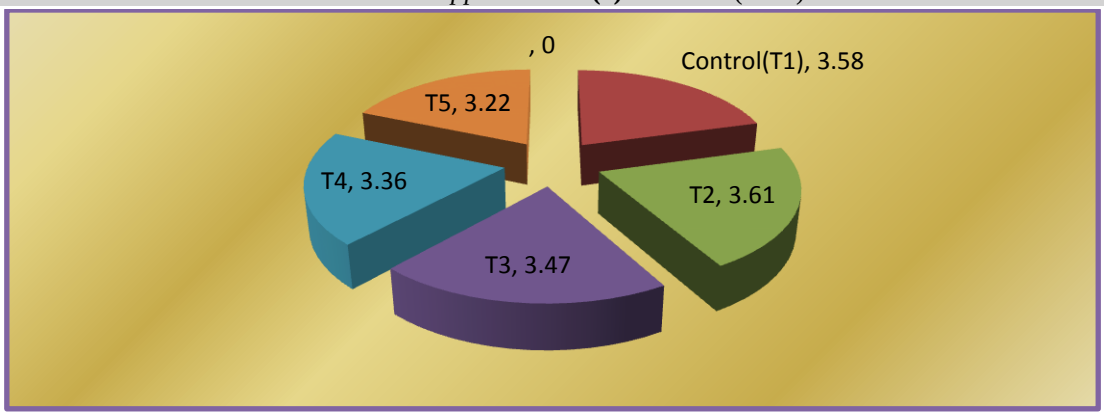

Fig. 3: Effect of different levels of *paneer* whey on specific volume (ml/g) of milk bread

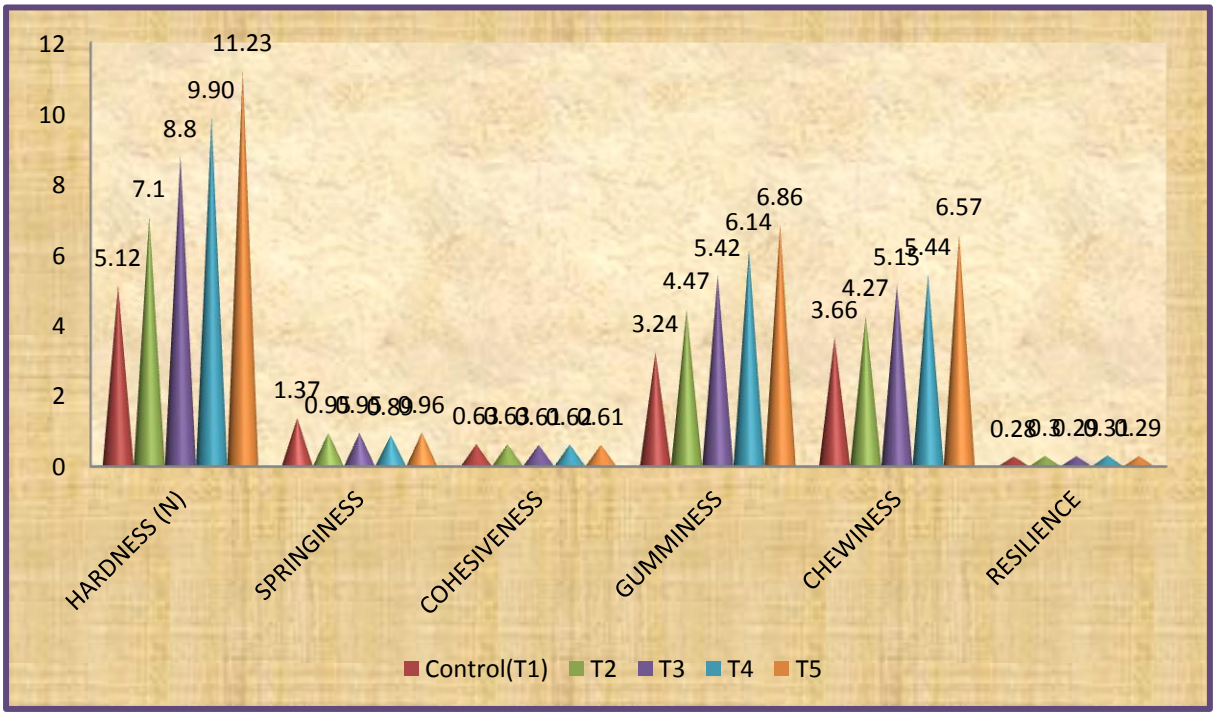

Fig. 4: Effect of different levels of *paneer* whey on textural properties of milk bread

CONCLUSIONS

Incorporation of *paneer* whey at different levels caused increase in loaf weight and reduction of specific volume of milk breads. The instrumental texture analysis studies of various samples obtained from different treatments showed that addition of *paneer* whey significantly increased the values of hardness, gumminess and chewiness. A positive correlation of hardness, gumminess and chewiness was observed while the difference between values for other parameters was non-significant. This indicates that the addition of *paneer* whey did not exercise negative effect on the texture of milk breads.

REFERENCES

1. A.A.C.C., Approved Methods of American Association of Cereal Chemists. The American Association of Cereal Chemists. *Inc. St. Paul, Minnesota, USA*. (2000).
2. Ahlborn, G.J., Pike, O.A., Hendrix, S.B. Hess, W.M. and Huber, C.S., Sensory, mechanical, and microscopic evaluation of staling in low-protein and gluten-free breads. *Cereal Chem*. **82:** 328-335 (2005).
3. Aneja, R.P., Mathur, B.N., Chandan, R.C., and Banerjee, A.K., Technology of Indian Milk Products. A Dairy India Publication, New Delhi. (2002).

4. Association of Official Analytical Chemist, A.O.A.C., Official methods of analysis. 15th edn. Washington D.C (1990).
5. Calderon-Domniguez, G., Vera-Domniguez, M., Ferrera-Rebello, R., Arana-Errasquin, R. and Mora-Escobedo, R., Int. *J. of Food Properties*., **7(2):** 165-174 (2004).
6. Gawali, A.H., Studies on preparation of bread using skim milk powder and whey. B. Tech Dissertation submitted to Marathwada Agriculture University, Parbhani, Maharashtra. (1994).
7. Gupta, V. K. and Singh, S., Utilization of whey in Monograph of IDA. (2007).
8. Hudson, H.M., Daubert, C.R., and Foegeding, E.A., Rheological and physical properties of derivatized whey protein isolate powders. *J. Agric. Food Chem*., **48:** 3112-3119 (2000).
9. I.S.I., Handbook of Food Analysis, Part XI: Dairy products. *Indian Standards Institution*, New Delhi. (1981).
10. I.S.I., ISI Handbook of Food Analysis, Part V: Bakery and Confectionary products. *Indian Standards Institution, New Delhi*. (1982).
11. Misra, A.K., Whey Management in Dairying. Dairy Year Book. (2008).
12. Puranik, D.B., Development of cake mixes using milk by-products as egg substitutes. Ph D thesis, submitted to National Dairy Research Institute (Deemed University), Karnal, India. (1999).
13. Pyler, E.J., Baking Science and Technology. Vol. 1 Siebel Publishing, Company, Chicago, IL. (1973).
14. Roberts, K.T., Influence of Fenugreek Gum on Bread and In Vitro Physiological Effects. *Thesis submitted to University of Guelph*. (2012).
15. See, E.F., Wan Nadiah, W.A. and Noor Aziah, A.A., Physico-chemical and sensory evaluation of breads supplemented with pumpkin flour. *ASEAN Food Journal*. **14(2):** 123-130 (2007).