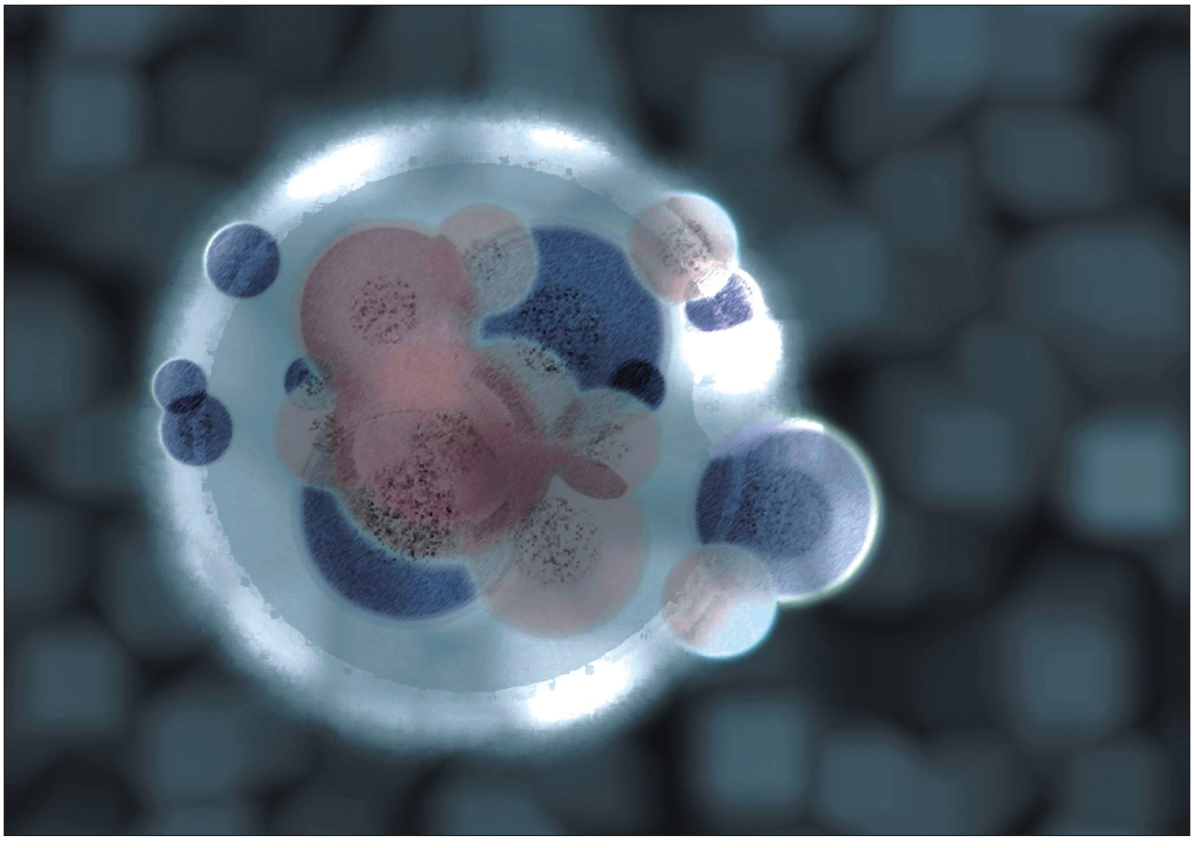

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Research Article
Assessment the Quality of Imitated Pumpkin Processed Cheese During Cold Storage

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Abstract

Background and Objective: In advances decades, producing novel products of processed cheese spreads suitable for individual consumers is considered urgent need. Producing of sweet cheese spreads is a new trail for overcoming many food healthy problems. The aim of this research was to study the effect of storage period on some properties of sweet pumpkin processed cheese spreads. Pumpkin is a fruit which has high nutritive value, it is considered a good source of anti-oxidants, carotenoids, potassium and fibers etc. **Materials and Methods:** Pumpkin paste was impact with processed cheese materials to prepare sweet-pumpkin processed cheese (SPPCs) samples. Samples were traditionally prepared by supplemented three ratios of pumpkin paste (5, 10 and 15% w/w) in cheese base. All resultant samples were stored at 7±1°C for 3 months. Soluble nitrogen content, pH values, color parameters as well as organoleptic properties were evaluated when fresh and after one and 3 months of storage. **Results:** Obtained data revealed that all treated samples were lower in pH values than control one. Control samples had the highest soluble nitrogen values when fresh or after one and three months compared to treated samples. However, during storage period, soluble nitrogen contents were increased in all samples after three months of storage. Color parameters data indicated that the treated samples had more yellowness color than control ones. Otherwise, sweet pumpkin processed cheese samples gained the highest scores in all acceptability. **Conclusion:** Preparing new type of processed cheese spread samples using 10 % (w/w) pumpkin past suitable for individual consumers whom suffer from hypertension and children could be available. Storage of these sweet processed cheese samples for three months at 7±1°C, improved their quality through lowing the pH values and increasing the soluble nitrogen contents. They possessed the best and the favorite sensorial properties where they had delicious, sweet and acceptable taste as well as preferable color.

Key words: Pumpkin fruit, sweet processed cheese, processed cheese spreads, soluble nitrogen content and color parameters

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Hypertension is one of the most popular diseases in recent years and it strongly linked with excess sodium intake. Salt is an old food preservation and flavoring material but it has risk effect especially hypertension patients. Excess sodium has been associated also with many diseases like stroke and cardiovascular disease. So, increasing consumption of foods that containing high levels of sodium considered a potential health threat[1]. Nevertheless, Potassium is also a balance parameter in healthy diet, increasing potassium level in the meal may protect against hypertension. The ratio of sodium/potassium is approximately one to one, which is considered beneficial for health[2]. World Health Organization recommends a sodium intake for adults of as maximum 2 g/day which equivalent to 5 g of salt[3].

Nowadays, there is increasing evidence from the previous literatures that optimizing the potassium nutritional status of plants can reduce the detrimental buildup of reactive oxygen species[4]. Health promotion initiatives to focus the health consequences of excess sodium-chloride-intakes. Role of food as an agent for improving health has proposed a new class of food, called functional and safe food. On other hand, using of fruits or vegetables such as carrot and apricot to prepare sweet processed cheese is recently applied to overcome many health troubles. Mohamed *et al.*[5] and Mohamed and Shalaby[6] evaluated the quality characteristics and acceptability of an analogue processed spreadable cheese made with Carrot paste and Apricot as a new sweet types.

Pumpkin is a fruit-vegetable which is cultivated in many regions of world. Likewise, Pumpkin can be used to prepare different food products, such as juices, jams, jellies and purees. The pumpkin has great economic power as a food and as an industrial crop. It is utilized for its seeds, leaves, marrow, fruit and pulp[7]. Stanton *et al.*[8] and Khalifa *et al.*[9] evaluated the characteristics of seeds and seed oils of some Egyptian Pumpkin cultivars. With concept to its nutrients composition it is considered a good source of carotenoids, potassium, vitamins such as B2, C and E. However, it has a large quantity of fiber and low level of energy[10].

Concerning to the term "processed cheese", it describes a dairy product which was consumed by various people and by different ages in a large scale. It manufactured of matured cheese-types in the presence of emulsifying and stabilizer salts and they cooked at 100°C until a smooth and homogenous mass is formed[11,12]. From other view, imitate cheese can figure out as a product prepared by mixing food components, with water, acid, emulsifying salts and cheese flavoring and exposed to thermal and mechanical energy to produce a uniform analogue product. Kassem *et al.*[13] evaluated the anti-oxidant activity, the texture profile as well as potassium and sodium content of fresh pumpkin processed cheese spreads.

Attention of consumer health, the current study was planned to produce a sweet imitated processed cheese samples and follow up their properties through 3 months of storage. The samples were prepared by supplementation of three ratios of pumpkin past and evaluate their pH values, the soluble nitrogen contents and color parameters as well as their organoleptic acceptability during cold storage.

MATERIALS AND METHODS

Materials: Pumpkin fruit were purchased from local Egyptian market. Calf rennet and whey protein powders were obtained from Dairy Technology Lab, National Research Centre (NRC), Egypt. Sweet butter was obtained from Dina farm, Sadat city, Egypt, while low heat skim milk powder was purchased from Irish Dairy Board, Grattan House, Ireland. Commercial emulsifying salts (JOHA) were obtained from BK-Ladenburg, Germany. Fresh raw buffalo's milk was obtained from Faculty of Agriculture, Cairo University, Giza, Egypt. The study began at 2017 and was ended in 2018 and it achieved in Dairy Chemistry and Technology Laboratory NRC Giza Egypt.

Methods

Preparation of pumpkin paste: Pumpkin fruit was well washed and cut into small pieces after cleaning and removed their outer skin. They immerse in boiling water for 2 min. The blanched pumpkin pieces were well mixed in a home kitchen mixer for 10 min to obtain a smooth paste. The pumpkin paste was stored under freezing until used.

Manufacture of unsalted cheese base: The soft cheese manufacture was achieved according to the method illustrated by Mohamed et *al.*[5]. After pasteurization of milk (72°C/15 sec), it cooled rapidly to 39±1°C and 0.04% calcium chloride and 4% of calf rennet (after diluted 10 times with water) were added and left to coagulate in about 3 h. The resultant curd was transferred to cheese molds over-night to drain the whey then stored at 4°C till used.

Manufacture of sweet pumpkin processed cheese (SPPCs): Pumpkin processed cheese spreads were made according to the method of Mohamed and Shalaby[6]. The control processed cheese (C) was prepared to be almost 59±1% moisture and 36±1% (F/DM) and Pumpkin processed cheese treatments

Table 1: Composition of SPPCs made with different ratios of pumpkin paste

	Pumpkin paste treatments			
Items	Control	T_1	T_2	T_3
TS (%)	39.85	40.87	40.91	40.99
Fat/DM	36.50	26.70	25.60	24.50
Total protein (%)	14.59	12.22	12.15	11.60
Ash (%)	4.05	3.14	3.08	3.05
Fiber (%)	-	0.233	0.356	0.499
pH	5.78	5.64	5.50	5.43

C: Control T1: 5% pumpkin, T2: 10% pumpkin, T3: 15% pumpkin, TS: Total solid

were manufactured by supplementing pumpkin paste in the base blend at ratios of 5 (T_1), 10 (T_2) and 15 (T_3) % (w/w), sugar was added at 15% for each treatment. All blends were cooked with controlled agitation for 8 min at 85-90°C using direct injection steam at pressure of 1.5 bar. The hot product of SPPCs were manually filled into 150 sterilized-glass-cups and covered with aluminum foil, then cooled rapidly at 7±1°C. The resultant SPPCs were analyzed when fresh and after 1 and 3 months of storage period. Three replicates of each treatment were manufactured and subjected for analysis.

The averages of composition of different sweet pumpkin processed cheese samples (SPPCs) were presented in Table 1. Data were previously reported in author's recent paper[13].

Chemical analysis: Samples of all sweet pumpkin processed cheese were checked for their total solids (TS), total protein (TP), fat/DM , fiber and soluble nitrogen contents according to AOAC[14].

Estimation of pH values: Values of pH of all samples were measured by using a digital pH meter with glass electrode (HANNA).

Estimation of color parameters: The color of the processed cheese spreads samples was measured using Hunter colorimeter Model D2s A-2 (Hunter Assoc. Lab. Inc. Va, USA). The instrument was first standardized using a white tile (top of the scale) and a black tile (bottom of the scale). A specimen of the cheese (flat layer) was placed at the specimen port.

The tri-stimulus values of the color namely, (L) Darkness from black (0) to white (100)) (a) Color ranging from red (+) to green (-) and (b) Yellow (+) to blue (-) were measured.

Evaluation of organoleptic properties: Organoleptic properties of SPPCs samples were evaluated by 20 trained stuff members of Dairy Department, NRC, Egypt. Samples were undertaken for color, flavor, taste, body, spread-ability and all acceptability. Each item record 5 scores.

RESULTS AND DISCUSSION

Values of the pH in pumpkin processed cheese samples during storage periods: Impact of pumpkin paste on pH values of pumpkin processed cheese was epitomized in Fig. 1. There were clear differences between each of treatments and control samples. All treated samples were lower in pH values than control one, this could be reverting to the range of pH of pumpkin itself which range between 4.90-5.50 (http://www.cfsan.fda.gov/~ comm/lacf-phs.html).

Soluble nitrogen contents of pumpkin processed cheese samples during storage periods: Soluble nitrogen is an indication for proteolysis occurred in protein and action of emulsifying salt that cause more solubilization of protein. Figure 2 represented the soluble nitrogen content of sweet pumpkin processed cheese when fresh and during storage period. It was clarified that control samples had the highest soluble nitrogen values when fresh and after one and three months compared to treated samples. During storage period, soluble nitrogen increased in all treated samples where after 3 months of storage they had gained the highest values. samples. The values of L were 93.50, 91.90, 87.96 and 84.90 for control, T1, T2 and T3, respectively. The obtained data were in agreement of Gliemmo *et al.*[15].

Organoleptic evaluation of sweet pumpkin processed cheese: Figure 3 revealed the organoleptic properties of sweet processed cheese during storage. Data indicated that the orange color of pumpkin itself resulted in gained desirable color to the final product. Gliemmo *et al.*[15] determined color stability of pumpkin puree during storage at room temperature and they reported that color changes were measured through lightness (L), redness (a), yellowness (b). They mentioned that the changes in a and b were

Table 2: Changes in color parameters of sweet pumpkin processed cheese (SPPCs) made with different ratios of pumpkin paste during storage periods

Color parameters	Storage periods	Control	T_1	T_2	T_3
L	Fresh	93.50	91.90	87.96	84.90
	1	90.16	88.71	85.30	83.02
	3	86.11	85.16	82.15	80.23
A	Fresh	-1.41	+1.33	+1.60	+1.88
	1	-1.90	+1.41	+1.69	+1.95
	3	-2.33	+1.55	+1.82	+2.13
B	Fresh	14.13	17.50	18.33	26.18
	1	17.91	18.11	19.22	27.05
	3	23.60	19.30	20.96	28.41

C: Control T1: 5% pumpkin, T2: 10% pumpkin, T3: 15% pumpkin, Where: L: Darkness from black (0) to white (100), a: Color ranging from red (+) to green (-), b: Yellow (+) to blue (-)

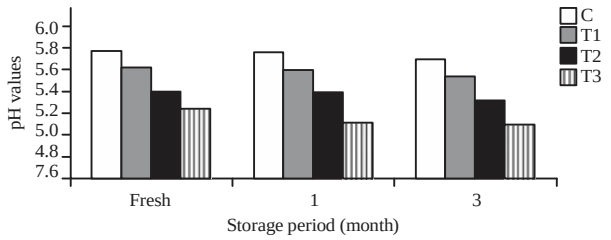

Fig. 1: Values of pH of pumpkin processed cheese (SPPCs) made with different ratios of pumpkin paste during storage periods
C: Control T1: 5% pumpkin, T2: 10% pumpkin, T3: 15% pumpkin

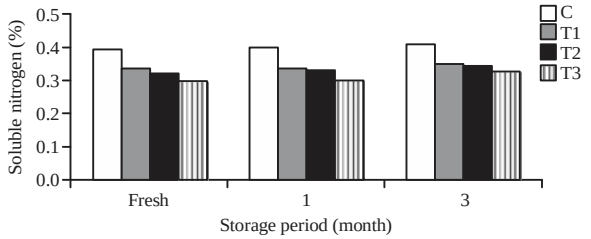

Fig. 2: Soluble nitrogen contents of sweet pumpkin processed cheese (SPPCs) made with different ratios of pumpkin paste during storage
C: Control, T1: 5% pumpkin, T2: 10% pumpkin, T3: 15% pumpkin

High content of protein in control samples may be the result of high values of soluble nitrogen.

Color parameters: Data listed in Table 2 represented the color parameters of cheese samples during 3 months of storage. It could be noticed, firstly, that color of fresh treated samples were tended to have more yellowness color. The b values were 14.13 17.50, 18.33 and 26.18, respectively, this means that as pumpkin ratio increased in the sample, the degree of yellowness or orange color increased. The data of whiteness (L value) confirmed this result, where L values decreased by increasing the pumpkin ratio in the treated mathematically modeled. In general, lightness, redness and yellowness diminished with storage time. They added that the increase in pH from 4.00-5.00 in the presence of KS significantly minimized color degradation of puree packed in PCPC.

For the effect of replacing of pumpkin past in the blends in body and texture properties, it could be noticed that pumpkin past caused weakness points in the structure of the resulted cheese through reduce the protein ratio and increased the pumpkin and sugar ratios. For flavor and taste data, it could be also concluded that slightly desirable acid taste and fruity flavor were noticed in treated samples. Storage at refrigerator of samples for 3 months did not clearly affected all sensory behaviors. Present data also revealed that addition of 10% pumpkin paste (T2) gained the preferable and acceptable sensorial properties and possessed the highest all acceptability. They seemed to had soft and spreadable body with attractive orange color and desirable flavor as well as sweet taste.

DISCUSSION

It could be noticed that the addition of pumpkin paste caused decrease in pH values of SPPCs. On the other hand, the storage period decreased the pH values of all pumpkin-samples but this decreases were more pronounced in treated samples compared to control ones. These results lied in the normal range of processed cheese. These decreased may be due to the lower pH of the fruit itself. Obtained data are in accordance to that obtained by Mohamed *et al.*[5].

The values of soluble nitrogen for control samples when fresh and during storage were 0.3933, 0.3933 and 0.4089, respectively, while the lowest one was T3 (0.2991, 0.3011 and 0.3279) at the same order. The same trend was illustrated by Awad *et al.*[16] when they fortified processed cheese analogue with lupine paste in different ratios where the protein percent was reduced by increasing the ratios of supplementation. They

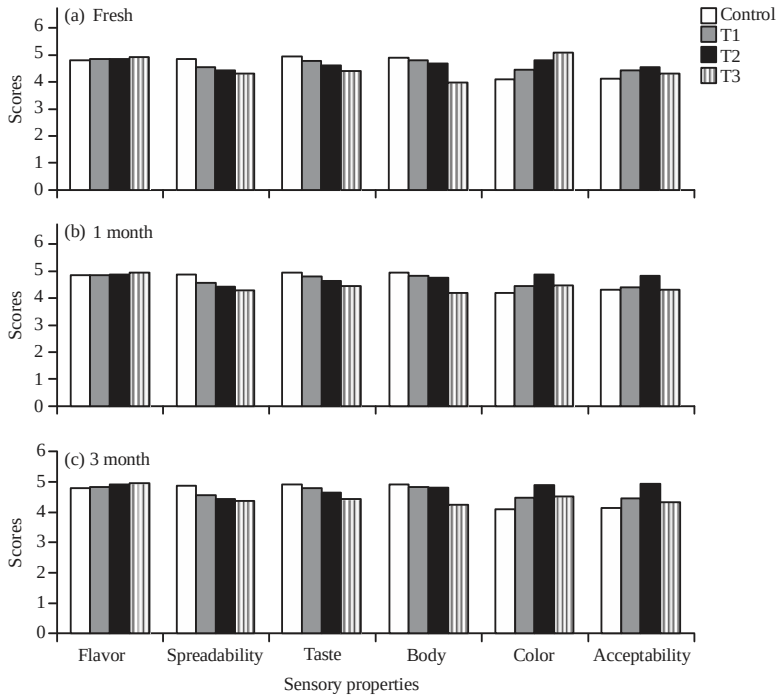

Fig. 3(a-c): Sensory attribution (0-5°) of sweet pumpkin processed cheese (SPPCs) made with different ratios of pumpkin paste, (a) Fresh (b) One month (c) Three months
C: control, T1: 5% pumpkin, T2: 10-5% pumpkin, T3: 15% pumpkin

deduced that increasing the soluble nitrogen values during storage period could be the result of enzymatic activity of resistant proteinases present in the product.

Gliemmo *et al.*[15] determined color stability of pumpkin puree during storage at room temperature and they reported that color changes were measured through lightness (L), redness (a), yellowness (b). They mentioned that the changes in a and b were mathematically modeled. In general, lightness, redness and yellowness diminished with storage time. They added that the increase in pH from 4.00-5.00 in the presence of KS significantly minimized color degradation of puree packed in PCPC.

For the effect of replacing of pumpkin past in the blends in body and texture properties, it could be noticed that pumpkin past caused weakness points in the structure of the resulted cheese through reduce the protein ratio and increased the pumpkin and sugar ratios.

For flavor and taste data, it could be also concluded that slightly desirable acid taste and fruity flavor were noticed in treated samples. Storage at refrigerator of samples for 3 months did not clearly affected all sensory behaviors.

Present data also revealed that addition of 10% pumpkin past (T2) gained the preferable and acceptable sensorial properties and possessed the highest all acceptability. They seemed to have soft and spreadable body with attractive orange color and desirable flavor as well as sweet taste.

CONCLUSION

This study concluded that preparing sweet processed cheese by supplementation with pumpkin fruit don't, mainly affected the quality of the final product when it stored for 3 months in refrigerator. Preparing of sweet pumpkin processed cheese using 10% (w/w) pumpkin paste gained the desirable acceptability with favorite orange color during storage of samples for 3 months at 7±1°C. Their quality were improved through lowing the pH values and decreasing the soluble nitrogen content rather than control ones.

SIGNIFICANCE STATEMENT

This study dealt with follow up some properties of pumpkin processed cheese samples during storage at refrigerator for 3 months.

REFERENCES

1. Doyle, M.E., 2008. Sodium reduction and its effects on food safety, food quality and human health. FRI Briefings, Food Research Institute, University of Wisconsin-Madison, November 2008.

2. WHO., 2003. Diet, Nutrition and the Prevention of Chronic Diseases: Report of a Joint WHO/FAO Expert Consultation. World Health Organization, Geneva, ISBN-13: 97892412 09168, Pages: 149.
3. WHO., 2012. Sodium intake for adults and children: Guideline. World Health Organization, Geneva, Switzerland, pp: 1-46.
4. Romheld, V. and E.A. Kirkby, 2010. Research on potassium in agriculture: Needs and prospects. Plant Soil, 335: 155-180.
5. Mohamed, A.G., S.M. Shalaby and W.A. Gafour, 2016. Quality characteristics and Acceptability of an Analogue processed spreadable cheese made with carrot paste (*Daucus carota* L.). Int. J. Dairy Sci., 11: 91-99.
6. Mohamed, A.G. and S.M. Shalaby, 2016. Texture, chemical properties and sensory evaluation of a spreadable processed cheese analogue made with apricot pulp (*Prunus armeniaca* L.). Int. J. Dairy Sci., 11: 61-68.
7. Kwak, N.S. and D.J. Jukes, 2001. Functional foods. Part 1: The development of a regulatory concept. Food Control., 12: 99-107.
8. Stanton, C., R.P. Ross, G.F. Fitzgerald and D. van Sinderen, 2005. Fermented functional foods based on probiotics and their biogenic metabolites. Curr. Opin. Biotechnol., 16: 198-203.
9. Khalifa, A.H., E.A. Abdel-Rahman, S.A. Mohamed and F.S. Al-Barbari, 2012. Characteristics of seeds and seed oils of some Egyptian pumpkin cultivars. J. Food Dairy Sci. Mansoura Univ., 3: 681-697.
10. De Escalada Pla, M.F., N.M. Ponce, C.A. Stortz, L.N. Gerschenson and A.M. Rojas, 2007. Composition and functional properties of enriched fiber products obtained from pumpkin (*Cucurbita moschata* Duchesne ex Poiret). LWT-Food Sci. Technol., 40: 1176-1185.
11. Solowiej, B., I.W.Y. Cheung and E.C.Y. Li-Chan, 2014. Texture, rheology and meltability of processed cheese analogues prepared using rennet or acid casein with or without added whey proteins. Int. Dairy J., 37: 87-94.
12. Salek, R.N., M. Cernikova, G. Nagyova, D. Kuchar, H. Bacova, L. Minarcikova and F. Bunka, 2015. The effect of composition of ternary mixtures containing phosphate and citrate emulsifying salts on selected textural properties of spreadable processed cheese. Int. Dairy J., 44: 37-43.
13. Kassem, J.M., H.M. Abbas, A.G. Mohamed, W.K. Bahgaat and T.M. El-Messery, 2017. Sweet processed cheese spread analogue as a novel healthy dairy product. Int. J. Dairy Sci., 12: 331-338.
14. AOAC., 2006. Official Methods of Analysis. 18th Edn., Association of Official Analytical Chemists Inc., Arlington, TX., USA.
15. Gliemmo, M.F., M.E. Latorre, L.N. Gerschenson and C.A. Campos, 2009. Color stability of pumpkin (*Cucurbita moschata*, Duchesne ex Poiret) puree during storage at room temperature: Effect of pH, potassium sorbate, ascorbic acid and packaging material. LWT-Food Sci. Technol., 42: 196-201.
16. Awad, R.A., W.M. Salama and A.M. Farahat, 2014. Effect of lupine as cheese base substitution on technological and nutritional properties of processed cheese analogue. Acta Sci. Pol. Technol. Aliment., 13: 55-64.