PJN
ISSN 1680-5194

PAKISTAN JOURNAL OF NUTRITION

ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorpjn@gmail.com

Pakistan Journal of Nutrition 9 (3): 205-208, 2010
ISSN 1680-5194

Effect of Storage Period on the Microbiological and Sensory Characteristics of Cooked Low Salt White Soft Cheese (Gebna Beyda)

Mohamed Osman Mohamed Abdalla and El Imam Hassan Sulieman Mohammed
Department of Dairy Production, Faculty of Animal Production, University of Khartoum,
Shambat, P.O. Box 32, Postal Code 13314, Khartoum North, Sudan

Abstract: This study was carried out to evaluate the microbial and sensory characteristics of cooked low salt white soft cheese during storage. Low salt cheese was made from pasteurized (72°C/1 min) cow's milk. After complete coagulation, the curd was cooked at 35°C for 30 min. Cheese was preserved in 2% brine solution for 48 h and then transferred to plastic bags and stored in the refrigerator at 4°C for 60 days. Microbiological examination as well as sensory characteristics was carried out at 1, 20, 40 and 60 day intervals. The results indicated that, during storage period the total viable bacteria count did not show significant change, while psychrotrophic bacteria and yeasts and moulds counts significantly increased throughout storage period. Storage period did not significantly affect the colour, while the flavour, taste, body, saltiness and overall acceptability were significantly affected by the storage period.

Key words: Cooked white soft cheese, low salt, storage period, cow milk

INTRODUCTION

The dominant and the most popular type of cheese manufactured in Sudan is Gebna Bayda, the local name for white soft cheese (Khateeb, 1997), which may be consumed fresh but more commonly after maturation in salt brine or salted whey (Abdalla and Abdel Razig, 1997). The cheese is traditionally made by adding 6-20% salt without the use of starter culture (Abdalla and Davidson, 1990; Abdalla *et al*., 1993). Salting process in cheese not only contributes to the flavour of cheese, but can also have an impact on the growth of microorganisms with the viability of probiotic bacteria being inversely proportional to salt concentration (Vinderola *et al*., 2000). Therefore the salting process may also lead to poor survival of bacteria in cheese. Coagulation time increases with increasing sodium chloride concentration (Patel and Bayoumi, 1988). Lifton *et al*. (2001) reported that all mendelian diseases associated with hypertension include defects that cause increase in salt absorption by the kidney.

Cooking process helps to destroy spoilage microorganisms, improves the shelf life of the processed cheese, contracts the particles and drives out the free whey, influences texture and gives more time for production of lactic acid that suppresses the growth of spoilage organisms (Nuser, 2001; Siew *et al*., 2004).

The high salt added to this cheese might affect the hypernsive people and deprives them from consuming this cheese, therefore this investigation aimed at producing cheese with low salt content that suits the hypertensive people and determining its acceptability in the market in addition to being safe during storage till consumption.

MATERIALS AND METHODS

The present study was conducted during the period February to May, 2009. Fresh cow's milk was brought from Khartoum University Farm at Shambat. Rennet powder was obtained from Chr. Hansen's Lab. (Denmark). The plastic bags (HiDiSpo bag™-10; size 10 cm x 6 cm) were obtained from HiMedia Laboratories Pvt. Limited, Mumbai, India. Salt was purchased from the local market.

Cheese manufacture: Cheese was manufactured according to the method described by Ibrahim (2003). Fresh cow's milk (25 L) was laboratory pasteurized at 72°C for 1 min and then cooled to 40°C. Rennet powder (1.3 gm) was dissolved in 50 ml distilled water and added to milk at 40°C. Milk was stirred for 5 min and left undisturbed to develop a curd. After complete coagulation, the curd was cut into small cubes (2.5 x 2.5 x 2 cm) and cooked at 35°C for 30 min. The curd was then poured into small wooden moulds lined with cheese cloth and pressed by weight (2.5 kg) overnight.

The next day, brine solution was prepared by adding salt to the collected whey (2%w/w), laboratory-pasteurized at 72°C for 1 min and cooled to 40°C. The pressed cheese was cut into small cubes and immersed into brine solution for 48 h. Cheese was then transferred to plastic bags and stored without whey in the refrigerator at 4°C for 60 days. A representative sample (20 g) was taken and subjected to microbiological examination and sensory evaluation at 1, 20, 40 and 60 day intervals. The analysis was carried out in triplicate.

Microbiological examination: The total viable bacteria count was determined according to Houghtby *et al*.

Corresponding Author: Mohamed Osman Mohamed Abdalla, Department of Dairy Production, Faculty of Animal Production, University of Khartoum, Shambat, P.O. Box 32, Postal Code 13314, Khartoum North, Sudan

(1992) using Standard Plate Count Agar medium. The plates were incubated at 32°C for 48 h and colonies were counted. Psychrotrophic bacteria count was determined according to Frank *et al.* (1992) using Standard Plate Count Agar medium. The plates were incubated at 7±1°C for 10 days. Yeasts and moulds count was determined according to Frank *et al.* (1992) using Potato Dextrose Agar medium. The plates were incubated at 25°C for 5 days.

Sensory evaluation: A panel of 10 untrained panellists were chosen and asked to judge on the quality of cheese (colour, flavour, body, taste, saltiness and overall acceptability) using an evaluation sheet, where colour ranged from 1 = not acceptable to 4 = acceptable; flavour from 1 = bland to 4 = extremely intense; taste from 1 = absent to 4 = excessive acid; body from 1 = smooth to 4 = pasty; saltiness from 1 = moderate to 4 = too salty; overall acceptability from 1 = unacceptable to 4 = acceptable.

Statistical analysis: Statistical analyses were performed using Statistical Package for Social Sciences (SPSS, 2004) program. Analysis of Variance (ANOVA) was used to estimate the effect of storage period (1, 20, 40, 60 days) on the microbial quality and sensory characteristics. Mean separation was carried out using Duncan's Multiple Test at $p \leq 0.05$.

RESULTS AND DISCUSSION

Storage period did not significantly ($p>0.05$) affect the total viable bacteria count (Table 1), although a slight increase was noticed at the end. These findings are in agreement with those of Hamed *et al.* (1992), Ahmed (1997) and Warsama *et al.* (2006) who reported that the total bacteria count of soft white cheese increased until day 60 of storage then gradually decreased. The increase can be explained by the sufficient change in the environmental conditions happened during the ripening period which allowed the growth and multiplication of microorganisms (Ibrahim, 2003; El Owni and Hamid, 2008). On the other hand, highly significant increase ($p<0.001$) due to the storage period was observed in the psychrotrophic bacteria count, gradually increasing from $\log_{10}$ 5.73±0.043 cfu/gm at day 1 to the $\log_{10}$ 6.20±0.043 cfu/gm at the end of storage (Table 1). This result is in accord with the findings of Nour Eldiam and El Zubeir (2006) who found that the storage period of soft white cheese showed significant differences ($p<0.05$) with psychrotrophic bacteria count. The yeasts and moulds count was significantly ($p<0.001$) affected by storage period as they showed a continuous increase with progress in storage. The counts were $\log_{10}$ 6.78±0.057, $\log_{10}$ 6.87±0.057, $\log_{10}$ 7.07±0.057 and $\log_{10}$ 7.20±0.057 cfu/gm at days 1, 20, 40 and 60 respectively (Table 1). These findings are in line with the results of Aly and Galal (2002); El Owni and Hamid (2008) who reported that yeasts and moulds increased as storage period progressed.

During storage the colour did not significantly change ($p>0.05$), while the flavour was moderately intense (2.93±0.133) at day 60 and slightly intense (2.30±0.133) at day 20 ($p<0.05$). The taste was slightly acidic (2.25±0.115) at day 60 and acid taste was absent (1.55±0.115) at day 40 ($p<0.001$). The body was harsh (2.98±0.163) at day 60 and slightly smooth (1.80±0.163) at day 20 ($p<0.001$). The cheese scored between salted and over salted (1.50±0.079) at day 20 and moderately salted (1.08±0.079) at day 60 ($p<0.001$). Overall, the cheese was slightly acceptable (3.10±0.134) at the beginning of storage, the quality was then decreased to half way between not acceptable and moderately unacceptable (1.40±0.134) at the end of storage ($p<0.001$) (Table 2).

Table 1: Effect of storage period on the microbial quality (Log_{10} cfu/ gm) of cooked low salt white soft cheese (Mean±SE)

	Storage period (days)				
Type of bacteria	1	20	40	60	SL
Total viable bacteria	8.10±0.047^{a}	8.16±0.047^{a}	8.09±0.047^{a}	8.20±0.047^{a}	NS
Psychrotrophic bacteria	5.73±0.043^{b}	6.07±0.043^{a}	6.13±0.043^{a}	6.20±0.043^{a}	***
Yeast and moulds	6.78±0.057^{c}	6.87±0.057^{b}	7.07±0.057^{a}	7.20±0.057^{a}	***

Means in the row bearing the same superscripts are not significantly different ($p>0.05$). *** = $p<0.001$.
NS = Not Significant, SL = Significance Level

Table 2: Effect of storage period on the sensory characteristics of cooked low salt (2%w/w) white soft cheese (Mean±SE)

	Storage period (days)				
Organoleptic parameters	1	20	40	60	SL
Colour	3.18±0.151^{a}	3.78±0.151^{a}	2.93±0.151^{a}	2.83±0.151^{a}	NS
Flavour	2.65±0.133^{ab}	2.30±0.133^{b}	2.55±0.133^{ab}	2.93±0.133^{a}	*
Taste	1.98±0.115^{b}	1.80±0.115^{b}	1.55±0.115^{b}	2.25±0.115^{a}	***
Body	2.15±0.163^{b}	1.80±0.163^{b}	2.18±0.163^{b}	2.98±0.163^{a}	***
Saltiness	1.35±0.079^{a}	1.50±0.079^{a}	1.13±0.079^{b}	1.08±0.079^{b}	***
Overall acceptability	3.10±0.0134^{a}	2.33±0.134^{b}	2.40±0.134^{b}	1.40±0.134^{c}	***

Means in the row bearing the same superscripts are not significantly different ($p>0.05$). *** = $p<0.001$. * = $p<0.05$.
NS = Not Significant, SL = Significance Level

The findings of this investigation are in agreement with those of Abdalla and Mohamed (2009) and Mohammed (2009) who reported that colour of cheese did not significantly change during storage period, while flavour and taste gradually improved throughout the storage, and Nuser (2001) who reported a significant change in body score during storage. The findings agree with those of Hamid and El Owni (2007) who reported that the flavour score of cheese and saltiness were significantly different. However, the results are in disagreement with those of Khalid (1990) who found that cheese developed acceptable flavour and acid taste after two weeks of storage. This might be attributed to low bacteria count of heat treated milk which resulted in slower acidity and flavour development (Abdalla, 1992). On the other hand, Hamed *et al*. (1992) reported that the composition and quality were affected more by storage temperature than by heat treatment of cheese milk. Cheese made from pasteurized milk received the organoleptic score of 92 and 88 (out of 100) after 90 days at room and refrigerator temperatures respectively, while cheese made from raw milk received the highest organoleptic score after 60 days at room temperature (Hamed *et al*., 1992).

Conclusion: In conclusion, the total viable bacteria, psychrotrophic bacteria and yeasts and moulds counts increased as the storage period progressed. During storage the colour, saltiness and overall acceptability of cheese deteriorated, while flavour, body and taste improved.

REFERENCES

Abdalla, O.M., 1992. Effect of processing conditions on the microbiological quality of white soft pickled cheese. Ph.D. Dissertation, University of Tenuessee, Knoxville, (USA).

Abdalla, M.O.M. and S.N. Mohamed, 2009. Effect of storage period on chemical composition and sensory characteristics of vacuum packaged white soft cheese. Pakistan J. Nutr., 8: 145-147.

Abdalla, O.M. and A.K. Abdel Razig, 1997. Effect of type of milk on the quality of white soft cheese. U.K. J. Agric. Sci., 5: 147-157.

Abdalla, O.M. and P.M. Davidson, 1990. Effect of starter culture and antimicrobials on the growth of *Staphylocuccus aureus* in Gebna Beyda cheese. Institute of Food Technologists' Annual Meeting, Anaheim, California, June 16-20.

Abdalla, O.M., G.L. Christen and P.M. Davidson, 1993. Chemical composition of and *Listeria monocytogenes* survival in white pickled cheese. J. Food. Prot., 56: 841-846.

Ahmed, M.A., 1997. The common microorganisms in the Sudanese white soft cheese. Sud. J. Vet. Sci. Anim. Husb., 36: 109-112.

Aly, A.S. and E.A. Galal, 2002. Effect of milk pretreatment on the keeping quality of Domiati cheese. Pak. J. Nutr., 1: 132-136.

El Owni, O.A.O. and. I.A.O Hamid, 2008. Effect of storage period on weight loss, chemical composition, microiological and sensory characteristics of Sudanese white cheese (Gebna Beyda). Pak. J. Nutr., 7: 75-80.

Frank, F.J., L.G. Christen and L.B. Bullerman, 1992. Tests for groups of microorganisms. In Standard Methods for the Microbiological Examination of Dairy Products, 16th Edn., Ed., R.T. Marshal. Washington, DC: American Public Health Association, pp: 271-286.

Hamed, A.L., N.A. Elsaify, S.L. Faray and F. Orsi, 1992. Effect of pasteurization and storage conditions on the microbiological, chemical and organoleptic of Domati cheese during pickling. Egypt. J. Dairy Sci., 20: 177-190.

Hamid, I.A.O. and O.A.O. El Owni, 2007. Microbiological properties and sensory characteristics of white cheese (Gebna Beyda) Collected in Zalingei Area, West Darfur State (Sudan). Int. J. Anim. Vet. Sci., 2: 61-65.

Houghtby, A.G., L.J. Maturin and K.E. Koenig, 1992. Microbiological count methods. In Standard Methods for the Examination of Dairy Products, 16th Edn., Ed., R.T. Marshal. Washington, DC: American Public Health Association, pp: 213-246.

Ibrahim, A.A., 2003. Effect of processing and storage condition on the chemical composition and microbial quality of white soft cheese. M.Sc. Thesis University of Khartoum, Sudan.

Khalid, E.A., 1990. The effect of salt concentration on the yield and chemical composition of Sudanese white soft cheese. M.Sc. Thesis, University of Khartoum, Sudan.

Khateeb, A.H., 1997. An attempt to Standardize the Manufacturing Procedure for Sudanese White Cheese. M.Sc. Thesis, University of Khartoum, Sudan.

Lifton, R.P., A.G. Gharavi and D.S. Geller, 2001. Molecular mechanisms of human hypertension. Cell, 104: 545-556.

Mohammed, H.S.E., 2009. Microbial and Sensory Characteristics of Low Salt White Soft Cheese (Gebna Beyda) During Storage. M.Sc. Thesis, University of Khartoum, Sudan.

Nour Eldiam, M.S.A. and I.E.M. El Zubeir, 2006. Comparison of Microbiological Quality of Processed Cheese and Non Processed Sudanese White Cheese. USA J. Microbiol., 1: 273-279.

Nuser, S.N.M., 2001. The effect of cooking and vacuum packaging on the quality of white soft cheese. M.Sc. Thesis University of Khartoum, Sudan.

Patel, M. and S. Bayoumi, 1988. Effect of soluble salts, ultra filtration process and processing temperature on rennet coagulation properties of milk. Japanese J. Dairy Food Sci., 73: A-61-A-65.

Siew, K.L., A. Skelte and K. Henning, 2004. The influence of moisture content on the reheological properaties of processed cheese spreads. Int. J. Food Sci. Technol., 39: 763-769.

SPSS, 2004. Statistical Package for Social Science, version 13.0. SPSS, Inc., Chicago, IL, USA.

Vinderola, C.G., W. Prosello, D. Ghiberto and J.A. Reinheimer, 2000. Viability of probiotic (*Bifidobacterium*, *Lactobacillus acidophilus* and *Lactobacillus casei*) and nonprobiotic microflora in Argentinian Fresco cheese, J. Dairy Sci., 83: 1905-1911.

Warsama, L.M., I.E.M. Elzubeir and O.A.O. El Owni, 2006. Composition and hygienic quality of Sudanese white cheese in Khartoum North markets (Sudan). Int. J. Dairy Sci., 1: 36-43.