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Effect of Storage Period on the Quality of Sudanese White Cheese (*Gibna Bayda)* Manufactured with *Solanum dubium* Extract

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Abstract: The objective of this study was to evaluate the effect of storage period on weight loss, chemical composition and microbiological and sensory characteristics of white cheese (*Gibna Bayda*) manufactured using *Solanum dubium* enzyme extract. Cheese was made (25 ml of extract /50 L milk), stored for 90 days at 35°C and evaluated for weight loss, chemical composition and microbiological and sensory characteristics at 1, 15, 30, 45, 60, 75 and 90 days. The results indicated that storage period significantly increased weight loss and chemical components except salt content. Storage period had a significant effect on titratable acidity and protein content of whey. Total viable bacteria, streptococci and lactobacilli counts (Log_{10} cfu/gm) decreased as the storage period progressed. There was a slight improvement in flavour and a decrease in saltiness, during storage, but there was no significant effect on cheese colour and texture.

Key words: *Solanum dubium*; storage period; chemical; microbiological; sensory

INTRODUCTION

Cheese making, as a means of preserving the most important constituents of milk in highly concentrated form, is known around the world, and it provides a palatable milk product of high nutritional value which can be kept fresh for a long time. Cheese is a good source of milk protein, rich in calcium and vitamins.

The majority of cheeses around the world is manufactured traditionally, and in many cases is still manufactured using an enzymatic coagulant extracted from the abomasa of milk fed calves (Guinee and Wilkinson 1992). Plant proteases have been investigated as milk coagulants, but only a small number of aspartic proteinases of plant origin have been isolated and partially characterized (Tavaria *et al*. 1997; Sousa 1998).

Many aspartic and other proteinases are obtained from plants and some have been studied as coagulants, i.e. proteinases from *Benincasa cerifera* (Gupta and Eskin 1977), *Calotropis procera* (Ibiama and Griffiths 1987; Mohamed and O'Connor 1996), *Dieffenbachia maculate* (Padmanabhan *et al*. 1993), *Centaurea calcitrapa* (Tavaria *et al*. 1997), flowers of *Cynara cardunculus* (Sousa 1993, 1998), the root latex of *Jacaratia corumbensis* (Duarte *et al*. 2009) and fruit parts of *Solanum dubium* (Yousif *et al.* 1996; Osman 2001). *Solanum dubium* "Gubbain" is a well known wild plant that grows widely in Khartoum, White Nile, Blue Nile, Gezira, Kordfan and Darfour states during the rainy season (Salih 1979).

Sudanese white cheese (*Gibna Bayda*) is the most common cheese of Sudan, having a strong odour and taste. It is made from raw or pasteurized whole milk, skim milk or reconstituted milk depending on the natural lactic acid bacteria (El Owni and Hamid 2008). Cheese ripening is a very complex biochemical process by which the rubbery or elastic curd is converted into a smooth-bodied and fully flavoured cheese. Flavour and texture are considered the two main criteria in determining the acceptability of the aged cheese. The time required for developing characteristic flavour and texture varies from a few weeks for soft up to three years for very hard cheeses (Kheadr *et al*. 2003).

The objective of this study was to evaluate the weight loss, chemical composition and microbiological and sensory characteristics during storage of white cheese *(Gibna Bayda)* made by *Solanum dubium* fruit extract.

MATERIALS AND METHODS

Cheese manufacture

The cheese was manufactured in the Biochemistry Laboratory, Faculty of Agriculture, University of Sinnar, Sudan. Three batches of white cheese (*Gibna Bayda*) were made. Raw milk was strained by a clean cloth, heated to 62°C for 30 minutes, cooled to 40°C and salt (8%) was added. Partially purified extract of *Solanum dubium* fruit (25 ml/50 L milk) was added to the milk followed by stirring for 10 minutes and left undisturbed to develop a curd. After coagulation, the curd was cut for whey separation and poured into a wooden mould lined with a clean cloth and pressed by a heavy weight (4 kg) for 16 hours. Next day, the curd was removed from the mould, cut into small cubes (2x2x2 cm) and stored at 35°C for 90 days. Weight loss, chemical composition and microbiological and sensory characteristics were determined at 1, 15, 30, 45, 60, 75 and 90 day intervals, while the whey was only analyzed for chemical composition.

Chemical composition

The titratable acidity and total solids, protein and ash contents were determined according to AOAC (1990) and fat content was determined according to Foley *et al* (1974), soluble protein according to Ling (1963) and salt content according to Breene and Price (1961). Tyrosine and tryptophan contents were determined according to Vakaleris and Price (1958).

Microbiological examination

The cheese was examined for total viable bacteria and streptococci and lactobacilli counts. To 99 ml sterile distilled water, 11g cheese were aseptically added and mixed thoroughly to make 10^{-1} dilution (Houghtby *et al.* 1992). One millilitre from the above-mentioned dilution was aseptically transferred to 10 ml sterile distilled water, and the procedure was repeated to make serial dilutions. One millilitre from each dilution

was transferred to a sterile Petri-dish (in duplicate), mixed gently with the appropriate culture medium and left to solidify and incubated in an inverted position. Total viable bacterial count was made, according to Houghtby *et al.* (1992), using standard plate count agar medium, and the plates were incubated at 37°C for 48 hours. Streptococci count was carried out, according to Oksuztepe *et al*. (2005), using M17 agar medium, and the plates were incubated at 37°C for 48 hours. Lactobacilli count was made, according to Frank *et al.* (1992), using MRS agar medium and the plates were incubated at 37°C for 48 hours.

Sensory evaluation

A panel of 10 untrained panelists were chosen and asked to judge the quality of cheese (colour, flavour, texture and saltiness) using an evaluation sheet where colour ranged from 1 = not acceptable to 7 = acceptable; flavour 1 = bland to 9 = extremely intense; texture 1 = very hard to 9 = very soft; saltiness 1 = poor to 9 = over salted. Cheese samples were placed in white plastic dishes, labeled and placed on benches in a way that there was no interference between the panelists. Water was provided for the panelists to rinse the mouth after each taste.

Experimental design and statistical analysis

Completely randomized design and general linear models (GLM) were used. Statistical analyses were carried out by SPSS (Statistical package for social sciences) program (ver. 12). Duncan's multiple range test at $P \leq 0.05$ was used for mean separation.

RESULTS AND DISCUSSION

Weight loss

Storage period significantly ($P<0.001$) increased weight loss (Table 1). The lowest weight loss was obtained after 15 days of storage and the highest after 90 days. These findings are in agreement with those of Nuser (2001) and El Owni and Hamid (2009) who reported that weight loss of the Sudanese white cheese increased as the storage period progressed.

Table 1. Effect of storage period on weight loss and chemical composition of white cheese

Storage period (days)	Weight loss (%)	Acidity (%)	Total solids (%)	Fat (%)	Protein (%)	Soluble protein (%)	Salt (%)	Ash (%)	Tyrosine (mg/100g cheese)	Tryptophan (mg/100g Cheese)
1	0.00	0.56^{d}	46.40^{b}	22.25^{b}	15.53^{b}	0.71^{ab}	4.63^{a}	3.92^{a}	1.50^{b}	0.44^{ab}
15	8.40^{c}	0.84^{c}	50.33^{a}	23.67^{b}	19.01^{a}	0.56^{b}	4.37^{a}	3.29^{ab}	1.87^{a}	0.51^{a}
30	13.22^{b}	0.88^{c}	52.61^{a}	26.75^{ab}	17.97^{ab}	0.71^{ab}	4.40^{a}	3.16^{ab}	1.56^{b}	0.46^{ab}
45	17.46^{b}	1.03^{b}	52.33^{a}	26.67^{ab}	17.85^{ab}	0.98^{a}	4.42^{a}	3.44^{ab}	1.61^{ab}	0.45^{ab}
60	22.13^{a}	1.32^{a}	52.50^{a}	26.38^{ab}	15.98^{b}	0.75^{ab}	4.42^{a}	2.51^{c}	1.27^{c}	0.39^{b}
75	23.41^{a}	1.09^{b}	50.18^{a}	27.42^{a}	18.36^{a}	0.70^{ab}	4.32^{a}	2.37^{c}	1.33^{c}	0.37^{b}
90	27.82^{a}	0.96^{b}	52.20^{a}	28.58^{a}	17.76^{ab}	0.53^{b}	4.33^{a}	2.97^{b}	1.21^{c}	0.36^{b}
L.S.	***	***	***	***	**	*	NS	*	***	**

Mean values bearing different superscripts within a column are significantly ($P<0.05$) different.
L.S. = Level of significance
*** = ($P<0.001$)
**= ($P<0.01$)
* = ($P<0.005$)
NS = Not significant

Effect of storage period on the chemical composition of white cheese

The titratable acidity significantly (P<0.001) increased with advancing storage period, with the maximum being at day 60, followed by a gradual decrease towards the end (Table 2). These results are in accord with those reported by Nuser (2001), Kilio *et al*. (2004) and El Owni and Hamid (2008, 2009). The increase in titratable acidity till day 60 could be attributed to growth of lactic acid bacteria leading to increased level of lactic acid (Walstra *et al*. 1999). On the other hand, the decrease in titratable acidity towards the end might be attributed to increased level of lactic acid which has an antagonistic effect on lactic acid bacteria and also may be due to depletion of lactose sugar.

Table 2. Effect of storage period on chemical composition of whey from white cheese

Storage period (days)	Acidity (%)	Total solids (%)	Fat (%)	Protein (%)	Salt (%)	Ash (%)
1	0.21^{c}	14.27^{a}	0.37^{a}	1.03^{c}	7.92^{a}	6.00^{a}
15	1.14^{b}	14.68^{a}	0.30^{a}	1.45^{ab}	8.25^{a}	6.41^{a}
30	1.27^{b}	14.50^{a}	0.55^{a}	1.83^{ab}	8.23^{a}	7.12^{a}
45	1.56^{a}	14.98^{a}	0.42^{a}	2.07^{a}	8.28^{a}	7.45^{a}
60	1.44^{ab}	14.88^{a}	0.25^{a}	1.68^{b}	7.83^{a}	7.17^{a}
75	1.61^{a}	14.63^{a}	0.25^{a}	1.81^{ab}	8.37^{a}	7.37^{a}
90	1.32^{bcd}	14.84^{a}	0.37^{a}	1.69^{b}	8.25^{a}	6.85^{a}
L.S.	***	NS	NS	*	NS	NS

Mean values bearing different superscripts within a column are significantly (P<0.05) different.
L.S. = Level of significance
*** = (P<0.001)
* = (P<0.05)
NS = Not significant

The total solids content gradually increased towards the end of storage period with a slight decrease at day 75. These findings agree with those of El Owni and Hamid (2008) who reported that the total solids content of white soft cheese increased during storage period. The increase was due to continuous loss of moisture from the curd as a result of lactic acid development which caused curd contraction (El Owni and Hamid 2008). However, the decrease in total solids content from day 15 to day 75 was possibly due to proteolytic effect of microorganisms on the protein and dissolution of fat and salt into the pickling solution (Abdalla and Nuser 2009). Talib *et al*. (2009) indicated that the decrease in moisture content during pickling period might be attributed to contraction of cheese curd as a result of acid development throughout the pickling period, which helps to expel the whey from cheese curd, as well as the effect of osmotic pressure on brine solution.

The fat content was significantly ($P<0.001$) affected by the storage period; it increased gradually to a maximum at day 90 (Table 1). These results are in accord with the findings of Talib *et al.* (2009) and in disagreement with those of El Owni and Hamid (2008) who reported a decrease in fat content during storage period which was due to lipolytic activity of microorganisms on fat resulting in leakage of some fat from curd into pickling whey.

The storage period significantly ($P<0.01$) affected the protein content of cheese, with the highest value being at day 15, decreasing at day 60, before increasing again at day 75 and then slightly decreased towards the end (Table 1). The irregular pattern of protein content during storage may be attributed to decrease in moisture content (Abdel Razig 1996; El Owni and Hamid 2008) and protein degradation leading to formation of water soluble compounds (Abdalla and Nuser 2009). The soluble protein content significantly ($P<0.05$) decreased at day 15, then gradually increased at day 45 before greatly decreasing towards the end (Table 1). These results agree with those of Abdel Razig (1996), El Owni and Hamid (2008) and Hayaloglu *et al*. (2002) who reported that proteolysis in pickled cheeses, such as Feta, Domiati and white cheese, occurs during storage. However, the decrease in soluble protein from day 60 till the end of the storage

period may be due to the fact that proteolytic bacteria were not able to grow and function.

The salt content was not significantly affected by the storage period, although it slightly decreased from 4.63% at day 1 to 4.33% at the end. The ash content was significantly ($P<0.05$) decreased by the storage period, which was possibly due to diffusion of salt from the curd into the pickling whey (Abdalla 1992). These results are not similar to those of Abdalla and Nuser (2009) who found that the ash content of cooked vacuum packaged white cheese increased with the advancement of storage period. El Owni and Hamid (2008) reported that the ash content of cheese increased from day 120 to day 240.

The tyrosine and tryptophan contents significantly increased from the beginning of storage period till day 45, and then decreased at the end. The lowest tyrosine and tryptophan contents were, respectively, 1.30 and 0.37 mg/100g cheese at day 90. The increase in tyrosine and tryptophan at the beginning of storage may be due to excessive proteolysis of protein. Abdel Razig (1996) and El Owni and Hamid (2008) reported that tyrosine and tryptophan contents increased as the storage period progressed.

Effect of storage period on chemical composition of whey

The storage period significantly ($P<0.001$) increased the titratable acidity of whey from 0.21% at day 1 to 1.56 % at day 45, before decreasing to 1.32% at the end (Table 2). There was no significant difference in total solids, fat, salt and ash contents of whey. The protein content of whey significantly ($P<0.05$) increased during the storage period to a maximum at day 45, before slightly decreasing towards the end.

Effect of storage period on microbiological quality

Total viable bacterial count (TVBC) significantly ($P<0.01$) decreased from 2.4×10^7 at day 1 to 1.36×10^4 at day 90 (Table 3). Increase in TVBC during the early storage periods (day 15 to 75) could be attributed to rapid growth of microorganisms; however, the decrease from day 75 to day 90 may be attributed to lactic acid production (antagonistic effect). Similar results were obtained by Nour El Diam and El Zubeir (2006) and

El Owni and Hamid (2008). Streptococci count was significantly ($P<0.05$) decreased with progress in the storage period from 8.1×10^{7} at day 1 to 8.85×10^{3} at day 90. Similarly, lactobacilli count was significantly ($P<0.001$) decreased from 9.25×10^{6} at day 1 to 6.22×10^{3} at day 90.

Table 3. Effect of storage period on microbiological quality of white cheese

Storage period (days)	TVBC (cfu/g)	Streptococci count (cfu/g)	Lactobacilli count (cfu/g)
1	2.40×10^{7a}	8.10×10^{7a}	9.25×10^{7}
15	4.42×10^{6ab}	4.15×10^{6b}	4.58×10^{6ab}
30	4.87×10^{6ab}	4.67×10^{6b}	5.32×10^{6ab}
45	3.48×10^{5b}	3.44×10^{5b}	4.03×10^{5b}
60	5.30×10^{5b}	1.04×10^{6b}	1.69×10^{6ab}
75	3.62×10^{4c}	1.17×10^{5ab}	3.09×10^{4c}
90	1.36×10^{4c}	8.85×10^{3}	6.22×10^{3c}
L.S.	**	*	***

Mean values bearing different superscripts within a column are significantly ($P<0.05$) different.
L.S. = Level of significance
***= ($P<0.001$)
** = ($P<0.01$)
* = ($P<0.05$)
TVBC = Total viable bacterial count

Effect of storage period on sensory characteristics

The storage period did not affect the colour of cheese, although the best score was obtained at day 30 (Table 4). These findings are in agreement with those of Nuser (2001) who reported that storage period did not affect the colour of Sudanese white cheese during storage period of 45 days, and in disagreement with Abdel Razig (1996) and El Owni and Hamid (2008). Tarakci and Kuckoner (2006) reported that the appearance and colour scores increased generally during ripening in Turkish Kashar cheese.

The flavour was significantly (P<0.01) decreased by the storage period, with the scores increasing to a maximum at day 15, then slightly decreased at day 30 and 45 and increased again at day 75, followed by a decrease at the end. Similar results were found by Abdel Razig (1996) and El Owni and Hamid (2008).

Table 4. Effect of storage period on sensory characteristics of white cheese

Storage period (days)	Colour	Flavour	Texture	Saltiness
1	5.80^{a}	5.00^{b}	5.98^{a}	6.42^{a}
15	6.00^{a}	6.63^{a}	5.68^{ab}	5.63^{ab}
30	6.40^{a}	5.77^{ab}	5.53^{ab}	5.33^{ab}
45	6.02^{a}	5.73^{ab}	5.05^{b}	5.60^{ab}
60	6.10^{a}	6.03^{a}	5.22^{b}	5.17^{b}
75	5.87^{a}	6.33^{a}	5.63^{ab}	6.13^{a}
90	6.07^{a}	5.70^{ab}	5.50^{ab}	5.53^{ab}
L.S.	NS	**	*	*

Mean values bearing different superscripts within a column are significantly (P<0.05) different.
L.S. = Level of significance
**= (P<0.01)
* = (P<0.005)

The texture was not significantly affected by the storage period, and the best score was at day 1. These results are not in line with those of Abdel Razig (1996) and El Owni and Hamid (2008) who found that the storage period had a significant effect on texture of cheese. The saltiness was significantly (P<0.05) affected by storage, with the highest score being at day 1, then steadily decreased till day 60 and increased again at day 75 followed by a decrease towards the end. Similar results were reported by Abdel Razig (1996) and El Owni and Hamid (2008). Kur (1992) found that cheese showed a superior quality during 30 days of storage, then the quality deteriorated as the acidity continued to increase; however, cheese was still acceptable after 90 days of storage.

CONCLUSION

The quality (chemical and microbiological) as well as flavour and saltiness of the cheese made from *Solanum dubium* extract are significantly changed during storage, unlike colour and texture.

REFERENCES

Abdalla, O.M. (1992). Effect of *Processing Conditions on the Microbiological and Chemical Properties of White Soft Cheese*. Ph.D. thesis. University of Tennesse, Knoxville, U.S.A.

Abdalla, O.M.M. and Nusr, S.M. (2009). Effect of storage period on chemical composition and sensory characteristics of vacuum packaged white soft cheese. *Pakistan Journals of Nutrit*ion 8(2), 145-147.

Abdel Razig, A.K. (1996). *Production of White Soft Cheese from Different Milk Sources*. M.Sc. thesis. University of Khartoum, Sudan.

AOAC (1990). *Official Methods of Analysis*, 15th edition. Association of Official Analytical Chemists (AOAC). Washington, D.C., U.S.A.

Breene, W.M. and Price, W.V. (1961). Dichlorofluorescent and potassium chromate as indicator in titration test for salt in cheese. *Journal of Dairy Science* 44, 722-729.

Duarte, A.R.; Duarte, D.M.R.; Moreira, K.A.; Cavalcanti, M.T.H.; de Lima-Filho, J.L. and Figueiredo, A.L. (2009). *Jacaratia corumbensis* O. Kuntze a new vegetable source of milk-clotting enzymes. *Brazilian Archieves of Biology and Technology* 52, 1-9.

El Owni, O.A.O. and Hamid, O.I.A. (2008). Effect of storage period on weight loss, chemical composition and microbiological and sensory characteristics of Sudanese white cheese (*Gibina Bayda*). *Pakistan Journal of Nutrition* 7(1), 75-80.

El Owni, O.A.O. and Hamid, O.I.A. (2009). Effect of type of storage container on weight loss, chemical composition, microbiological properties and sensory characteristics of Sudanese white cheese (*Gibna Bayda*). *Australian Journal of Basic and Applied Sciences* 3(2), 432-439.

Foley, J.; Buckley, J. and Murphy, M. F. (1974). *Commercial Testing and Product Control* in *the Dairy Industry*. University of Maryland, College Park, Maryland, U.S.A.

Frank, J.F.; Christen, G.L. and Bullerman, L.B. (1992). Tests for groups of microorganisms, pp. 271-286. In: *Standard Methods for the Examination of Dairy Products*, 16th edition. R.T. Marshall (Edt.). American Public Health Association, Washington, D.C.

Guinee, T.M. and Wilkinson, M.G. (1992). Rennet coagulation and coagulants in cheese manufacture. *Journal of the Society of Dairy Technology* 45 (4), 94–104.

Gupta, S.K. and Eskin, N.A.M. (1977). Potential use of vegetable rennet in the production of cheese. *Food Technology* 31, 62–64.

Hayaloglu, A.A.; Guven, M. and Fox, P.F. (2002). Microbiological, biochemical and technological properties of Turkish white cheese 'Beyaz Peynir'. *International Dairy Journal* 12 (8), 635-648.

Houghtby, G.A.; Maturin, L.J. and Koenig, E.K. (1992). Microbiological count methods, pp. 213- 246. In: *Standard Methods for the Examination of Dairy Products*, 16th edition. R.T. Marshall (Edt.).: American Public Health Association. Washington, D.C.

Ibiama, E. and Griffiths, M.W. (1987). Studies on a milk-coagulating enzyme, calotropain, obtained from sodom apple (*Calotropis procera*). *Journal of the Science of Food and Agriculture* 1,157–162.

Kheadr, E.E.; Vuillemard, J.C. and El- Deeb, S.A. (2003). Impact of liposome-encapsulated enzyme cocktails on cheddar cheese ripening. *Food Research International* 36,241-252.

Kilio, S.; Harun, U.; Gokhan, K.; Necati, A. and Harun, K. (2004). Manufacture and some properties of Turkish freh goat cheese. *Pakistan Journal of Biological Science* 7 (6), 1037-1039.

Kur, L. L.A (1992). *Effect of Storage on the Quality and Chemical Composition of Sudanese White Soft Cheese*. M.Sc. thesis. University of Khartoum, Sudan.

Ling, E.R. (1963). *A Textbook of Dairy Chemistry*, Vol. 2. Chapman and Hall Ltd. London.

Mohamed, A.M. and O'Conner, C.B. (1996). Milk coagulation by *Calotropis procera* juice: Effects of Juice, storage time and temperature, trial for cheese making. *Indian Journal of Dairy Science* 49 (4), 277-285.

Nour El Diam, M.S.A. and El Zubeir, I.E.M. (2006). Comparison of microbiological quality of processed and non-processed Sudanese white cheese. *Research Journal of Microbiology* 1(3), 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.

Oksuztepe, G.; Patir, B. and Calicioglu, M. (2005). Identification and distribution of lactic acid bacteria during the ripening of Savak Tulum cheese. *Turkish Journal of Veterinary and Animal Sciences* 29, 873-879.

Osman, D.A.A. (2001). *Studies on a Rennet Substitute from Solanum dubium* Fresen *(Gubbain)*. Ph.D. thesis. University of Khartoum, Sudan.

Padmanabhan, S.; Chitre, A. and Shastri, N.V. (1993). Milk clotting protease isolated from *Dieffenbachia maculata*. *Nahrung* 37, 99–101.

Salih, H.M. (1979). *Investigation of Alkaloidal Content of Certain Solanum* species. M.Sc. thesis. University of Khartoum, Sudan.

Sousa, M.J. (1993). *Plant Rennet Substitute from Flowers of Cynara cardunculus*. M.Sc. thesis, National University of Ireland, Cork, Ireland.

Sousa, M.J. (1998). *Characterization of the Proteolytic Action of the Flowers of Cynara cardunculus in Ovine, Caprine and Bovine Cheeses*. Ph.D. thesis. Escola Superior de Biotecnologia, Universidade Católica Portuguesa, Porto, Portugal.

Talib, M.A.; Abubakar, M.M.; Jideani I.A. and Hassan, A. (2009). Use of Jiben seeds extract to manufacture soft white cheese. *American Journal of Applied Sciences* 6(4), 551-554.

Tarakci, Z. and Kucukoner, E. (2006). Changes in physicochemical, lipolysis and proteolysis of vacuum packed Turkish Kasar cheese during ripening. *Journal of Central European Agriculture* 7 (3), 459-464.

Tavaria, F.K.; Sousa, M.J.; Domingos, A.; Malcata, F.X.; Brodelius, A.; Clemente, A. and Pais, M.S. (1997). Degradation of caseins from different milk types by extracts of *Centaurea calcitrapa*. *Journal of Agriculture and Food Chemistry* 45, 3760–3765.

Vakaleris, D.G. and Price, V.V. (1958). A rapid spectrophotometric method for measuring cheese ripening. *Journal of Dairy Science* 42, 264-276.

Walstra, P.; Geurts, T. J.; Noomen, A.; Jellemena, A. and Nan Boekel, M.A.J.S. (1999). *Dairy Technology Principles of Milk Properties and Processing*, 3rd edition. Marcel Dekker, Inc. New York, pp. 325-608.

Yousif, B. H.; McMahon, D. J. and Shammet, K. M. (1996). Milk clotting enzyme from *Solanum dubium* plant. *International Dairy Journal* 6, 637-644.

مجلة جامعة الخرطوم للعلوم الزراعية: المجلد التاسع عشر – العدد الثانى ، 2011م

تأثير فترة التخزين على نوعية الجبن الأبيض المصنع باستخدام المنفحة المستخلصة من نبات الجبين

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المستخلص: هدفت الدراسة إلى تقييم تأثير فترة التخزين على الفقد فى الوزن والتركيب الكيميائي والصفات الميكروبيولوجية والحسية للجبن الأبيض المصنع باستخدام المنفحة المستخلصة من نبات الجبين (*Solanum dubium*) . صنع الجبن باستخدام تركيز 25 مل من المنفحة لكل 50 لتر من اللبن وخزن الجبن عند درجة حرارة 35 مئوية لمدة 90 يوماً ، وتم تحديد الفقد في الوزن والتركيب الكيميائي والصفات الميكروبيولوجية والحسية فى الأيام : 1 ، 15 ، 30 ، 45 ، 60 ، 75 ، 90 . أوضحت النتائج أن فترة التخزين أثرت معنويا على الفقد في الوزن والتركيب الكيميائي عدا نسبة الملح في الجبن ، كما أثرت فترة التخزين على الحموضة العيارية والبروتين فى الشرش ، بينما لم تؤثر على نسبة الجوامد الكلية والدهن والملح والرماد . أثرت فترة التخزين معنوياً على العد الكلي للبكتيريا والبكتيريا السبحية (streptococci) وبكتيريا حمض اللاكتيك (lactobacilli) ، ومع تقدم فترة التخزين نقصت أعداد البكتيريا . كان لفترة التخزين تأثير معنوي على نكهة وملوحة الجبن ، بينما لم يؤثر التخزين على اللون والملمس .