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CHEMICAL, SENSORY, RHEOLOGICAL AND MICROSTRUCTURAL ATTRIBUTES OF LOCAL WHITE SOFT CHEESE VARIETIES

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ABSTRACT

Nine white soft cheese varieties resemble the local production from the large and small scale plants were collected. The cheeses were grouped in five comparative groups represented the most important elements which affect the cheese attributes. Chemical composition, sensory evaluation, texture profile analysis (TPA) and microstructure of all cheese brands were determined. Data obtained were analyzed and compared between and within cheese groups. A wide range of variations were found in all parameters measured ($P< 0.05$). Chemical composition differences were more pronounced as a function of manufacture technique and ripening conditions. As for sensory evaluation, the UF *Tallaga* cheese scored the highest, whilst traditional cheese scored the least. Texture profile analysis (TPA) indicated that the highest parameters were hardness and brittleness for TSP brand, cohesiveness and springiness for TTP brand and adhesiveness, gumminess and chewiness for HFP brand among UF and traditional cheeses. Within cheese groups the biggest variation in TPA were found in groups 4 and 5, which represent the manufacture technique and ripening conditions. The only clear variation in cheese microstructure was obtained between fresh UF and traditional ripened cheeses.

INTRODUCTION

In Egypt, a very large dramatically amount of white soft cheeses are produced by large and small scale plants. These cheeses vary in physical, rheological and organoleptical properties throughout the local plants and present a wide range of texture. Texture is one of the most important factors that determine the quality of cheese. Cheese has a complicated structure due to the interaction of milk components (water, protein, fat and salts). The cheese structure may resemble that of a three dimensional network (Masi and Addeo, 1987), it is non-homogeneous and may vary tremendously in the same plant. Even so, each batch of cheese might exhibit different structure properties.

Although, white soft cheese is the most popular variety of cheeses for the Egyptian consumers, its manufacturing procedure, additives and recipes are considered as a function of the producer. The milk may optionally be pasteurized, homogenized, hydrogen peroxide-catalase treated, phosphated, citrated, ripened with culture, partially skimmed or fortified with skim milk powder. While most of the knowledge of the physical, rheological and microstructural properties of hard cheeses and some soft cheeses have been reported (Cooper, 1987; Lucisano *et al.*, 1987), there have been no similar reports on the Egyptian white soft cheese. Quantitative descriptions of its rheological and microstructural qualities as well as physical standards have not been established. For this reason, cheese quality varies from one manufacturer to another, leading to a delay in the improvement in cheese quality and has provided no protection for the consumer.

Accordingly, the objective of the present study is to investigate the rheological variations of the local white soft cheese brands either produced in large or small scale dairy plants. In addition, to figure out a comprehensive identification of its different chemical, rheological and organoleptic criteria as well as microstructure which in turn may help in the hypothesis of enhancement and standardization of white soft cheese texture attributes.

MATERIALS AND METHODS

Cheeses

Nine commercial trade markets of white soft cheeses (seven UF and two traditional cheeses) were chosen for this study. UF-cheeses were fresh (1-7 days) except Halayeb full-fat cheese (3 months refrigeration). Traditional cheeses were *Tallaga* cheese; 3 months refrigeration; and *Stanboully* cheese; 7 months at room temperature. UF-cheeses were obtained from 4 large scale plants while traditional cheeses were obtained from local market. Each two brands of the same attributes were formulated in one group, creating 5 groups as shown in Table (1). All cheeses were full fat except group 3 (HRP & MRP) which were low salt and reduced fat cheeses.

Table (1): White soft cheese samples; groups; codes of trade markets.

Cheese group [a]	Code	Trade market
1. Tallaga	GFP	Green land UF Tallaga cheese.
	DFP	Domti UF Tallaga cheese.
2. Aseptic package	MFA	El-Masrein UF cheese.
	GFA	Green land UF cheese.
3. Half-cream	HRP	Halayeb UF cheese.
	MRP	El-Masrein UF cheese.
4. Manufacture technique	TTP	Traditional Tallaga cheese.
	HFP	Halayeb UF Tallaga cheese.
5. Ripened types	TTP	Traditional Tallaga cheese.
	TSP	Traditional Stanboully cheese.

[a] Group 1, 3, 4 and 5 cheeses were packed in plastic package.

Chemical composition

Fat, total calcium (T.Ca) and NaCl content were determined according to Ling (1963), Ntailianas & Whitney (1964), and IDF standard methods (17A: 1972), respectively. The pH value was measured using a digital pH meter with combined glass electrode (Jenway 3305, England). Moisture and ash contents, titratable acidity (TA) and total nitrogen (TN) as well as water soluble nitrogen (WSN) prepared by Polychroniadou *et al.*, (1999) were determined according to (AOAC, 1990). WSN was expressed as (WSN/TN)%.

Rheological assessments

Cheese cubes (25 x 25 x 25 mm) 20 mm depth of the cheese blocks were used to measure the texture employing Instron Universal Testing Machine model 4302 (Instron Ltd, High Wycombe HP12 35Y, UK), equipped with a flat plunger 35 mm in diameter attached to the cross-head and a 100 N (10 kg) load cell. Testing conditions were as follows: samples were compressed axially in two consecutive cycles with 75% deformation (18.75 mm) from the initial sample's height. The speed of the cross-head was set at 25 mm/min. Allbrit Planimeter (UK) was used to measure the area under the response curve. The textural parameters assessed from the TPA test are hardness, brittleness, cohesiveness, adhesiveness, springiness, gumminess, and chewiness.

Cheese microstructure

Cheese samples were prepared for SEM examination according to El-Zeny, (1991). Specimens were viewed in a JEOL – jsm 5200 scanning electron microscope operating at 10 KV accelerating voltages.

Sensory evaluation

Organoleptic assessment of the cheeses was carried out using a seven graduated scale (scores, 1 to 7) and reference substances to define the scale (Volikakis *et al.*, 2004) by an interest and experienced seven panelists, who are the members of dairy science department. The cheeses were evaluated for appearance (color and surface holes), body and texture (hardness and crumbliness), elasticity, taste (flavor and saltiness) and total impression. Preference scale (very undesirable, undesirable, a little undesirable, neutral, a little desirable, desirable and very desirable) was used for scoring total impression. Cheese samples were tempered by holding at ambient temperature (20 ± 5 °C) and then presented to the panelists in random order for testing. Water was provided for palates washing between samples. Cheese scoring was achieved at the same time of doing the rheological and chemical analysis.

Statistical analysis

The two-way analysis of variance (ANOVA) was performed by running the MSTAT-C (ver.2.10, MSU, USA.) package on a personal computer. The same program was used to analyze one Factor Randomized Complete Block Design. The statistical significance of the data was determined using *P* value at $\alpha = 0.05$.

RESULTS AND DISCUSSION

Chemical composition of white soft cheese

As shown in Table (2), moisture content of the white soft cheese brands collected from large scales plants or local markets was significantly ($P<0.05$) fluctuated among all cheeses as a function of the commercial trade brand. Half-cream brand (group 3; HRP) exhibited the highest moisture content (65.98%), whilst that of traditional brand (group 5; TSP) was the lowest (53.89%). This was expected since whey exudation is the case with the extension of ripening of traditional cheese (7 months). UF cheeses had also moisture content higher (60.36% vs 57.62%) than that of cheese made by traditional technique (Table 2, group 4) due to the higher water holding capacity of whey proteins retained in UF cheeses (El Soda and Abd El-

Salam, 2002;Abd El-Salam *et al.*, 1993; Werner, 1999). In addition, Moisture content of cheese ripened at low temperature significantly (P<0.05) increased compared with that ripened at room temperature (57.62 vs. 53.89%) (group 5 cheeses), which probably due to the swelling of protein at low temperature and the shrinking of protein and exclusion of moisture content by developing acidity at room temperature (Abd El-Salam *et al.*, 1993; Salama *et al.*, 1982). Furthermore, heat treatment if used in cheese processing gives a higher moisture cheese due to denaturation of whey proteins and its incorporation into the curd (Mottar *et al.*, 1989; Donovan and Mulvihill, 1987).

Table (2): Gross composition and chemical indices of local market white cheese samples.

Criteria	Group (1) (Tallaga)		Group (2) (Aseptic pack.)		Group (3) (Half-cream)		Group (4) (Manufacture Tech.)		Group (5) (Ripened types)	
	GFP	DFP	MFA	GFA	HRP	MRP	TTP	HFP	TTP	TSP
Moisture%	62.76	64.79	58.73	56.72	65.98	64.59	57.62	60.36	57.62	53.89
Fat%	19.50	18.33	19.17	22.17	16.67	14.17	18.17	22.17	18.17	18.67
F/DM (fat/dry matter)	52.36	52.07	46.44	51.22	48.98	40.01	42.86	55.92	42.86	40.48
Salt%	3.47	3.23	5.67	5.33	1.83	1.80	6.27	2.47	6.27	6.40
T.Ca (mg/100g) (total calcium)	345.93	379 37	249.40	213.87	241 03	316.50	463.57	251.50	463.57	316.50
Ash%	4.04	3.88	2.46	4.84	2.48	2.57	7.23	1.67	7.23	5.74
pH	4.95	6.19	4.20	4.95	5.98	5.06	5.07	4.21	5.07	3.92
TA% (titratable acidity)	0.43	0.18	1.24	1.76	0.29	0.28	1.38	1.35	1.38	2.61
TN%	1.86	1.39	1.38	1.30	1.63	1.78	2.07	1.19	2.07	2.43
WSN/TN%	6.81	6.71	9.89	9.21	6.54	7.28	6.27	8.14	6.27	7.55

All cheese brands had F/DM conformable to the Egyptian Legal Standard (EOSQC, 2000), except half-cream cheeses (group 3; HRP and MRP) which were higher F/DM (40 – 48%) than their corresponding Egyptian legal standard (20 – 35%). This increase may ascribed to the crucial role of milk fat in cheese quality attributes and to achieve the acceptability and agreement of consumer for that cheese brand (Drake and Swanson, 1995). Even though, F/DM significantly (P< 0.05) varied as a function of commercial trade markets.

It is obvious from Table (2) that UF-full fat cheeses contain higher fat and F/DM than that of traditional full-fat cheeses. which were consistent with Omar (1988) and Renner and Omeroglu (1981), who attributed the higher fat and protein contents of the UF cheeses to the greater recovery (retention) of fat and protein from the milk. Values of salt, T.Ca, ash, TA and pH of half-cream cheese brands significantly (P< 0.05) varied between both commercial brands (HRP and MRP).

Chemical composition (DM, TA, pH and TN) of *Tallaga* cheese brands (GFP and DFP) were significantly (P< 0.05) different as a function of the cheese brands. Unlike, the salt, T.Ca, ash contents which non significantly differed. In aseptic package cheese group 2 (MFA and GFA), chemical composition had a similar trend except that for TN%, which was not significantly changed, whilst the ash content significantly (P< 0.05) varied, probably due to some additives used in manufacturing processes by the producers. Moreover, the aseptic cheese brands exhibited the highest salt and WSN/TN% and lowest moisture content among all UF cheese brands.

Manufacturing technique and ripening conditions as shown in cheese group 4 and 5, respectively were responsible for the significant ($P< 0.05$) variation in all chemical composition elements determined (Table, 2). In general, traditional brands (TTP and TSP) possessed higher salt, T.Ca, ash and TN content than those of UF ones. Also, cheese ripened at room temperature (TSP) exhibited the lowest moisture content and pH values, whilst salt, TA and TN values compared not only to *Tallaga* cheese; TTP, *ripened in refrigeration;* but also to all cheese brands, were the highest. The forgoing results showed a large scope of variations between the plants in Egypt. Several authors reported some variations in chemical composition of white soft cheese as a result of processing technique used, UF & traditional methods, pickling conditions (such as temp., pH, pickling medium & time) (Erdem, 2004; Abd El-Salam *et al.*, 1993; Omar, 1988; Omar *et al.*, 1986).

Sensory evaluation

Table (3) presents simple profiles of sensory evaluation scores for the five cheese brands groups. There were significant ($P< 0.05$) variations detected among all organoleptic properties within each group of cheese brands except for GFP & DFP (group, 1) and HRP & MRP (group, 3) cheeses, which were more preferable to panelists. However, all UF cheeses exhibited higher score of appearance criteria than that of traditional ones, with the greatest score for full-fat *Tallaga* cheese (GFP and DFP) at 0.05 α level. Moreover, UF *Tallaga* cheeses obtained the highest taste score, which may be attributed to its clear white color, good saltiness perception and soft body & texture criteria, followed by traditional *Stanboully* cheese (TSP), properly due to its satisfactory levels of F/DM and its good pronounced flavor.

Table (3): Sensory attributes score (out of 7 degrees) of local market white cheese samples.

Criteria	Group (1) (Tallaga)		Group (2) (Aseptic pack.)		Group (3) (Half-cream)		Group (4) (Manufacture Tech.)		Group (5) (Ripened types)	
	GFP	DFP	MFA	GFA	HRP	MRP	TTP	HFP	TTP	TSP
Appearance (7) (color & surface holes)	6.375	6.438	6.063	5.750	6.500	6.125	4.219	5.750	4.219	4.125
Body and texture (7) (hardness & crumbliness)	5.875	5.625	4.438	4.438	5.250	5.313	4.188	5.000	4.188	4.875
Elasticity (7)	5.375	5.250	4.188	3.625	5.375	5.375	4.000	4.063	4.000	3.125
Taste (7) (flavor & saltiness)	5.250	5.250	3.875	3.875	4.125	4.250	3.000	4.125	3 000	5.000
Total score (28)	22.875	22.563	18.564	17.688	21.25	21.063	15.407	18.938	15.407	17.125

On the other hand, traditional *Tallaga* cheese (TTP) received the lowest acceptance score followed by UF aseptic packed cheese (GFA), which may be due to their poor flavor, high salt levels and their crumply body & texture. In spite of reducing fat content of half cream cheeses (HRP and

MRP), they received high scores for both taste and total impression as a reflection of their good appearance and texture properties. Regardless the high level of fat content of that type of cheese, the high score maintained relied on their satisfactory levels of moisture, salt and F/DM as well as some food additives that might be used.

Variations in organoleptic properties of white soft cheese were also recorded in literature (Mehaia, 2002; Romeih *et al.*, 2002; Hofi *et al.*, 2001; Hydamaka *et al.*, 2001; Abd El-Salam *et al.*, 1993; Kyle and Hickey, 1993; Omar, 1987; Hagrass *et al.*, 1986; Omar and Buchheim, 1986; Mahmoud, 1980).

Texture Profile Analysis (TPA)

Data of texture parameters in Fig. (1, a-e) clearly indicated that significant ($P< 0.05$) differences were found as a function of brand alteration. Stanboully cheese (TSP) characterized with the highest hardness; this finding was not surprising since Stanboully cheese exhibited the lowest moisture content and the highest acidity (Table, 2). Additionally, *Stanboully* cheese had the lowest cohesiveness, which was expected as a 7 months ripened cheese that possesed weak internal bonds. This relationship is in accordance with those of Volikakis *et al.* (2004); Ozer *et al.* (2003) and Romeih *et al.* (2002). Both traditional cheeses (TTP and TSP) were significantly ($P< 0.05$) varied in hardness, adhesiveness and springiness, whilst brittleness, gumminess, chewiness and cohesiveness values showed insignificant change. These variations were a function of cheese ripening at low-temperature (protein swelling), whilst cheese ripened at room temperature exhibited hard texture due to exudation of cheese serum as a result of acidity increasing and shrinking of protein matrix (Abd El-Salam *et al.*, 1993).

Texture profile also changed as a result of manufacture technique used (group 4). UF-cheese (HFP) exhibited significant ($P< 0.05$) increase in adhesiveness and gumminess values and non-significant higher hardness & chewiness and lower brittleness & springiness values than those of corresponding traditional cheeses (TTP). These results indicated that the work needed by the plunger to overcome the cheese attraction for HFP type was double that of TTP cheese, which may be due to the higher fat content of the cheese and the higher (WSN/TN) %. *Tallaga* cheeses (group 1, GFP and DFP) exhibited significant variation ($P< 0.05$) in all TPA parameters, except adhesiveness, with significant higher values for GFP compared with DFP cheese, which are in agreement with the significant decrease in its moisture content and increase in its F/DM, TN and TA% (Table 2). However, it was not the case regarding cheeses of aseptic package (group 2, MFA and GFA), which no showed significant changes among their TPA parameters, These results are in contrast with those of chemical composition (Table 2). It was also noted that brittleness values of *Tallaga* group (GFP and DFP) and half-cream group (HRP) cheese were not detected in TPA charts, reflecting that the force required for the first significant fracture in cheese sample is either equal to that needed to attain the given deformation or lower than the sensitivity of the test.

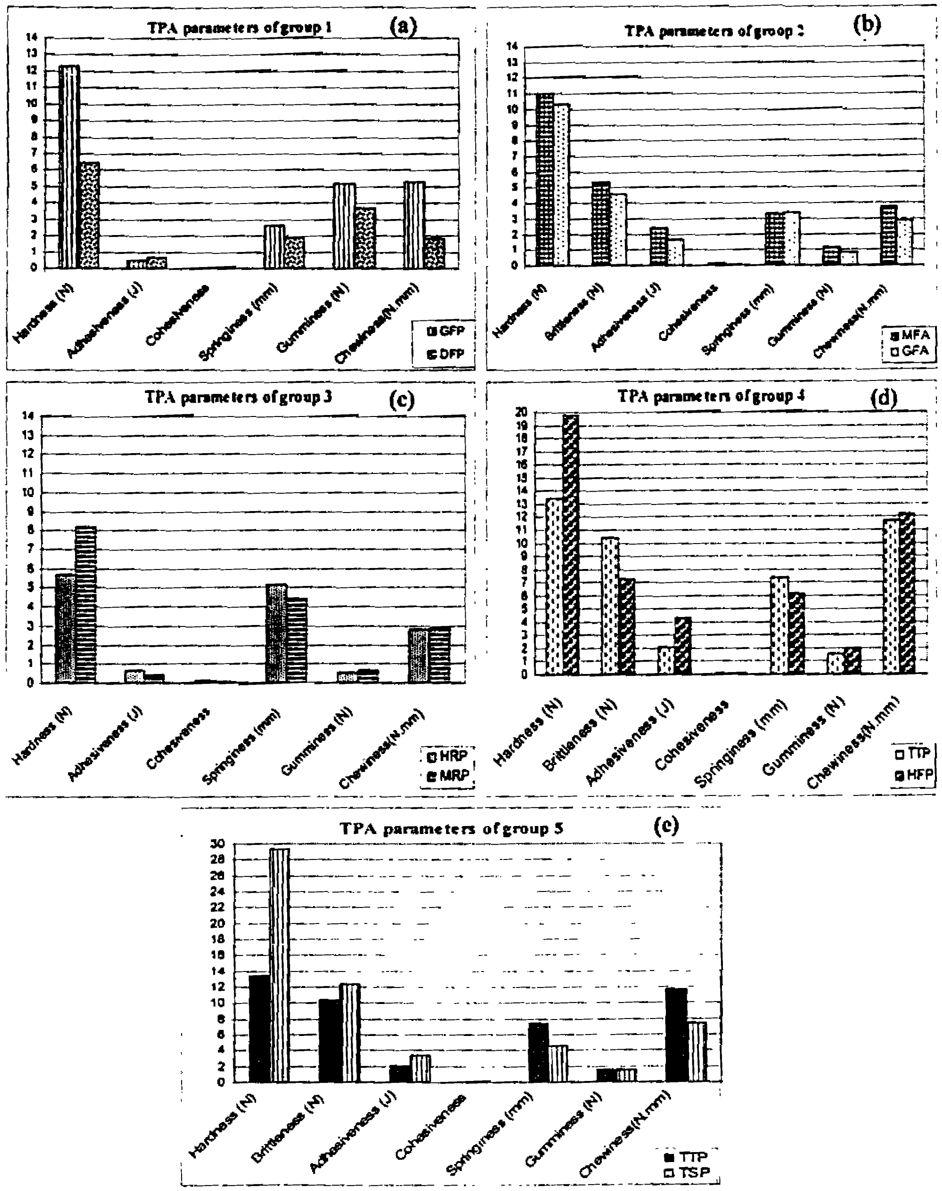

Fig. (1): Textural parameters as obtained by an instrumental texture profile analysis (TPA). Symbols a, b, c, d and e referred to cheese groups 1, 2, 3, 4 and 5, respectively.

However, MRP cheese exhibited significant higher value or hardness compared with those of HRP cheese, which may be attributed to their significant lower moisture (Table 2). These findings are in agreement with those reported by Volikakis *et al.* (2004) and Romeih *et al.* (2002).

As for group 2 (MFA and GFA), aseptic packaging had no significant effect on both types of cheese in all TPA parameters tested. However, all TPA parameters were highly influenced ($P < 0.05$) by the brand of the cheese, when multi-regression test is applied. Negative connections were found between moisture content of the cheese and its hardness, adhesiveness, springiness, gumminess and chewiness with fair correlations (-0.747, -0.694 and -0.656) for hardness, adhesiveness and gumminess respectively, and bad correlations for springiness and chewiness (-0.044 and -0.454).

Cheese microstructure

As shown in fig. (2 a & b), the microstructure of GFP cheese appeared as a loose network of aggregates of casein micelles. It consists of homogeneous masses of clusters and the protein structure didn't differ systematically. It is obvious that spherical shapes of casein micelles are lost due to loosing boundaries. Fat globules formed weak points throughout the body of the matrix. Although, both GFP and DFP are ultrafiltered plastic packed cheeses, the differences in the microstructure were clear. In DFP and HFP, more large size fat globules were embedded in the matrix which could be seen in the micrographs indicating that either the milk was not homogenized or different processing procedure was performed. Beside, in DFP type, the changes occurred in the protein matrix as casein micelles spherical shape and loosing surrounded boundary were far less than in GFP type. These variations might be due to differences in cheese recipes, techniques or additives used in the production.

The apparent microstructure of the protein matrix in MFA (Fig. 3, e) cheese was quite similar to GFP (Fig. 2, a) in spite of the aseptic package used with MFA cheese. The micelles appeared like a matrix with globular proteic unities of various sizes displayed in a loose network. Fat globules are found inside (invisible) and gathered within the casein framework. Protein in both brands disintegrated into small particles joined with each others. So, no microstructure modification was noticed by the presence of plastic package. Whereas HRP and MRP are reduced-fat brands, experimental cheese showed the casein distribution is roughly similar to that of other UF types. The cheese matrix consists of dispersed opaque casein granular with filamentous appearance. The gaps in all cheese brands filled with whey forming a continuous phase. The development of the microstructure of various cheeses during ripening is characterized by varying degree of disintegration of casein micelles resulting in a penetration of whey into the disintegrated casein mass (Abd El-Salam *et al.*, 1993; Omar, 1987). After different storage periods the content and structure of cheese modifies. Therefore, as shown in TSP cheese (Fig. 3, g) ripened for 7 months at room temperature, fat looks like globules, some of them being broken or mis-shaped. The casein network forms short strands, mainly structured in smaller or larger proteic globules and becomes denser. The casein aggregates lose their spherical shape and tend to enlarge their size losing their initial form.

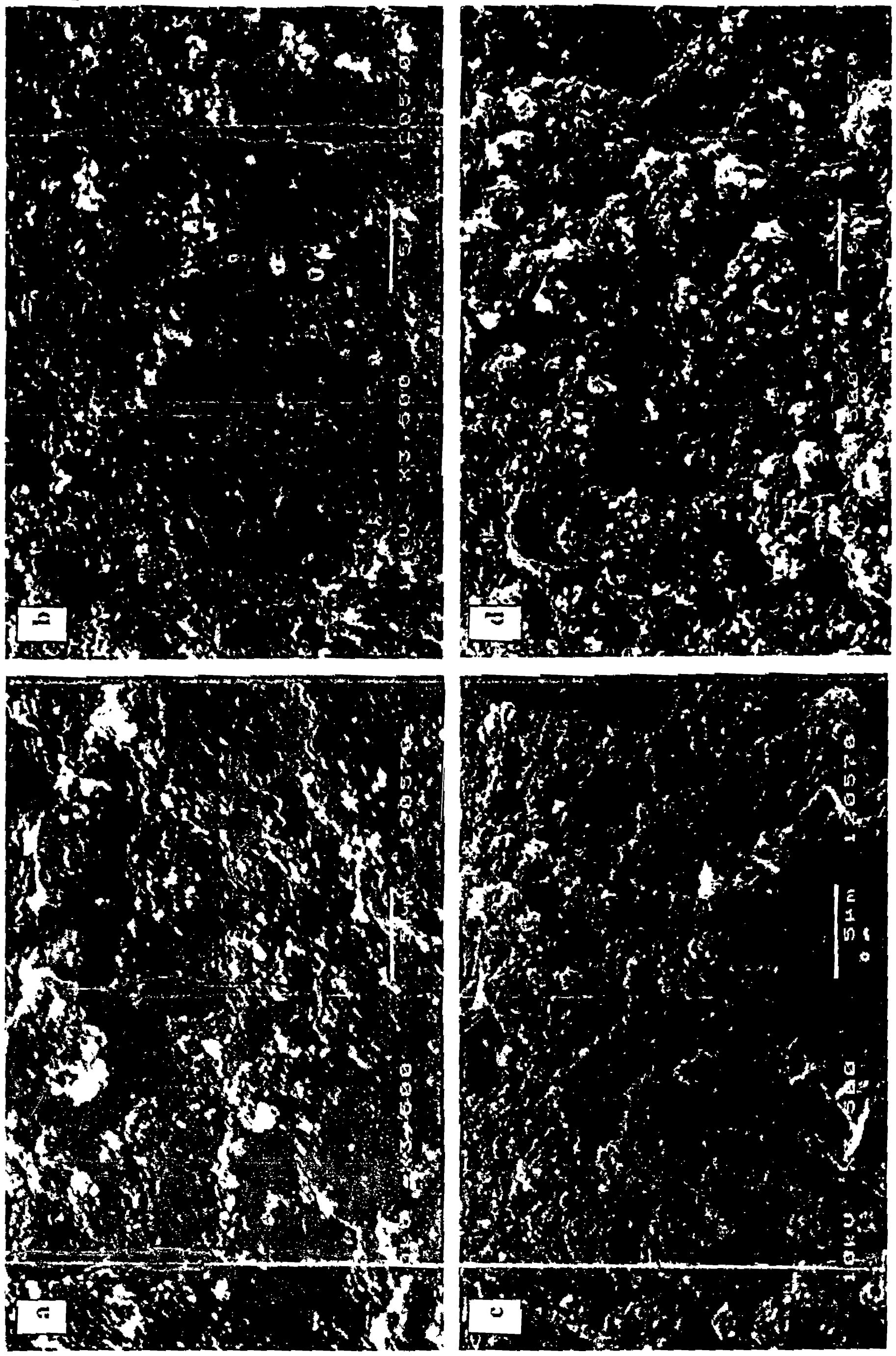

Fig. (2, a-d): SEM micrographs (magnification 3500) of white soft cheese brands; a) GFP, b) DFP, c) HRP and d) MRP.

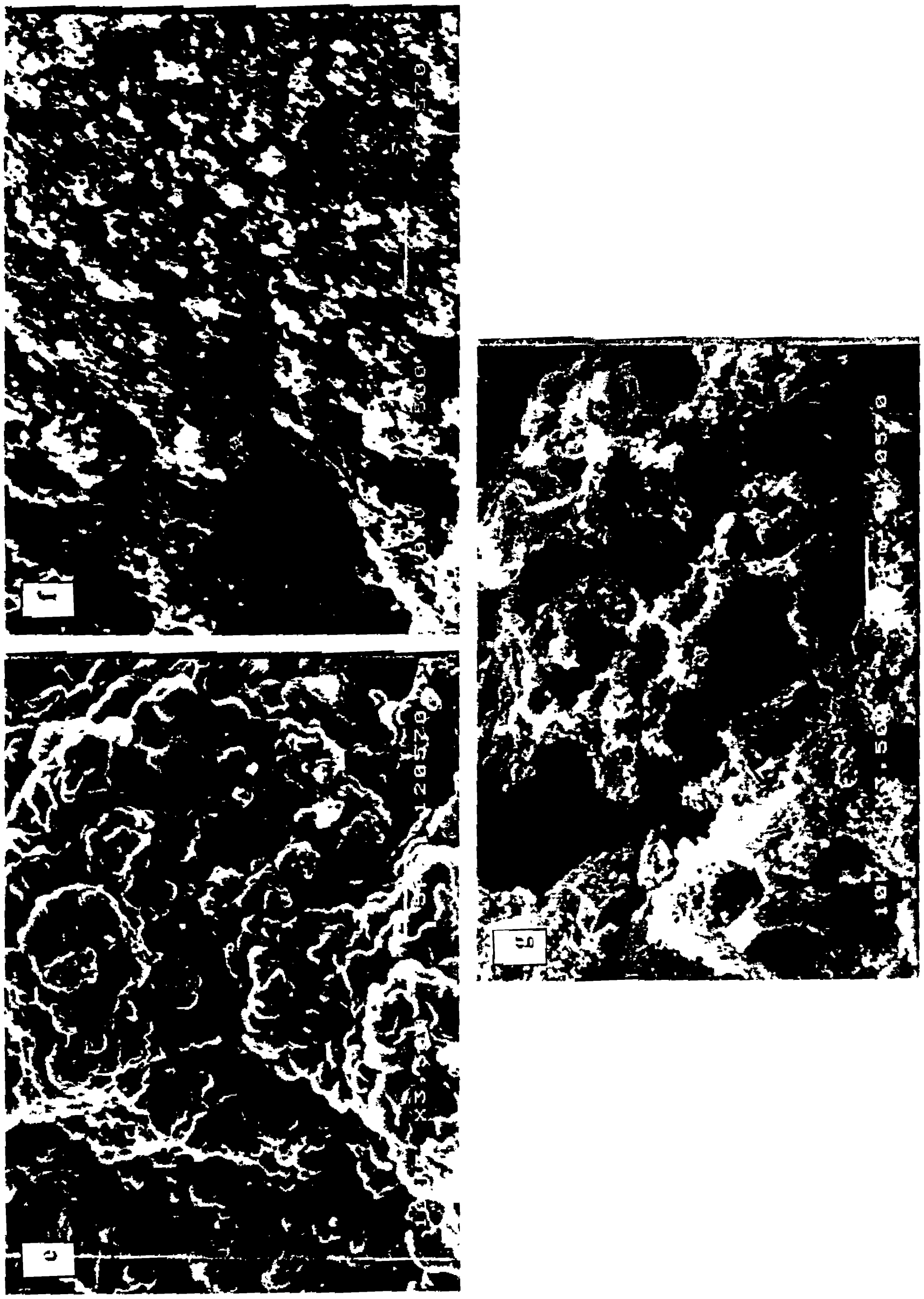

Fig. (3, e-g): SEM micrographs (magnification 3500) of white soft cheese brands; e) MFA, f) HFP and g) TSP.

The casein network is much looser and contains whey as a result of proteolysis proceeds. Besides, the protein in cheese is not so well organized; it has a tendency to form a large casein reticular structure, including large spaces inside.

The micrographs of UF cheeses showed similar structure in spite of their differences in the package type and even the fat content. The only clear variation in microstructure was found between fresh UF cheeses and traditional ripened one. These results were in agreement with Abd El-Salam *et al.* (1993); Omar (1987 & 1986); Omar and Buchheim (1986); Omar *et al.* (1986).

CONCLUSION

A great variation in all surveyed cheeses was found which indicated a multi range of chemical and textural properties. Chemical attributes often didn't match well the cheeses textural properties. More effort should be exerted to uniform the physical, chemical and textural characteristics of the white soft cheeses produced in all Egyptian dairy plants.

REFERENCES

Abd El-Salam, M.H., Alichanidis, E. and Zerfiridis, G.K. (1993) Domiati and Feta cheeses. In P.F. Fox (Ed.). *Cheese: chemistry, physics and microbiology.* (Vol. 2, 2nd ed., pp. 301-335) Chapman & Hall Press, London.

AOAC "Association of official analytical chemists" (1990). Official methods of analysis (15th ed.). Association of Anal. Chem. INC., Suite 400, 2200, Wilson Boulevard, Arlington, Virginia 22201, USA.

Cooper, H.R. (1987). Texture in Dairy Products and its Sensory Evaluation. Chap.2. In "Food Texture Instrumental and Sensory Measurments". (H.R. Moskowitz, Ed.), Marcel Deckker, Inc. NY.

Drake, M.A. and Swanson, B.G. (1995) Reduced- and low-fat cheese technology: A review. *Trends Food Sci. & Technol.* 6: 366-369.

Donovan, M. and Mulvihill, D. M. (1987). Effect of chemical modifications and sodium dedecyle sulphate binding on the thermostability of whey proteins. *Irish J. Food Sci. and Technol.*, 11: 77-85.

El-Soda, M. and Abd El-Salam, M.H. (2002). Cheese matured in brine. In H. Roginski, et al. (Eds). Encyclopedia of Dairy Science (Vol.1, pp. 406-410). Academic.

El-Zeny, H.M. (1991). Rennet coagulation of salted milk and rheology of soft white cheese produced from it. Ph.D. thesis, Michigan State Univ., East lansing, 48824 MI, USA.

EOSQC "Egyptian Organization for Standards and Quality Control" (2000). Egyptian Standards for soft cheese. ES: 1008/2000.

Erdem Y.K. (2004). Effect of Ultrafiltration, fat reduction and salting on textural properties of white brined cheese. *J. Food Eng.*, 71: 366-372.

Hagrass, A.E.A., Renner, E. and Fayed, A.E. (1986). Comparison between the ultrafiltration and traditional Karish cheeses produced from fresh and dried skim milk. Proceeding of 3rd Egyptian Conference for Dairy Science and Technology, Cairo, Egypt.

Hofi, M.A.; Hofi, A.A.; El-Kanany, Y.M. and El-Beialy, R. (2001). Microstructure of Domiati cheese manufactured by ultrafiltration. Proc. 8th Egyptian Conference of Dairy Science and Technology, Cairo, Egypt.

Hydamaka, A.W.; Wilbey, R.A.; Lewis, M.J. and Kuo, A.W. (2001). Manufacture of heat and acid coagulated cheese from ultrafiltered milk retentates. *Food Res. Int.*, 34: 197-205.

IDF, International Dairy Federation (1972) Determination of chloride content of cheese. International Standard No 17A, Brussels.

Kyle, S. and Hickey, M.W. (1993). Feta cheese with ultrafiltration retentate. *The Australian J. Dairy Technol.*, 48: 47-48.

Ling, F.F. (Ed.) (1963). A text Book of Dairy Chemistry. Vol.2, Practical, (3rd ed.). Chapman & Hall Press, London.

Lucisano, M. Pomple, C. and Casiraghi, E. (1987). Texture evaluation of some Italian cheeses by Instrumental Texture profile analysis. *J. Food Qual.*, 10: 73-78.

Mahmoud, M.M. (1980). Ultrafiltration in the manufacture of soft pickled cheese and production of alcohol and single cell protein from whey. Ph.D. Thesis, Cornell Univ., Ithaca, USA.

Masi, P. and Addeo, F. (1987). An examination of some mechanical properties of a group of Italian cheeses and their relation to structures and conditions of manufacture. *J. Food Eng.*, 5: 217-221.

Mehaia. M.A. (2002). Manufacture of fresh soft white cheese (Domiati-type) from ultrafiltered goat's milk. *Food Chem.*, 79: 445-452.

Mottar, J.; Bassier, A.; Joniau, M. and Baert, J. (1989). Effect of heat-induced association of whey proteins and casein micelles on yoghurt texture. *J. Dairy Sci.*, 72: 2247-2256.

Ntailianas, H.A. and Whitney, R.M. (1964). Calcein as an indicator for determination of total calcium and magnesium and calcium alone in the same aliquot of milk. *J. Dairy Sci.*, 47: 19-27.

Omar, M.M. (1986). Microstructure and chemical changes in Twaroge cheese made from ultrafiltered milk and from lactose-hydrolyzed milk. *Food Chem.*, 22: 147-163.

Omar, M.M. (1987). Microstructure and composition of soft brine cheese produced from recombined milk by ultrafiltration. *Egypt. J. Dairy Sci.*, 15: 123-133.

Omar, M.M. (1988), Composition and Microstructure of Domiati cheese made from reconstituted UF milk. *Food Chem.*, 28: 85-95.

Omar, M.M. and Buchheim, W. (1986). Microstructure and composition of Domiati cheese mad from ultrafiltered milk. Proceeding of 3rd Egyptian Conference for Dairy Science and Technology, Cairo, Egypt.

Omar, M.M.; Choynowski, W. and Smietana, Z. (1986). Quality and microstructure of "Solan" cheese produced by ultrafiltration. *Egypt. J. Dairy Sci.*, 4: 43-53.

Ozer, B.H.; Robinson, R.K. and Grandison, A.S. (2003). Textural and microstructure properties of Urfa cheese (a white brined Turkish cheese). *Int. J. Dairy Technol.*, 56: 171-176.

Polychroniadou, A., Michaelidou, A. and Paschaloudis, N. (1999). Effect of time, temperature, and extraction methods on the trichloroacetic acid-soluble nitrogen of Cheese. *Int. Dairy J.* 9: 559-568.

Renner, E. and Omeroglu, S. (1981). Herstellung Von Weisskase aus Ultrafiltriertter Milch. *Milchwiss.*, 36: 334-339.

Romeih, E.A., Michaelidou, A., Biliaderis, C.G. and Zerfiridis, G.K. (2002). Low-fat white-brined cheese made from bovine milk and two commercial fat mimetics: chemical, physical and sensory attributes. *Int. Dairy J.*, 12: 525-540.

Salama, F.A.; Ismail, A.A.; Youssef, AM. And Salem S.A. (1982). Comparative studies on white pickled Brinza cheese made from cow's and buffalo's milk in Egypt. II. Effect of pickling conditions. *Egypt. J. D. Sci.*, 10: 243-252.

Volikakis P., Billiaderis C.G., Vamvakas C. and Zerfiridis G.K. (2004). Effects of a commercial oat- β-glucan concentrate on the chemical, physico-chemical and sensory attributes of low-fat white-brined cheese product. *Food Res. Int.*, 37: 83- 94.

Werner, H. (1999). North European Varieties of cheese. In P. F. Fox (Ed.). Cheese: chemistry, Physics and Microbiology. (Vol. 2, pp. 245-253). Chapman & Hall Press, London.

الخواص الكيميائية و الحسية و الريولوجية و التركيب البنائى الدقيق لأنواع محلية من الجبن الأبيض الطرى

هدى محمـــود الزينى ، محمـــــد عبد الغنـــى الأعسر ، شريـــف محمـــود أنيس و إيهاب على رميح

كلية الزراعة – جامعة القاهرة – قسم علوم الألبان

تم تجميع تسعة عينات من أنواع الجبن الأبيض الطرى تمثل الانتاج المحلى لهذه الجبن من المصانع الكبيرة الحديثة و كذلك المصانع الصغيرة التقليدية. و قد وضعت هذه الأنواع من الجبن فى خمسة مجموعات للمقارنة تمثل أهم العناصر المؤثرة فى خواص الجبن.

تم تحليل عينات الأنواع المختلفة من الجبن كيميائيا و حسيا و ريولوجيا و كذلك التركيب البنائى الدقيق، و تم تحليل النتائج المتحصل عليها و مقارنة النتائج ببعضها لكل المجموعات و داخل كل مجموعة على حدة.

و قد أشارت النتائج إلى وجود إختلافات واسعة النطاق فى جميع الخواص التى تم قياسها بين أنواع الجبن المختلفة. و كانت الفروق فى التركيب الكيميائى أكثر وضوحا نتيجة لإختلاف طريقة التصنيع المستخدمة أو ظروف تخزين (تسوية) الجبن.

من حيث الخواص الحسية حصلت الجبن الثلاجة المصنعة بطريقة الترشيح الفائق (UF) على أعلى درجات التقييم، بينما حصلت الجبن المصنعة بالطريقة التقليدية على أقل درجات التقييم. اما من حيث خواص القوام فقد أظهرت نتائج الــ TPA أن أعلى قيم لهذه الخواص كانت كما يلى: Hardness و brittleness فى الجبن الاسطنبولى (TSP) ، Cohesiveness و Springiness للجبن الأبيض الثلاجة التقليدى (TTP)، adhesiveness و gumminess و chewiness للجبن (HFP) فى المجموعة الرابعة و الخامسة و التى تمثل الاختلاف فى طريقة تصنيع الجبن و كذلك ظروف التخزين (التسوية). أما التركيب البنائى الدقيق فقد أظهر وجود إختلافات واضحة فقط بين أنواع الجبن الطازج المصنع بطريقة الترشيح الفائق (UF) و الجبن المسوى المصنع بالطريقة التقليدية.