American Journal of Applied Sciences 10 (11): 1392-1397, 2013
ISSN: 1546-9239

doi:10.3844/ajassp.2013.1392.1397 Published Online 10 (11) 2013 (http://www.thescipub.com/ajas.toc)

Development of Set and Drinking Sesame Yoghurt from Decorticated Sesame Seed

Ibrahim Abdullah Afaneh

Department of Food Processing, Faculty of Science and Technology,
Al-Quds University, Jerusalem, P.O. 20002, Palestine

Received 2013-08-20, Revised 2013-09-23; Accepted 2013-09-24

ABSTRACT

Sesame yoghurt developed from sesame seed fortified with different fortifiers resulted in yoghurt that lacks the typical yogurt texture. This study aimed to develop set and drinking yoghurt from sesame milk. Gums were used to develop sesame set yoghurt and sesame yoghurt drink. The best set yoghurt was produced from the sesame milk fortified with 2% Cheese Dried Whey (CDW) plus 0.6% pectin and 0.2% CMC. The best yoghurt drink was produced from sesame milk fortified with dried whey plus 0.2% guar gum and pasteurized at 75°C for 5 min.

Keywords: Drinking Yoghurt, Set Yoghurt, Imitated Dairy Products, Sesame Seed

1. INTRODUCTION

In a previous work, the fermentability of sesame milk and quality of sesame milk prepared with different fortifiers, inoculated with starter culture and incubated for different times had been investigated. The texture of all resulted yoghurt lacked the typical set yoghurt body and was similar to that of drinking yoghurt with phase separation. The developed fermented sesame milk must be in a given shape, form, texture and functionality to make them acceptable food products, which means: transform them from a mixture of materials to a palatable foodstuff.

The group of food ingredients most effective for this purpose is hydrocolloids (Glicksman, 1986). Hydrocolloids, or more commonly gums, were defined as complex nondigestible polysaccharides that dissolve or disperse in water to give thickening or viscosity-building effect (Bergenstahl *et al*., 1988; Anderson and Andon, 1988). Gums are used for stabilization of emulsions, suspension, inhibition of syneresis and gelling. For this reason, they are frequently classified as thickeners and gelling agents. However, this definition is less than perfect because thickeners can sometimes form gels while gelling agents are sometimes used as thickeners (Sanderson, 1996). Few gums form gels including kappa-and iota-carragenan, alginate, agar and combination between xanthan and locust been gums (Dziezak, 1991). Hydrocolloids were used in production of soymilk and youghurt (Holmes *et al*., 1986; Manning *et al*., 1986; Villaudy *et al*., 1987).

The aim of this research was to investigate the possibility of producing set and drinking sesame yoghurt with acceptable sensory properties.

2. MATERIALS AND METHODS

2.1. Sesame Seed

Decorticated sesame seed (originated from Ethiopia) were used. It was obtained from Al-Kasih Factories Group for Food Stuff in Zarqqa/Jordan and characterized as sweet sesame (bitter taste was absent).

2.2. Sesame Milk

Sesame milk was prepared according to the procedure described by Quasem *et al*. (2009) using 14% initial concentration of sesame seed (sesame seeds: Water ratio).

2.3. Starter Culture

Commercial (YC-380) Direct-Vat-Set yoghurt culture (DVS) composed of Streptococus thermophilus and

Lactobacillus delbruekii subsp. Bulgaricus was used. The starter culture preparation and inoculation procedure were done according to the manufacturer recommendations (Chr. Hansen Denmark).

2.4. Other Materials

Non-Fat Dried Milk (NFDM) (Regilait, France); UHT skim milk (Hammodah, Jordan); full fat milk (University of Jordan Dairy Plant, Jordan); cheese whey powder (KemFuds, Mexico); glucose (Panreac, Spain).

2.5. Effect of Using Stabilizers on Yoghurt Drink Dispersion Stability and Sensory Acceptability

The effect of different stabilizers was evaluated on yoghurt formulated from sesame milk (100g sesame milk, 2.7g dextrose and 2g dried whey). Formulated sesame milk was pasteurized at 75°C-5 min, cooled to 43°C, inoculated with starter culture and incubated at 43°C for 6 h. Direct-vat-set yoghurt culture was prepared according to the manufacturer instructions. Two replicates were made for each treatment and the sample size was 100mL of sesame yoghurt for each sample dispensed in 300-ml beakers and one of the following treatments were applied for each treatment:

- Homogenization for 1.5 min
- Addition of 1% salt and homogenization for 1.5 min
- Addition of 1% salt, homogenization and pasteurization. Homogenization (for 1.5 min) was done after pre-heating the yoghurt to 60°C. Pasteurization was at 75 C-5 min. Samples were then filled in 50mL presterilized medical tubes, cooled and stored refrigerated. Treatments from 4 to 14 were subjected to the same treatment but with the addition of gums before the homogenization step
- Addition of 0.1% Carboxy Methyl Cellulose (CMC)
- Addition of 0.15 % CMC
- Addition of 0.2 % CMC
- Addition of 0.2 % Locust Bean Gum (LBG)
- Addition of 0.4% LBG
- Addition of 0.6% LBG
- Addition of 0.2% gum Arabic
- Addition of 0.4% gum Arabic
- Addition of 0.6% gum Arabic
- Addition of 0.2% gum Arabic
- Addition of 0.4% gum Arabic

All produced drinking sesame yoghurt were stored refrigerated (at 4 C) for 40 days.

2.5.1. Treatments Evaluation

The treatments were evaluated by:

- Measuring dispersion stability during 40 days of refrigerated storage (at 4°C) (each day during the first week and then at day 14, 20 and 40 of processing). Dispersion stability was measured by observing if there is a line separating the lower layer (clear serum phase) from the above layer (condensed dispersed phase), then the height of the dispersed phase was measured and calculated as a ratio to total height. If no line can be observed, the separation index would be 1.00 (Foley and Mulcahy, 1989; Priepke *et al*., 1980)
- Expert panel sensory evaluation for selected samples. Four panelists were selected for their experience in dairy products from the Department of Nutrition and Food Technology in the University of Jordan. All treatments (sesame products) were served at 8-10°C. During the evaluation, each member independently, informally evaluated the treatments and expressed his opinion by a free description of what he/she likes or dislikes from the perceived sensory attributes. After that, the results were discussed with each member and, based on these discussions, group of treatments were selected for further sensory evaluation using 5-points hedonic scale or to be further improved by processing before evaluating them again

2.5.2. Statistical Analysis

The results were analyzed statistically by Analysis of Variance (ANOVA) using completely randomized design and LSD test with significance at $p<0.05$. The analysis was performed using SAS system (Delwiche and Slaughter, 2003).

2.6. Effect of using Stabilizers on Sensory Properties and Syneresis of Sesame Set Yoghurt

Twenty treatments for sesame set yoghurt were formulated from sesame milk. Formulated sesame milks were pasteurized at 75°C-5min, cooled to 43°C, inoculated with starter culture and incubated at 43°C for different periods: 4 and 8 h. Direct-vat-set yoghurt culture was prepared according to the manufacturer instructions. The formulas used and the incubation times are listed in **Table 1**. Two replicates were made for each treatment and the sample size was 100 mL of sesame set yoghurt.

Table 1. Sesame milk formulas and incubation times used to prepare sesame set yoghurt with the aid of gelling agent

Sesame milk basic formula		Treatment number	Stabilizers added	Fermentation time
Sesame milk	50 g	1,2,3	Carragenan and LBG (0.2 and 0.05%; 0.2	8 h
Skim milk	50 g		and 0.1%; 0.2 and 0.2%)	
Glucose	1.4 g			
Sesame milk	50 g	3, 4, 5	Alginate (0.2, 0.4 and 0.6%)	8 h
Glucose	2.7 g	6, 7, 8	Carragenan (0.2%; 0.4%; and 0.6%)	
NFDM	2.0 g	9, 10, 11	Carragenan and LBG (0.2 and 0.05%; 0.2 and 0.1%; 0.2 and 0.2%)	
		12, 13	Xanthan and LBG (0.1 and 0.1%; 0.2 and 0.2%)	
Sesame milk	50 g	14, 15	pectin (0.4 and 0.6%)	6 h
Glucose	2.7 g	16	0.4% pectin and 0.2% CMC	
Dried whey	2.0 g	17	0.4% pectin and 0.2% guar gum	
		18	0.6% pectin and 0.2% CMC	
		19	0.6% pectin, 0.2% CMC and 0.2% gum Arabic	
		20	0.6% pectin, 0.2% guar gum and 0.2% gum Arabic	

2.6.1. Treatments Evaluation

The treatments were evaluated by:

- Expert panel sensory evaluation for all samples were performed as described previously
- Measuring the syneresis for selected samples. Syneresis was measured by centrifuging 40 g of set yoghurt in 50 mL plastic centrifuge tube for 30 min at 2700 rpm at 20°C. The whey was drained for 1 min and weighed. The percentage of syneresis was calculated by the following equation (Shirai *et al*., 1992):

$$\text{Weight of whey/weight of yoghurt} \times 100$$

2.6.2. Statistical Analysis

The results were analyzed statistically by Analysis of Variance (ANOVA) using completely randomized design and LSD test with significance at $p<0.05$. The analysis was performed using SAS system (Delwiche and Slaughter, 2003).

3. RESULTS

3.1. Using of Stabilizers to Improve the Dispersion Stability of Sesame Yoghurt Drink and their Effect on the Sensory Acceptability

Figure 1 shows the dispersion stability of sesame drinking yoghurt as affected by different treatments (addition of NaCl, pasteurization and the combined effect of salt, gums and pasteurization). All treatments without added gums (control, with salt and with salt and pasteurization) had inferior dispersion stability throughout the refrigerated storage period. With the end of the storage period these treatments had dispersion stability values ranged from 0.50 to 0.63. Addition of gums improved the dispersion stability and the highest values during the storage period were found for guar gum and Locust Bean Gum (LBG) with varying degrees depending on the level used for each stabilizer. LBG at levels of 0.4% or 0.6% and guar gum at levels of 0.4% had a dispersion stability value of 1.00 throughout storage period (40 days), while yoghurt with LBG at a level of 0.2% and guar gum at a level of 0.2% had dispersion stability values that slightly decreased throughout the storage to reach values of 0.73 and 0.85 respectively with the end of storage period. Treatments with added 0.2% guar gum had the optimum mouthfeel as indicated by the expert panel sensory evaluation.

3.2. Production of Sesame set Yoghurt using Gums

Table 2 shows the results of expert panel sensory evaluation of 22 sample of sesame set yoghurt produced from three sesame milk formulas (14% initial sesame seed) with the addition of 2.7% glucose (for all treatments) and one of the following dairy products: 2% NFDM, 2% dried whey and skim milk in a ratio of 1:1 with sesame milk and different gums. From these treatments, four treatments number 18, 19, 20 and 22 (**Table 2**) gave acceptable gel strength and the best treatment was number 19. These four samples were further evaluated by syneresis (**Fig. 2**). The figure shows that there are considerable variations in the syneresis between the four treatments.

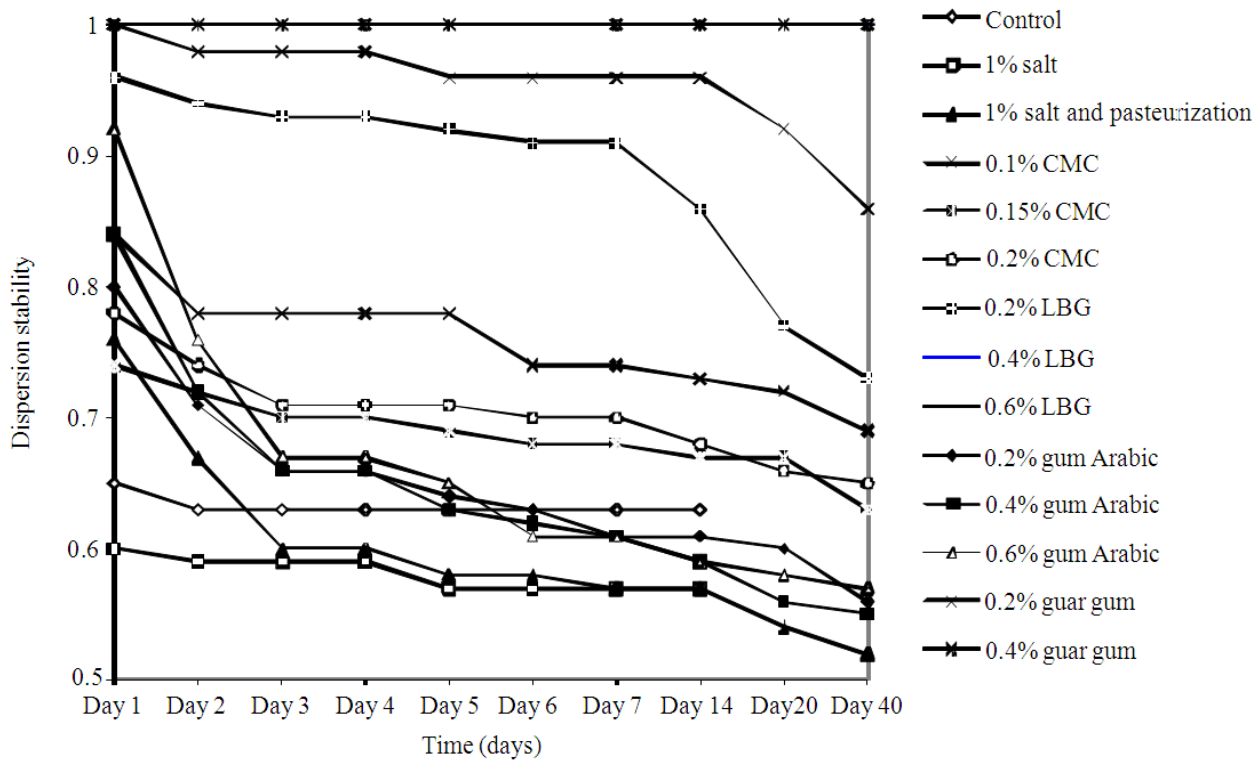

Fig. 1. Effect of some processing variables and stabilizers on dispers stability of sesame drinking yoghurt during 40 days of refrigerated storage

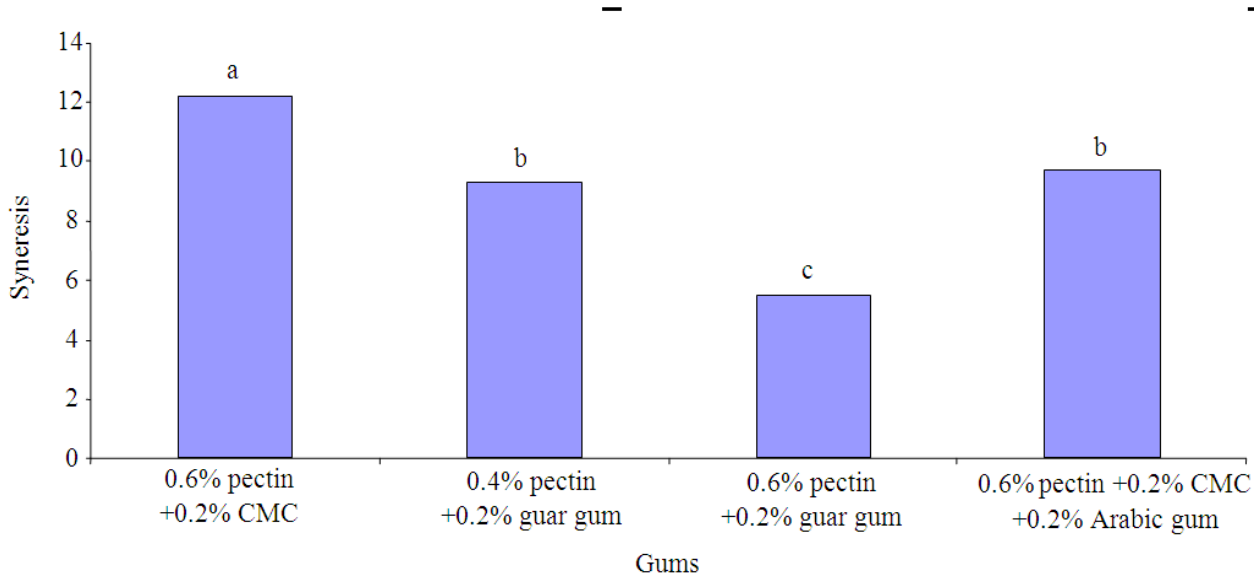

Fig. 2. Syneresis of selected sesame set yoghurt formulas

Table 2. The expert panel sensory evaluation of sesame set yoghurt. (Best treatments are shadowed)

Treatment*		Treatment number	Observation
Sesame milk fortified with 2% NFDM and	0.2% alginate	1	- High syneresis decreasing with increased alginate concentration
	0.4% alginate	2	
	0.6% alginate	3	- All samples have a high gel strength
	0.2% carragenan	4	- Gritty texture
	0.4 % carragenan	5	- High syneresis - Gritty texture
	0.6 % carragenan	6	- High syneresis - Gritty texture
	0.2% carragenan and 0.05% LBG	7	- Gritty texture
	0.2% carragenan and 0.1% LBG	8	- Gritty texture reduced but still present
	0.2% carragenan and 0.2 % LBG	9	- Gritty texture reduced but still present
	0.1% xanthan and 0.1% LBG	10	- High syneresis increasing with increased stabilizers concentration
	0.2 % xanthan and 0.2 % LBG	11	
Skim milk extended with 50% sesame milk	0.2% carragenan and 0.05% LBG	12	- Distinctive gel layers
	0.2% carragenan and 0.1% LBG	13	- Distinctive gel layers
	0.2% carragenan and 0.2 % LBG	14	- Grainy texture - Very strong gel
Sesame milk fortified with 2% dried whey	0.4% pectin	15	- Distinctive gel layer in the bottom - Gritty texture
	0.6% pectin	16	- Presence of separated gel layer in the bottom of the container - Gritty texture
	0.4% pectin and 0.2% CMC	17	- Presence of separated gel layer in the bottom - Gritty texture
	0.4% pectin and 0.2% guar gum	18	- Good texture
	0.6 % pectin and 0.2% CMC	19	- Good texture
	0.6 % pectin and 0.2% guar gum	20	- Good texture
	0.6 % pectin, 0.2% CMC and 0.2% gum Arabic	21	- High syneresis
	0.6 % pectin, 0.2% guar gum and 0.2% gum Arabic	22	- Good texture

4. DISCUSSION

4.1. Yoghurt Drink

The problem of phase separation can negatively affect its acceptability as yoghurt drink. For this reason, an experiment was designed to improve the dispersion stability using gums. Heat treatment was used to disperse the gums and as pasteurization treatment to increase the shelf life. From this experiment, successful drinking yoghurt was developed by the addition of 1% salt, 0.2% guar gum to sesame yoghurt and then pasteurizing it at 75°C for 5 min. The resulted yoghurt drink had good dispersion stability during 40 days of refrigerated storage. Foley and Mulcahy (1989) reported that aseptic packaging after heat treatment of ripened milk product gave a shelf life of several months at ambient temperatures. They also reported that thermisation at 60-65°C after ripening increased the shelf life of yoghurt to two months. Similar shelf life is expected for the pasteurized yoghurt drink produced in this study and for this reason the drinking yoghurt was monitored during storage by measuring the dispersion stability only. However, another microbial study is needed to investigate the storability of this product. The total solids of the developed yoghurt drink in this study was 15.85%, which is higher than the reported value of commercially available yoghurt drink in the Kingdom of Saudi Arabia (10.88%) (Salji *et al*., 1984), so it is feasible (from a commercial point of view) to investigate the effect of reducing the total solids concentration on the quality of the produced yoghurt drink.

4.2. Set Yoghurt

The best three yoghurt formulas were number 4 (sesame milk with skim milk in a ratio of 1:1), 6 (sesame milk with 2% NFDM) and 9 (sesame milk with 2% dried whey) and used for set yoghurt with different gum

systems. From this experiment, four treatments of set yoghurt out of 22 treatments (**Table 2**) resulted in good texture. The four accepted treatments were produced from milk formulated with 2% dried whey and four different gum systems (all gum systems contain pectin). In set yoghurt it was found that gums systems is more efficient than adding one type of gums, which is the contrary to the results of drinking yoghurt in which adding one type of gums gives good results. Since the gum systems used in the best four treatments were not used with other milk formulas, more experiments are needed to try them with other milk formulas. Syneresis is a problem frequently faced by yoghurt manufacturers. The reported syneresis values in this study ranged from 5.51 to 12.2 (**Fig. 2**), which is comparable to the reported syneresis values of soymilk yoghurt (9.75-13.75) (Yazici *et al*., 1997).

5. CONCLUSION

Hydrocolloids were successfully used to impart the desirable texture for set and drinking sesame yoghurt. The best set yoghurt was produced from the sesame milk fortified with 2% Cheese Dried Whey (CDW) plus 0.6% pectin and 0.2% CMC. The best yoghurt drink was produced from sesame milk fortified with dried whey plus 0.2% guar gum and pasteurized at 75 C for 5 min. The developed yoghurt had good sensory acceptability.

6. REFERENCES

Anderson, D.M.W. and S.A. Andon, 1988. Water-soluble food gums and their role in product development. Cereal Foods World, 33: 844-850.

Bergenstahl, B., S. Fogler and P. Stenius, 1988. The Influence of Gums on the Stability of Dispersions. In: Gums and stabilisers for the food industry, Phillips, G.O., D.J. Wedlock and P.A. Williams, (Eds.), IRL Press, Oxford, ISBN-10: 1852210877, pp: 285-293.

Delwiche, L.D. and S.J. Slaughter, 2003. The Little SAS Book: A Primer. 3rd Edn., SAS Institute Inc., Cary, ISBN-10: 1590473337, pp: 330.

Dziezak, J.D., 1991. A focus on gums. Food Tech., 45: 116-132.

Foley, J. and A.J. Mulcahy, 1989. Hydrocolloid stabilisation and heat treatment for prolonging shelf life of drinking yoghurt and cultured buttermilk. Irish J. Food Sci. Technol., 13: 43-50.

Glicksman, M., 1986. Hydrocolloid functionality in fabricated foods. Food Technol. Aus., 38: 17-25.

Holmes, A.W., W.M. Marrs and M.M. Boyar, 1986. Hydrocolloids and processed food. G In: Gums and Stabilizers for the Food Industry, .O. Phillips, D.J. Wedlock and P.A. Williams, (Eds.), Pergamon Press, Oxford, pp: 243-252.

Manning, D.J.R., H. Witt and J. Ames, 1986. Increasing cheese yields with carragenan. In: Gums and Stabilizers for the Food Industry, Phillips, G.O., D.J. Wedlock and P.A. Williams, (Eds.), Pergamon Press, Oxford, pp: 379-385.

Priepke, P.E., L.S. Wei, A.I. Nelson and M.P. Steinberg, 1980. Suspension stability of Illinois soybean beverage. J. Food Sci., 45: 242-245. DOI: 10.1111/j.1365-2621.1980.tb02586.x

Quasem, J.M., A.S. Mazahreh and K. Abu-Alruz, 2009. Development of Vegetable Based Milk from Decorticated Sesame (*Sesamum Indicum*). Am. J. Applied Sci., 6: 888-896. 10.3844/ajassp.2009.888.896

Salji, J.P., W.N. Sawaya, S.R. Saadi and W.M. Safi, 1984. The effect of heat treatment on quality and shelf life of plain liquid yoghurt. Cultured Dairy Products J.

Sanderson, G.R., 1996. Gums and their use in food systems. Food Technol., 50: 81-84.

Shirai, K., M.G. Duran, V.M.E. Marshall, S.R. Moiseev and M.G. Garibay, 1992. Production of a yogurt-like product from plant foodstuffs and whey. Sensory evaluation and physical attributes. J. Sci. Food Agric., 59: 205-210. DOI: 10.1002/jsfa.2740590211

Villaudy, B., G. Tilly and R. Rizzotti, 1987. The role of hydrocolloids in food preparations based on “Tonyu” (soya milk) and/or “Tofu” (Soybean curd). In: Gums and Stabilizers for the Food Industry, Phillips, G.O., P.A. Williams and D.J. Wedlock, (Eds.), IRL Press, Oxford, ISBN-10: 1852210877, pp: 309-319.

Yazici, F., V.B. Alvarez and P.M.T. Hansen, 1997. Fermentation and properties of calcium-fortified soy milk yogurt. J. Food Sci., 62: 457-461. DOI: 10.1111/j.1365-2621.1997.tb04406.x