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RESEARCH ARTICLE

SURVIVAL OF YOGHURT CULTURE IN FREEZE DRIED AND CHEMICALLY STABILIZED SPRAY DRIED YOGHURT POWDER DURING STORAGE

Gnanalakshmi K. S., Dhanalakshmi B., Ayyavoo Preamnath Manoharan A. and Baskaran D.

Department of Dairy Science, Madras Veterinary College, Chennai-7, India

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ABSTRACT

A study was undertaken to determine the viability of yoghurt culture on spray drying and freeze drying. In spray drying outlet air temperature of 70o C was found to be optimum as the percentage of survival of yoghurt culture was higher. The survival of yoghurt culture was found to be maximum in fresh yoghurt, followed by freeze dried powder and spray dried powder. Statistical analysis of data revealed that there was no significant difference in survival of *S.salivarius* ssp. *thermophilus* between freeze dried powder (zero day), (30th day at 4°C) and chemically stabilized powder (zero day), (30th day at 4°C) respectively.Statistical analysis of data with regard to survival of *L.delbrueckii* ssp. *bulgaricus* revealed that there was significant difference ($p < 0.01$) noticed between freeze dried powder (zero day, 30th day at 4°C) and chemically stabilized spray dried powder (zero day, 30th day at 4°C) respectively.

INTRODUCTION

Yoghurt has been established globally as an important dairy product despite its obscure ethnic origin. It is a coagulated milk product obtained by lactic acid fermentation through the action of *L.delbrueckii* ssp. *bulgaricus* and *S.salivarius* ssp. *thermophilus* from milk and milk products with or without optional additions such as milk powders, skimmed milk powders, whey powder etc. Consumption of yoghurt is recommended as a remedy for gastrointestinal disorders and for lactose intolerant people. It is also recommended for immune system stimulation, cancer suppression and blood cholesterol reduction. In yoghurt, bioavailability of copper, calcium, iron, zinc, manganese and phosphorus are high as compared to milk (Sherwood, 1990). Obviously a fluid milk product has limited shelf life and is not readily transportable to distant markets at low cost. A dry product could better serve these needs. Drying yoghurt is a very old method of preservation. At present, drying yoghurt is carried out by using modern machines and processing The spray drying of microorganisms began in 1914 with the study by Rogers (1914) of dried milk cultures of lactic acid bacteria. Powdered Yoghurt with a clean, fresh flavour is obtained from spray drying technology with viable cultures of *S.salivarius* ssp. *thermophilus* and *L.delbrueckii* ssp. *bulgaricus*. Active cultures are guaranteed for 1 year under cool, dry conditions. Freeze drying provides less damage to microflora than other conventional drying methods and it causes least damage to milk constituents and loss of flavour (Rybka and Kailasapathy, 1995). The present study was undertaken to compare the stability of freeze dried yoghurt powder with chemically stabilized spray dried yoghurt powder with chemically stabilized spray dried yoghurt powder.

MATERIALS AND METHODS

Fresh whole cow milk collected from the dairy plant, Department of Dairy Science, Madras Veterinary College was used. It was mixed with skim milk and standardized to 2 per cent fat. Whole milk was standardized to 2 per cent fat by addition of skim milk. Skim milk powder was added to increase the solids-not-fat content to 14 per cent level. Sugar was added at the rate of 7 per cent and stabilizer at a level of 0.2 per cent. The yoghurt mix was warmed to 54°C, homogenized at 2500 psi, pasteurized at 85°C for 30 min and cooled to 45°C (Tamime and Deeth, 1980). The batch was inoculated with 2 per cent starter culture comprising of *Streptococcus salivarius* ssp. *thermophilus* and *Lactobacillus delbrueckii* ssp. *bulgaricus* in the ratio of 1:1. The inoculated yoghurt mix was filled into plastic containers and incubated at 42°C until the desired pH of 4.2 was attained. The cups were stored in the refrigerator at 4°C until further use. Freezing of yoghurt was carried out after loading of 0.5 ml yoghurt in vials. The vials were freezed at -20°C for 2 h and it was freeze dried in Alpha 1~2 christ freeze drier for 96 h (Rybka and Kailasapathy, 1995). Before loading the samples, the freeze drier was run for about 20 min to obtain a constant minimum temperature of -54 ± 3°C in the condenser.

Spray drying of yoghurt was carried out by slightly modifying the procedure followed by Kim and Bhowmik (1990). Yoghurt was vigorously stirred in a Waring Blender for 1 min (20 sec at low speed; 20 sec high speed; and 20 sec again at low speed) and rapidly warmed to 30°C before spray drying. Stirred yoghurt was diluted with equal quantity of water in order to prevent clogging of the nozzle during spray drying in a laboratory-scale spray drier. Indian make (Jektron Engineers Pvt. Ltd., Pune) laboratory model spray drier of 2kg/h capacity with co-current parallel air flow type fitted with centrifugal, spraying device was used. Survival of yoghurt culture at different outlet temperature were studied during spray drying. The outlet temperature was decided based upon the minimum moisture content and maximum survival of yoghurt culture. For chemical stabilization of yoghurt ascorbic acid (12.5 g/L) and mono sodium glutamate (12.5 g/L) were added before spray drying. M17 medium was used to count viable cells of *S.salivarius* ssp. *thermophilus*. Plates were incubated at 37°C for 48 h. Colony counting of *L.delbrueckii* ssp. *bulgaricus* was carried out on an M.R.S. medium after incubating for 72 h at 37°C in an anaerobic culture jar (Kim and Bhowmik, 1995).

RESULTS AND DISCUSSION

Survival of *S.salivarius* ssp. *thermophilus* in freeze dried and chemically stabilized spray dried yoghurt powder during storage

The data with respect to survival of *S.salivarius* ssp. *thermophilus* in freeze dried and chemically stabilized spray dried yoghurt powder are given in Table 1. The mean ± SE with regard to survival of *S.salivarius* ssp. *thermophilus* for fresh yoghurt, freeze dried yoghurt powder (zero day) and freeze dried yoghurt powder (30th day at 4°C) were 9.38 ± 0.18, 8.27 ± 0.26 and 7.57 ± 0.18 respectively. The mean ± SE with regard to survival of *S.salivarius* ssp. *thermophilus* for fresh yoghurt, chemically stabilized powder (zero day) and chemically stabilized powder (30th day at 4°C) were 9.38 ± 0.18, 8.30 ± 0.23 and 7.79 ± 0.32 respectively. Statistical analysis of data revealed that there was no significant difference in survival of *S.salivarius* ssp. *thermophilus* between freeze dried powder (zero day), (30th day at 4°C) and chemically stabilized powder (zero day), (30th day at 4°C) respectively.

Survival of *L.delbrueckii* ssp. *bulgaricus* in freeze dried and chemically stabilized spray dried yoghurt powder during storage

The data with respect to survival of *L.delbrueckii* ssp. *bulgaricus* in freeze dried and chemically stabilized spray dried yoghurt powder are given in Table 2. The mean ± SE with regard to survival of *L.bulgaricus* for fresh yoghurt, freeze dried powder (zero day) and freeze dried powder (30th day 4°C) were 8.56 ± 0.28, 6.19 ± 0.21 and 3.23 ± 0.24 respectively. The mean ± SE with regard to survival *L.delbrueckii* ssp. *bulgaricus* for fresh yoghurt, chemically stabilized spray dried powder (zero day) and chemically stabilized spray dried powder (30th day at 4°C) were 8.56 ± 0.28, 7.19 ± 0.20 and 6.32 ± 0.28 respectively. Statistical analysis of data with regard to survival of *L.delbrueckii* ssp. *bulgaricus* revealed that there was significant difference ($P<0.01$) observed between freeze dried powder (zero day) and chemically stabilized spray dried powder (zero day). Moreover, there was significant difference ($P <0.01$) observed between freeze dried powder (30th day at 4°C) and chemically stabilized spray dried powder (30th day at 4°C).

(Yadav *et al*., 1992). In spray drying, chemical stabilization of yoghurt with ascorbate coupled with monosodium glutamate enhances the survival rate comparable to that of freeze dried yoghurt.

Survival of *L.delbrueckii* ssp. *bulgaricus* in freeze dried and chemically stabilized spray dried yoghurt powder during storage

The data with respect to survival of *L.delbrueckii* ssp. *bulgaricus* in freeze dried and chemically stabilized spray dried yoghurt powder are given in Table 2. Statistical analysis of data with regard to survival of *L.delbrueckii* ssp. *bulgaricus* revealed that there was significant difference ($p < 0.01$) noticed between freeze dried powder (zero day, 30th day at 4°C) and chemically stabilized spray dried powder (zero day, 30th day at 4°C) respectively. The mean values for survival of *L.delbrueckii* ssp. *bulgaricus* in chemically stabilized spray dried powder was higher (7.19 ± 0.20) than that of freeze dried powder (6.19 ± 0.21) at zero day. The mean values for survival of *L.delbrueckii* ssp. *bulgaricus* in chemically stabilized spray dried powder was higher (6.32 ± 0.28) than that of freeze dried powder (3.23 ± 0.24) at 30th day at 4°C. This might be due to the fact that *L.delbrueckii* ssp. *bulgaricus* was more sensitive to freezing damage, leading to lower survival of *L.delbrueckii* ssp. *bulgaricus* in freeze dried powder. Moreover, the survival of *L.delbrueckii* ssp. *bulgaricus* was lower in freeze dried powder during storage. This result was in agreement with Kim and Bhowmik (1990) and Rybka and Kailasapathy (1995).

Conclusion

A detailed investigation was carried out to improve the survival of yoghurt culture during drying. Outlet air temperature is a major processing parameter affecting the extent of survival of lactic acid bacteria. Survival of yoghurt culture was higher during freeze drying than in spray drying. This is due to the fact that higher temperature, employed in spray drying causing destruction of yoghurt culture. Ascorbic acid and monosodium glutamate was added to impart stabilization during storage because of the anti oxidant properties. Storage studies upto 30 days at 4°C and 30°C revealed that the Survival of *S.salivarius* ssp. *thermophilus* in chemically stabilized spray dried powder was equal to that of the freeze dried powder. But *L.delbrueckii* ssp. *bulgaricus* was higher in chemically stabilized spray dried yoghurt powder than in freeze dried powder. This is due to the fact that *L.delbrueckii* ssp. *bulgaricus* is more vulnerable to freezing damage during freeze drying and so its count was lower in freeze dried yoghurt powder. During further storage also the survival of *L.delbrueckii* ssp. *bulgaricus* decreased.

Table 1. Survival of *S.salivarius* ssp. *thermophilus* in Freeze dried and chemically stabilized spraydried yoghurt powder during storage

Sl.No.	Sample	Freeze dried	Chemically stabilized spray dried	t-value
		$\log_{10}$ cfu/ml	$\log_{10}$ cfu/ml	
1.	Fresh yoghurt (control)	9.38 ± 0.18	9.38 ± 0.18	0.00
2.	Dried powder (zero day)	8.27 ± 0.26	8.30 ± 0.23	0.09
3.	Dried powder (30th day at 4°C)	7.57 ± 0.18	7.79 ± 0.32	0.60

"Chemically stabilized" indicates addition of ascorbic acid and mono sodium glutamate.

Table 2. Survival of *L.delbrueckii* ssp. *bulgaricus* in Freeze dried and chemically stabilized spraydried yoghurt powder during storage

Sl.No.		Freeze dried	Chemically stabilized spray dried	t-value
		$\log_{10}$ cfu/ml	$\log_{10}$ cfu/ml	
1.	Control (before drying)	8.56 ± 0.28	8.56 ± 0.28	0.00
2.	dried powder (zero day)	6.19 ± 0.21	7.19 ± 0.20	3.45**
3.	dried powder (30th day at 4°C)	3.23 ± 0.24	6.32 ± 0.28	8.45**

** Indicating significant difference at 1% level ($p < 0.01$).
"Chemically stabilized" indicates addition of ascorbic acid and mono sodium glutamate.

Survival of *S.salivarius* ssp. *thermophilus* in freeze dried andchemically stabilized spray dried yoghurt powder during storage

The data with respect to the survival of *S.salivarius* ssp. *thermophilus* in spray dried and chemically stabilized spray dried yoghurt powder are given in Table 1. Statistical analysis of data with regard to survival of *S.salivarius* ssp. *thermophilus* revealed that there was no significant difference noticed between freeze dried powder (zero day, 30th day at 4°C) and chemically stabilized spray dried powder on zero day and 30th day at 4°C respectively. This might be due to the fact that skim milk used in preparation of yoghurt itself acts as a cryoprotective agent and thus it preventing the cold shock. Hence further addition of cryoprotective agents is not necessary during freeze drying

REFERENCES

ABD-EL-Gawad, I.A., M.M. Metwally, S.A. EL-Nockrashy and K.E. Ahmed, 1989. Spray drying of lactic acid cultures. II. The effect of culture conditions and storage on microorganisms survival. Egypt. *J. Dairy Sci.*, 17:273-281.

Kim, S.S and S.R.Bhowmik, 1990. Survival of lactic acid bacteria during spray drying of Plain yoghurt. *J. Food Sci*., 55:1008.

Porubcan, R.S. and R.L.Sellers, 1975. spray drying of yoghurt and related cultures. *J. Dairy Sci*., 58:787.

Rogers, L.A. 1914. The preparation of dried cultures. *J. Infectious diseases*. 14: 100-123.

Sherwood, G.L., 1990. Lactic acid bacteria and human health. Ann. Med., 22:37.

Snedecor, G.W. and W.G. Cochran, 1994. Statistical method. IOWA State University Press, Ames, IOWA, USA.

Tamime, A.Y. and H.C. Deeth, 1980. Yoghurt : Technology and Biochemistry, *J. Food Prot*., 43 : 939.

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