Research Paper

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Sensory Evaluation of Pasteurised Flavoured Milk Supplemented with Co-Encapsulation of Pre- And Probiotics During Refrigerated Storage

Science

KEYWORDS : Sensory evaluation, prebiotics, probiotics co-encapsulation, flavoured milk

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ABSTRACT

The present study was done to evaluate effect of co-encapsulation of certain probiotics namely, Lactobacillus paraplantarum 321 and Bifidobacterium bifidum 235 with commercial prebiotic sugars (FOS) on sensory characteristics in flavoured milk samples at refrigerated condition for 8 days of storage. Co-encapsulation of probiotics @ 1×107cfu/g with 3% prebiotic sugars (FOS) was done by extrusion method using 2% sodium alginate. Five different flavoured milk treatments were prepared to study the sensory characteristics of flavoured milk samples by subjecting it to sensory evaluation using 9 point hedonic scale evaluated during eight days of refrigerated storage. The results indicated that supplementation of co-encapsulated L. paraplantarum 321 with prebiotic (FOS) sugar treatment flavoured milk samples improved flavour and mouth feel characteristics and received higher scores than other treatment groups during refrigerated storage

INTRODUCTION

Flavoured milk has a good consumer acceptance as a refreshing and nourishing milk beverage. Innovative products within the dairy segment may include milk-based products or milk as a carrier for good ingredients. It can be flavoured milk with addition of probiotics as well as prebiotics in it. Indian probiotic products currently are Dahi, flavoured milk and butter milk. Probiotics "For Life" are living, health-promoting microbial food ingredients that have a beneficial effect on humans (Chuayana et al., 2003). Prebiotics are classified as "non-digestible food ingredients that beneficially affect the host by selectively stimulating the growth and/or activity of one or a limited number of bacteria in the colon, and thus improve host health" (Gibson and Roberfroid, 1995). As the popularity of flavoured milk products continue to grow, manufacturers are constantly evaluating value-added ingredients such as utilisation of co-encapsulated prebiotics and probiotics to entice health-consciousness of consumers.

Sensory analysis represents a critical step at various stages during food product development (Cruz et al., 2010). Inclusion of probiotics does not significantly alter the sensory properties of dairy products (Hekmat and Reid, 2006).

Sensory analysis of flavoured milk with co-encapsulated prebiotics and probiotics is required for manufacturers so as to have healthful ingredients into their products. Although flavoured milk is widely consumed, its sensory profile has received less attention.

No investigation has been reported on sensory attributes of flavoured milk incorporated with co-encapsulated pre- and probiotics during refrigerated storage in flavoured milk. The aim of the present study was to evaluate the sensory characteristics of flavoured milk supplemented with encapsulated pre- and probiotics during refrigerated storage.

MATERIALS AND METHODS

Probiotic cultures

The probiotic organisms used in the present study are Lactobacillus paraplantarum 321 and Bifidobacterium bifidum 235, obtained from National Collection of Dairy Cultures, NDRI, Karnal, and Haryana. L. paraplantarum 321 and B. bifidum 235 strains and were activated to get bacterial powder.

Micro-encapsulation

The micro-encapsulation of L. paraplantarum 321 and B. bifidum 235 using 1% sodium alginate as coating material was carried out according to the method of Chen et al. (2005), with some modification using micro-encapsulator.

Preparation of probiotic flavoured milk

Probiotic flavoured milk was prepared according to the method of Sadaghdar et al. (2012) with some modifications using encapsulated and non encapsulated probiotics with prebiotics. The toned milk was preheated and mixed with sugar (6%), rose colour and flavour and heated at 900 C for 15 minutes with proper mixing. Then cooled to 370C and divided into different lots. Then it was added with encapsulated and non encapsulated probiotics L. paraplantarum 321 and B. bifidum 235 with prebiotics, respectively in aseptic conditions along with control containing only flavoured milk, and stored under refrigeration temperature for 8 days.

Sensory evaluation

The properties such as appearance, flavour and mouth feel for flavoured milk samples were evaluated by subjecting it to sensory evaluation by 5 untrained panelists using a 9 point hedonic scale. Randomly, each cup of treatment was drawn from the refrigerator and was served to panelists for judging.

RESULTS AND DISCUSSION

Appearance scores

The mean scores for appearance (Table 1) in flavoured milk treatment groups showed no significant ($p<0.05$) effect of treatments and storage periods on the appearance scores in all the flavoured milk samples. The panellists did not differentiate appearance in all the flavoured milk treatments. The result is in accordance with the findings of Kailasapathy (2006) who reported that there was no effect on appearance and color between yogurts containing free and encapsulated probiotic bacteria.

Flavour scores

The mean flavour scores (Table 2) of control flavoured milk group were not significantly ($p<0.05$) different from flavoured milk supplemented with non encapsulated L. paraplantarum 321 and B. bifidum 235 groups during corresponding storage periods, respectively. It might be due to acid production in both non encapsulated free cells mainly by utilising prebiotic FOS during fermentation process and affecting flavour profile during storage, the result is in agreement with the results of microbial counts in both non encapsulated cells that showed increased counts.

The flavour scores for flavoured milk supplemented with encapsulated B. bifidum 235 did not differ significantly ($p<0.05$) with control flavoured milk group on 4th and 8th day of storage.

The result is in accordance with findings of Hansen et al. (2002) who found that flavour profiles in micro-encapsulated cells showed that micro-encapsulation using alginate altered the resting metabolism of bifidobacteria, possibly producing small peptides known to give bitter flavours in milk.

Flavoured milk supplemented with encapsulated L. paraplantarum 321 group showed significantly ($p<0.05$) higher scores than control flavoured milk group. It may be due to metabolically inert state of probiotic bacteria in microcapsule and lesser production of fermentation metabolites like lactic acid during refrigerated storage without affecting flavour. Flavoured milk supplemented with encapsulated L. paraplantarum 321 group showed more scores for flavour than any other groups.

The result is similar to the findings of Khalil and Mansour (1998) who reported that encapsulated mayonnaise had improved texture due to the production of exopolysaccharides produced by bifidobacteria and/or with the presence of calcium alginate.

Mortazavian et al. (2007) reported that micro-encapsulation of probiotics leads to flavour fixation of fermented products because encapsulated cells are relatively or totally inactive in metabolism and do not influence flavour profile of the products, especially during storage time.

Capsule beads size with the range of 1-3 mm in diameter can adversely affect both texture and flavour of the final product (Chandramouli et al. 2004). The alginate bead in Fig. 1. showing the size ranging 35.7-96.7 µm which therefore, might have not adversely affected on flavour profile in flavoured milk.

Mouth Feel scores

The mean mouth feel scores (Table 3) in flavoured milk groups supplemented with encapsulated L. paraplantarum 321 and encapsulated B. bifidum 235, respectively had significantly ($p<0.05$) higher scores than control flavoured milk group. Added alginate beads ranging in size of 35.7-96.7 µm may be too small to be detected and also may have contributed to better mouth feel than control group.

Mortazavian et al. (2007) stated that the microbeads with diameters of more than the special limit (>100 µm) can deteriorate mouth feel properties of products such as liquid milk, yogurt and sour cream due to the appearance of the special sense of coarseness.

It was also reported that small capsules or beads under controlled conditions will not affect the texture of food products (Rokka and Rantamaki, 2010).

The result is also in agreement with Sousa et al. (2012) who stated the micro-capsules prepared by extrusion were of spherical shape and had an average diameter of 80-100 µm. These dimensions are adequate if incorporation in food products is foreseen because being so small they will not affect mouth feel.

The mouth feel scores of flavoured milk supplemented with non encapsulated L. paraplantarum 321 and B. bifidum 235 respectively showed significantly ($p<0.05$) higher scores than control flavoured milk group on 8th day of storage. The panellists gave higher scores for flavoured milk supplemented with non encapsulated groups than control flavoured milk. It may be due to the presence of prebiotic which may have affected the mouth feel in flavoured milk.

The result is in agreement with the statements made by Franck (2002) who stated that inulin-type fructans are used as a means of providing texture, stabilising foam and improving mouth feel in various food products.

Nondigestible oligosaccharides have been used in food products to improve the mouth feel owing to their viscosity properties (Mussatto and Mancilha, 2007). Increasing the concentration of prebiotics, inulin, has been shown to increase the viscosity and other mouthfeel characteristics of products (Guggisberg et al. 2009).

CONCLUSION

It may be concluded that co-encapsulation of pre- and probiotics improved flavour and mouth feel in flavoured milk. Addition of co-encapsulated L. paraplantarum 321 with prebiotic sugars influenced positively during storage period, received higher sensory scores compared to other treatments and control group. Future studies are needed to find the effect of probiotics with different coating materials on the organoleptic properties of dairy based products.

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Table 1. Effect of different treatments and storage periods on mean appearance scores of flavoured milk

Treatment	Initial day	Fourth day	Eighth day
T1 (Control)	7.80±0.20	7.40±0.20	7.20±0.20
T2 (Encapsulated L. paraplantarum 321 with FOS)	7.80±0.20	7.40±0.24	7.20±0.20
T3 (Non encapsulated L. paraplantarum 321 with FOS)	7.80±0.20	7.60±0.24	7.40±0.24
T4 (Encapsulated B. bifidum 235 with FOS)	7.60±0.24	7.40±0.24	7.20±0.24
T5 (Non encapsulated B. bifidum 235 with FOS)	7.80±0.20	7.40±0.24	7.20±0.24

Each mean value is obtained from three replications

Table 2. Effect of different treatments and storage periods on mean flavour scores of flavoured milk

Treatment	Initial day	Fourth day	Eighth day
T1 (Control)	7.80±0.20	7.00b±0.20	6.60b±0.24
T2 (Encapsulated L. paraplantarum 321 with FOS)	8.00±0.24	7.80a±0.20	7.60a±0.24
T3 (Non encapsulated L. paraplantarum 321 with FOS)	7.80±0.20	7.00b±0.20	6.80b±0.20
T4 (Encapsulated B. bifidum 235 with FOS)	8.00±0.32	7.40b±0.24	7.00ab±0.20
T5 (Non encapsulated B. bifidum 235 with FOS)	7.80±0.20	7.20b±0.20	7.00ab±0.20

Each mean value is obtained from three replications abValues with same superscripts in a column do not differ significantly at the level of $p<0.05$.

Table 3. Effect of different treatments and storage periods on mean mouth feel scores of flavoured milk

Treatment	Initial day	Fourth day	Eighth day
T1 (Control)	7.20±0.20	6.80c±0.20	6.40c±0.24
T2 (Encapsulated L. paraplantarum 321 with FOS)	8.00±0.20	7.80a±0.20	7.60a±0.24
T3 (Non encapsulated L. paraplantarum 321 with FOS)	7.60±0.24	7.00c±0.20	7.00b±0.20
T4 (Encapsulated B. bifidum 235 with FOS)	7.80±0.20	7.60ab±0.24	7.00b±0.20

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T5 (Non encapsulated B. bifidum 235 with FOS)	7.60±0.24	7.20bc±0.20	7.00b±0.20

Each mean value is obtained from four replication

abcValues with same superscripts in a column do not differ significantly at the level of $p<0.05$

Figure:

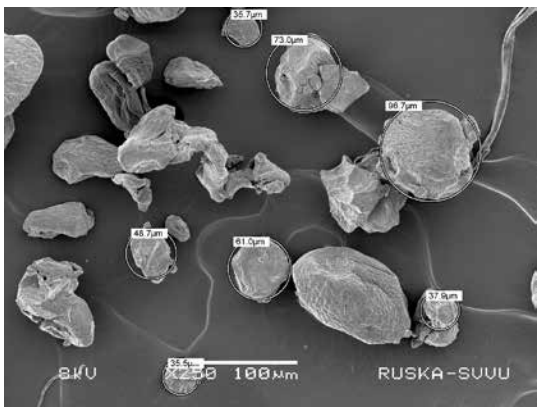

Fig. 1. Scanning Electron Microscopy (SEM) showing varying sizes of alginate micro- capsule

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