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Development and standardization of no added sugar probiotic and symbiotic functional yoghurts and their sensory characteristics on the day of preparation

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ABSTRACT
Functional foods like probiotic yoghurts are familiar in western countries but in India it's value of health benefits is just getting started among elderly subjects. Compare with elders, children prefer yoghurts due to their availability in the market are mostly sweet oriented which is avoidable in elderly because of their health reasons. Elderly generally consume bland diet due to their taste, age, health problems which influence the intake of foods. This study is development of possible bland, no added sugar yoghurt variations with probiotics (L.casei and B.bacterium bifidum) and prebiotics (Fructo oligosaccharides (FOS) and onion extracted prebiotics (OEP)) and their sensory properties on the day of preparation. The yoghurts with L. casei individual and in combination with prebiotics (OEP/FOS) had significantly higher mean overall acceptability scored compared to yoghurts with Bifido bacterium bifidum in combination with prebiotics (OEP/FOS). Health conscious elderly have opted for bland yoghurts compared with young panelists.
Key words: *Bland yoghurts, Elderly health, Onion, Probiotics and prebiotics, Yoghurt variations*

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INTRODUCTION

Yoghurts in the market are though less familiar to the Indian consumers, they think that those are kid's diet because, all the live cultured yoghurts available in the market are flavoured, sweet, fruit mixed to attract consumers and reduce the sourness which is common attribute of live probiotic cultured or symbiotic functional yoghurt. Functional foods are "those foods that encompass potentially healthful products including any modified food or ingredient that may provide a health benefit beyond the traditional nutrients it contains" [1]. The best known functional compounds are probiotics, prebiotics and synbiotics. FAO/WHO defined probiotics as "live microorganisms that when administered in adequate amounts to confer a health benefit on the host"[2]. *Lacticacid bacteria* (LAB) and *bifidobacteria* (BB) are the most important probiotic microorganisms typically associated with the human gastrointestinal tract.[3] The prebiotics undergo fermentation by probiotics and becomes energy sources in the large intestine. Common prebiotics in use include inulin, fructo-oligosaccharides (FOS), galacto oligosaccharides (GOS), soy-oligosaccharides, xylo-oligosaccharides, pyrodextrins, iso-maltooligosaccharides and lactulose. There is also emerging of new prebiotic compounds that include: pectic oligosaccharides, lacto-sucrose, the sugar alcohols, gluco-oligosaccharides, levans, resistant starch, xylosaccharides and soy-oligosaccharides. These are present in many vegetables and grains, such as leeks, onions, garlic, oats, barley and rye.[4] When taken together through, pre- and probiotics are termed as *synbiotics* as both work together in a synergistic way to enhance the probiotic benefits through functional foods. The medium mostly used for these pre, pro and synbiotics is dairy milk. Among the dairy milk products, yoghurt is one of the commonly consumed dairy product. Yoghurt is a nutritious and fermented dairy product which contains more than ten essential nutrients based on the strains of starter culture and type of whole or skimmed milk used, time of incubation and sweeteners and fruits added into it.

Many factors affect the consumption of yoghurt in elderly[13]. In view of increasing demand for yoghurt food products, the industries are concentrating not only on the quantity but also ensuring safety and healthy products.[5] Also, the industrial scenario has considerably improved in terms of storage, transportation and commercialization of these products. There is a strong link between interest in health and perceived need for health benefits *via* functional foods, both of which together found more frequently in older consumers and as well as a propensity to consume functional foods. Being conventional products, the functional foods modify the ways of providing health benefits above and beyond basic nutrition are concentrated in the areas of bone and cardiovascular health aspects and gastrointestinal functioning, all of which are primary health concerns in older people. They play a pivotal role in supporting older people's health, but don't replace healthy eating but needs to be supplemented. Many consumers are aware of the link between health and nutrition.[6, 7] and therefore the trend in society is to demand for healthy food with added health-improving benefits.[8] But yoghurts available in the market are lack of natural and plain in their taste or flavor. So health conscious people do less opt for sweet mixed yoghurts and prefer towards plain yoghurt which has health benefits, bland taste with less sweetness and low fat.
Plain probiotic and symbiotic yoghurts are not seen in the market and very limited studies are available with prebiotics from onion, FOS with the combination of *L.casei* and *B.bifidum.* Hence the possible combinations of probiotic and symbiotic plain yoghurts were developed to get motivated by the consumers especially health conscious elderly.

MATERIALS AND METHODS

The stationery-phase of probiotic bacterial strains (*L. casei 17* and *B. bifidum 231)* were obtained from Live stock Production Technology, College of Veterinary Sciences, Hyderabad before harvesting and used in milk fermentation. Onions for extraction of prebiotics and milk for the preparation of yoghurts were obtained from the local market. Commercially available fructo oligosaccharides (FOS) were also used as a prebiotic.

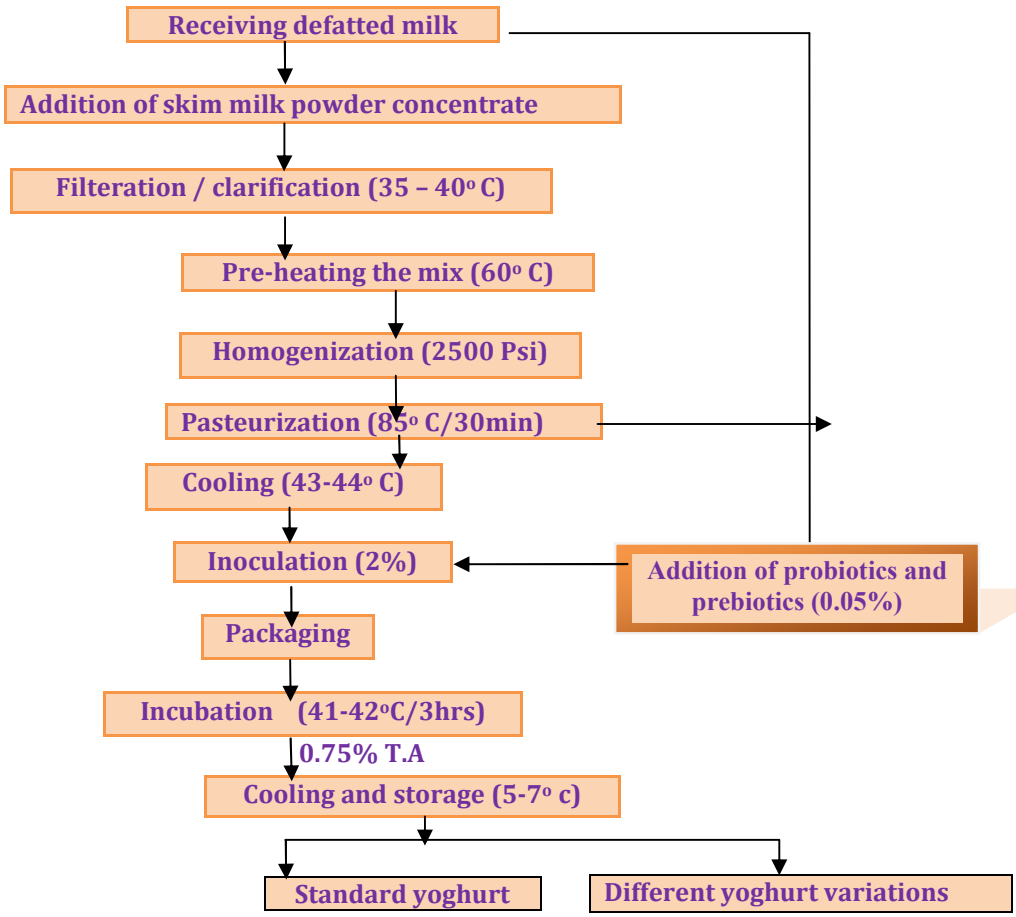

Fig.-1 Standard method for preparation of yoghurt (Firm bodied)

Source : Sukumar De, 2012.

Mother cultures for yoghurt preparation were made with the activated cultures. Reconstituted skim milk (RSM) supplemented with 9% (w/v) skimmed milk powder was autoclaved at 115°C for 15 min and inoculated separately with 1% (w/v) of each strain *L. casei* 17, *B. bifidum* 231 and commercial starter culture (CHR HANSEN YC-381 freeze dried - direct vat set culture (DVS)) under sterile conditions and incubated at 37°C for 12h. These set yoghurt samples were stored at -4±1°C for the purpose of inoculum.

Prebiotics from onions were extracted by the method given by Kamada *et al*.[9] The onion (*Allium cepa L.)* ground fine-paste was heated in hot-water at 98ºC for 2h and crude extract was pre-filtered by a muslin cloth to avoid blocking of membranes with the suspended particles. Later, it was subjected to ultra-filtration (UF) in a pilot-scale membrane system of Nishotech Systems, Mumbai, India. Nano membrane used in the system were PES 20 KD (polyethelene sulphate 20 Kilo Daltons) supplied by the same company.

Development of yoghurt variations: The basic starter cultures *Lactobacillus bulgaricus* and *Streptococcus thermophilus* are used for the preparation of standard yoghurt (Fig.-1).

Experimental yoghurts were prepared with the addition of prebiotics and probiotics with 0.5% fat skimmed milk. Milk boiled at 90°C was cooled to 40°C, supplemented with requisite inoculums (2%) and left for coagulation in incubator at 37°C for 12h. The functional foods were standardized by incorporating the probiotics (*L. casei* 17 and *B.bifidum* 231) either alone or in combination with the extracted prebiotics from onion and fructo-oligosaccharides + yoghurt starter culture at different combinations. Onion extracted prebiotics and FOS 0.5% (w/v) were heated separately in 10 mL of milk to dissolve properly and cooled to approximately 40°C followed by inoculation at 2% (v/v) each of *L. casei* 17, *B. bifidum* 231 and yoghurt starter culture separately. Eight batches of fermented milk were processed using the yoghurt starter culture in different combinations of pre- and probiotics and compared with the basic starter culture yoghurt as control. The different combinations of yoghurt varieties developed are given in Table.-1.

Table.-1 Formulations used for the development of yoghurt variations

Sample No.	Yoghurt variations
C	Control (Yoghurt starter culture = *S.thermophilus* and *L.bulgaricus delbrucki sp.)*
V1	Yoghurt starter culture + *L. casei* 17
V2	Yoghurt starter culture + *B.bifidum* 231
V3	Yoghurt starter culture + Fructo-oligosaccharides
V4	Yoghurt starter culture + *L. casei* 17 + Fructo-oligosaccharides
V5	Yoghurt starter culture + *B.bifidum 231* + Fructo - oligosaccharides
V6	Yoghurt starter culture + Onion extracted prebiotics
V7	Yoghurt starter culture + *L. casei 17* + Onion extracted prebiotics
V8	Yoghurt starter culture + *B. bifidum 231* + Onion extracted prebiotics

RESULTS AND DISCUSSION

Yoghurt samples developed were evaluated for sensory quality characteristics on the day of preparation. The mean sensory evaluation score for all the sensory attributes of different yoghurts on the day of preparation is given in Table 4.1. The mean score for color ranged from 7.63 (V8) - 8.00 (V1), appearance scored least in V2, V5, V8 (7.63) and maximum in C and V7 (7.88). Mean scores for flavor ranged from 7.63 (V5) to 8.00 (C, V1), mouth feel scored least in V2, V3, V5, V6 (7.50) highest in C,V7,V8 (7.75), taste ranged from 7.62 (V5,V8) to 8.00 (V1, V6), body and texture mean scores ranged from 8.00 (V2,V3,V5) to 8.50 (V1) and overall acceptability scored least for V2, V4 and V5 (8.25) and highest for V1,V3 and V8 (8.50).

Table-1: Mean sensory evaluation score of yoghurt variations on the day of preparation

Yoghurt variations combination	Color	Appearance	Flavor	Mouthfeel	Taste	Body and texture	Overall Accptability
C - YSC	7.88 ± 0.83	7.88 ± 0.35	8.00 ± 0.75	7.88 ± 0.70	7.88 ± 0.64	8.25 ± 0.46	8.38 ± 0.51
V1 - Lc	8.00 ± 0.75	7.75 ± 0.46	8.00 ± 0.75	7.63 ± 0.51	8.00 ± 0.53	8.50 ± 0.53	8.50 ± 0.53
V2 - Bb	7.75 ± 0.70	7.63 ± 0.51	7.75 ± 0.46	7.50 ± 0.53	7.75 ± 0.46	8.00 ± 0.53	8.25 ± 0.46
V3 - FOS	7.75 ± 0.70	7.75 ± 0.46	7.75 ± 0.46	7.50 ± 0.53	7.88 ± 0.64	8.00 ± 0.75	8.50 ± 0.53
V4 - Lc+FOS	7.75 ± 0.70	7.75 ± 0.46	7.75 ± 0.70	7.63 ± 0.51	7.88 ± 0.35	8.13 ± 0.64	8.25 ± 0.46
V5 - Bb+FOS	7.75± 0.70	7.63 ± 0.51	7.63 ± 0.51	7.50 ± 0.53	7.62 ± 0.51	8.00 ± 0.00	8.25 ± 0.46
V6 - OEP	7.75 ± 0.46	7.75 ± 0.46	7.75 ± 0.46	7.50 ± 0.75	8.00 ± 0.75	8.13 ± 0.64	8.38 ± 0.51
V7 - Lc+OEP	7.75 ± 0.46	7.88 ± 0.35	7.75 ± 0.70	7.75 ± 0.46	7.75 ± 1.03	8.38 ± 0.51	8.38 ± 0.51
V8 - Bb+OEP	7.63 ± 0.74	7.63 ± 0.51	7.88 ± 0.35	7.75 ± 0.46	7.62 ± 0.74	8.25 ± 0.46	8.50 ± 0.53

Values are Mean ± SD

C= yoghurt starter culture (control); V1=yoghurt starter culture + Lactobacillus casei17; V2= yoghurt starter culture + Bifidobacterium bifidum 231; V3= yoghurt starter culture+ fructo- oligosaccharides;

V4= yoghurt starter culture + Lactobacillus casei17+Fructo oligosaccharides; V5= yoghurt starter culture + Bifidobacterium bifidum 231+fructo oligosaccharides; V6= yoghurt starterculture + onion extracted prebiotics; V7= yoghurt starter culture + Lactobacillus casei17 + onion extracted prebiotics; V8=yoghurt starter culture + Bifidobacterium bifidum 231 + onion extracted prebiotics.

Significant difference was not observed in the mean scores for color, appearance, flavor, taste, body and texture of yoghurt samples on 0^{th} day between control and experimental variations and also among the different variations of yoghurt samples studied (Table.1).

The significant decrease ($P < 0.05$) was observed in the mean scores for mouth feel and overall acceptability of all yoghurt samples on 0^{th} day between control and experimental variations and also among the different varieties of yoghurt samples studied. This may be due to onion flavor in OEP mixed yoghurts varied from other variations of yoghurts which is giving smell of *raita* an Indian dish curd mixed with onions. The similar results showed on the day of preparation in yoghurts made with coconut enriched yoghurts had lower mouth feel scores compared to conventional control yoghurt without addition of coconut. [11] and garlics [12].

CONCLUSION

The yoghurts with *L. casei* 17 individual and in combination with prebiotics (OEP/FOS) had significantly higher mean overall acceptability score compared to yoghurts with *Bifido bacterium bifidum* in combination with prebiotics (OEP/FOS). Yoghurts prepared with the combination of *L.casei* 17 had firm in texture than other yoghurts. However, all yoghurts developed bland i.e. without sugar or salt significantly showed higher acceptable among elderly and health conscious people. Hence, promoting different bland yoghurt variations such as without addition of preservatives, salt or sugar is need to be followed by the industries for the health of elderly.

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