COMPARATIVE STUDIES ON INDIGENOUS STARTER CULTURE STRAINS FOR THEIR RATE OF ACID PRODUCTION

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Summary

Three strains each of *L. bulgaricus* and *S. thermophilus* isolated from indigenous dahi were examined for their rate of acid production and corresponding pH values in skim milk medium incubated at 40℃. No significant increase in titrable acidity or decrease in pH were recorded from initial period up to 2nd hour in both the strains. Following this period, however, there was a continuous increase in titrable acidity and a decrease in pH value in the milk for all the tested strains. Further it was observed that there was a variation among these strains for their acid production rate. High rate of acid production was recorded for the *L. bulgaricus* as compared to *S. thermophilus*.

The results further, suggested that efforts should be made to select a proper pair of *L. bulgaricus* and *S. thermophilus* according to their rate of acid production, at a particular temperature in order to produce a good quality product.

(Key Words: Indigenous Bacterial Strains, *L. bulgaricus*, *S. thermophilus*)

Introduction

In an earlier communication (Masud at al., 1991) it has been reported that *L. bulgaricus* and *S. thermophilus* constituted the predominant micro-flora of market made dahi samples. It is well recognized that these two species play an important role for the preparation of high quality product by their symbiotic relationship (Hamann and Marth, 1984). Both organisms produce lactic acid as the main fermentation product (Puhan et al., 1973). The rate of acid production depends upon the strain used for inoculation at a particular temperature (Martley, 1983).

In the present study an attempt was made to compare our indigenous strains of *L. bulgaricus* and *S. thermophilus* for the rate of acid-production with the aim of selection of better pair of starter culture for good quality product.

Materials and Methods

Bacteria (culture)

Three strains each of *L. bulgaricus* and *S. thermophilus* isolated from indigenous dahi samples from local market (Masud et al., 1991) were used. They were maintained in skim milk (Difco) at 4℃ and renewed at weekly interval. Sixteen hours old milk culture of these strains were used for inoculation. The skim milk was inoculated separately with individual cultures of these organisms at 1% level of each. Each strain was examined three times. The inoculated milk samples were incubated at 4℃ for 8 hrs.

Chemical Analysis

Growth of each strain was observed for their titrable acidity as described by Robinson and Tamime (1976). pH was determined by pH meter at one hour interval.

Results and Discussion

The starter culture used for the preparation of a fermented product have been selected on the basis of their acidification rates and organoleptic quality of final product (Batt, 1986). In manufacturing yoghurt with the defined starter the *S. thermophilus* is used in conjunction with *L. bulgaricus* as starter, the cocci forming the greatest proportion of the population at the time

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of inoculating the milk. The production of acid in the early stages of yoghurt making depends substantially on the activity of cocci while lactobacilli are responsible for continuing the acidification process. These properties depend upon the strains used for inoculation.

The results showing the mean value of acid production rate and their corresponding pH for the examined strains of *L. bulgaricus* and *S. thermophilus* at 40℃ upto 8 hours are presented in figure 1 and figure 2 respectively. There was a considerable diversity between the individual

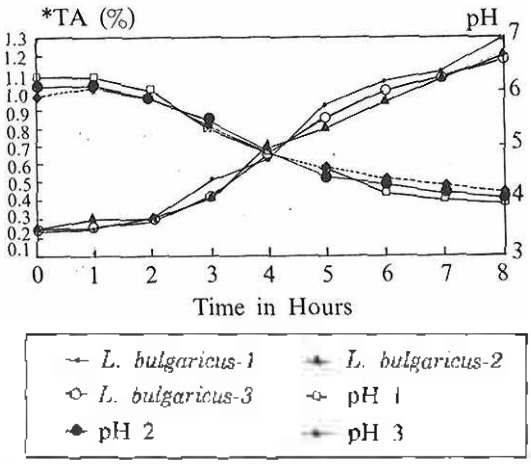

Figure 1. Rate of acid production and their corresponding pH values with time among the tested strains of *L. bulgaricus* at 40℃.

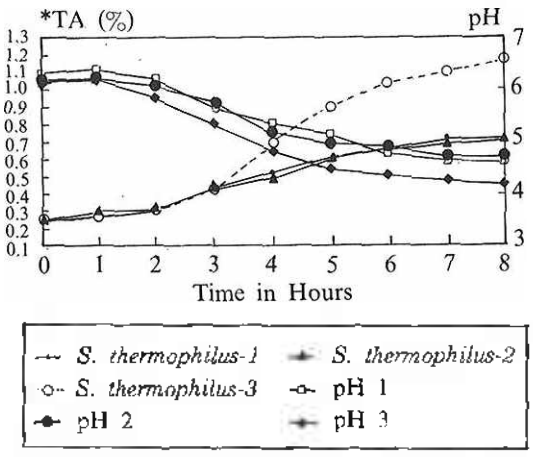

Figure 2. Rate of acid production and their corresponding pH values with time among the tested strains of *S. thermophilus* at 40 ℃.

strains of *L. bulgaricus* and *S. thermophilus* with respect to their rates of acid production confirming the observations of Accolas et al. (1980). This diversity is propably more significant than the generalization that the *L. bulgaricus* exhibit maximum rate of acid production as compared to the *S. thermophilus*. These results are also in line with the findings of Mohanan et al. (1983). They reported that of the 3 cultures inoculated into milk individually, *L. bulgaricus-1* was found to be the most active followed by *L. bulgaricus-2 and S. thermophilus* both in regard to their viable count as well as acid production at all the incubation temperatures.

The data presented in the paper also supports the view of Radke-Mitchell and Sandine (1986) that the *S. thermophilus* had large generation time relative to *L. bulgaricus*. The generation time determined for *S. thermophilus* varies from 51.7 to 109.3/min while *L. bulgaricus* strain varies from 40.2 to 77.9/min.

There was no significant difference among the examined strains of *L. bulgaricus* for their rate of acid production. In case of *L. bulgaricus-1* the acidification varies from 0.24 to 1.25%, *L. bulgaricus-2* varies from 0.26 to 1.20% and in *L. bulgaricus-3* from 0.25 to 1.18% at 0 to 8 hours time intervals. However in *S. thermophilus* tested strains, there was also no significant increase in titrable acidity upto 3 hours, afterwards a high rate of acid production was recorded in case of *S. thermophilus-3* as compared to other tested strains of *S. thermophilus* (figure 2). This may be due to its optimum temperature. Our findings generally agreed with those of Randke-Mitchell and Sandine (1986), who determined the optimum growth temperature for 9 strains of *S. thermophilus* ranged from 35-42℃. The other possible reason for this variation may be due to the differences in their genetic make up. Jeffery (1985) reported that some of the properties essential for successful milk fermentation are encoded by genes located on plasmid DNA. Furthermore, it was reported by Yu et al., (1983) that if the plasmid profile of the two organisms is similar or even identical, however, they may be different in their nucleotide composition, nucleotide sequence or even both.

It was further observed that there was an inverse relationship between titrable acidity and pH values of each strain at different time inter-

vals. This reciprocal relation has also been presented in figure 1, 2 respectively. There was no significant increase in their rate of acid-production upto 2 hours, therefore, this period may be considered as their lagphase. Afterwards there was a continuous increase in their rate of acid-production up to 8 hours in case of *L. bulgaricus* strain. However, a different pattern of acid production was recorded in case of *S. thermophilus* strains. There was no significant increase in titrable acidity during 6, 7, 8 hours of incubation for *S. thermophilus-1* and *S. thermophilus-2* except for *S. thermophilus 3* strains which showed significant increase upto 1.17% titrable acidity at 8 hours. This different pattern of acid production among these two species might be due to the pH of the media which was continuosly changing as a result of bacterial growth. The *L. bulgaricus* may grow at low pH as compared to *S. thermophilus*. Similar views are expressed by Mohanan et al. (1983).

On the basis of the present investigations it may be concluded that *L. bulgaricus* produced more acid as compared to tested strain of *S. thermophilus*. The results further suggested that in order to produce a good quality product a balanced growth of the two organisms is essential. As Martley (1983) reported that in the preparation of yoghurt the relative acid production abilities of both the streptococcus and lactobacillus in addition to any synergetic effect that might exist between the strains must be accounted. If the pH-temperature curves of the two organisms are not mentioned, the streptococcus may predominate and the quality of the yoghurt be affected adversely. Therefore, further study is needed to determine their optimum growth temperature so that a suitable pair can be selected according to our local environmental conditions.

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