Sensory evaluation of spray dried and agglomerated goat milk powder and their comparison

Sudharshan Reddy Ravula, Ramachandra CT, Parabhaker Reddy Ravula, Sharanagouda Hiregoudar and Uday Kumar Nidoni

Abstract
The aim of this present investigation was to study the sensory evaluation of spray dried and agglomerated goat milk powder. The goat milk powder was characterized by four characteristics: colour and appearance, flavour, consistency and overall acceptability. A nine-point hedonic scale was used to point out the differences amongst the spray dried and agglomerated goat milk powder samples. An average score of ten judgments was determined for each sample. The overall acceptability of spray dried was almost similar to market cow milk powder whereas agglomerated milk powder was dissimilar.

Keywords: Sensory evaluation, spray dried, agglomerated goat milk powder, their comparison

1. Introduction
Milk can be considered a source of macro- and micronutrients, and also contains a number of active compounds that play a significant role in both nutrition and health protection (Ceballos et al., 2009) [3]. Goat’s milk has some special characteristics that discuss technological advantages when compared to cow’s milk, such as a smaller size of fat globules, which provides a smoother texture in derived products, lower amounts of casein, resulting in softer gel products, a higher water holding capacity and a lower viscosity (Haenlein, 2004; Silanikove et al., 2010; Gomes et al., 2013) [6, 11, 9]. It is estimated that there are 102 breeds and types of goats in the world, 95% of them are developed countries. There are 20 breeds of goats in India (Banerjee, 2006) [2], although 70% of their population are non-descript and meat type, however, some of the Indian breeds such as Jamunapari, Barbari, Beetal, Surti and Jarkhana produce fair amount of milk and meat type, however, some of the Indian breeds such as Jamunapari, Barbari, Beetal, Surti and Jarkhana produce fair amount of milk and

Material and Methods
Production of goat milk powder
The spray dried goat milk powder process involves the preheating, filtration, standardization, homogenization, pasteurization, concentration (35, 40 and 45%) at 60 °C and spray drying (160, 170 and 180 °C). These unit operations and powder evaluation explained by Reddy et al. (2014) [11] were adopted to produce optimized spray dried goat milk powder of inlet temperature of 171/85 °C and concentration of 39% total solids. Agglomeration goat milk powder at different conditions (Temperatures from 50 to 70 °C and binding concentration from 0 to 0.8%) was produced with optimized spray dried condition.
Sensory evaluation of developed product

In the present investigation, the goat milk powder can be characterized by four characteristics: colour and appearance, flavour, consistency and overall acceptability. Colour and appearance is characterized as whiteness. Flavour descriptors include mixed fruit flavour, goaty flavour and cooked flavour. Consistency is represented as fairness and flowability. The goat milk powder was judged for attributes viz., colour and appearance, flavour and consistency and overall acceptability of spray dried and agglomerated Osmanabadi goat milk powder. A panel of judges drawn from the University community assessed the sensory quality of non-agglomerated and agglomerated goat milk powders. Panelists worked in partitioned booths (36±1 °C), without air flow, free from noise and odours and under off white light in order to mask different colours of the spray dried and agglomerated samples and therefore to prevent bias. A nine-point hedonic scale was used to point out the differences amongst the spray dried and agglomerated goat milk powder samples. The judges rated the spray dried and agglomerated goat milk powder samples for colour and appearance, flavour, consistency and overall acceptability [Singh et al., 2003] [14].

The freshly prepared samples of spray dried and agglomerated goat milk powder were subjected to sensory evaluation by a panel of judges. The samples chosen for sensory evaluation were; Sample-1 = 35% concentration and 170 °C temperature; Sample-2 = 39% concentration and 171 °C temperature and Sample-3 = 45% concentration and 170 °C temperature; for Agglomeration treatments; Sample-4 = 0% binder concentration and 60 °C temperature; Sample-5 = 0.8% binder concentration and 60°C temperature; Sample-6 = 0.32% binder concentration and 60 °C temperature; Sample-7 = Commercial cow milk powder. Score cards were provided to judges to evaluate the product on a 9 point Hedonic scale. An average score of ten judgments was determined for each sample. The milk powder was rated on a nine-point hedonic scale. Nine points were awarded as like extremely-9, like very much-8, like moderately-7, like slightly-6, neither like nor dislike-5, dislike slightly-4, dislike moderately-3, dislike very much-2 and dislike extremely-1 (Gandhi and Taimini, 2009) [6].

Results and discussion

Sensory evaluation of spray dried and agglomerated goat milk powder

The spray dried and agglomerated goat milk powder acceptance was evaluated based on product colour and appearance, flavour, consistency and overall acceptability. The results of sensory analysis of spray dried and agglomerated goat milk powder is presented in Table 1.

Colour and appearance

The average sensory score for colour and appearance of spray dried goat milk powder was found to be maximum in sample-2, i.e., 7.9, whereas, the sensory score for agglomerated goat milk powder was found to be maximum in sample-7, i.e., 7.54 and minimum in sample-6, i.e., 6.22. It is evident from Fig. 1, that there was not much variation in colour values of spray dried goat milk powder in all treatments whereas less score was obtained for agglomerated goat milk powder in all treatments when compared to control due to addition of lecithin. Yellowness increased with increase in lecithin concentration, consequently whiteness decreased which was proved by Hunterlab colourimeter.

Flavour

The average sensory score for flavour of spray dried goat milk powder was found to be maximum in sample-2 and 3, i.e., 7.50 and 7.30, respectively whereas the sensory score for agglomerated goat milk powder was found to be maximum for sample-7, i.e., 7.33 and minimum in sample-6, i.e., 6.00. It is clearly observed from Fig 1, that the average sensory score for flavour of spray dried goat milk powder was observed to be slightly more or less same, but in case of agglomerated goat milk powder, it was less in all treatments compared to control. This might be due to addition of mixed fruit flavour and increase in lecithin concentration which gave the unpleasant flavour to the judges. The milk flavour of agglomerated goat milk powder was strongly dominated by these two additives.

Consistency

The average sensory score for consistency of spray dried goat milk powder was found to be maximum in sample-2, i.e., 7.40 and minimum score was obtained in sample-1, i.e., 6.90. The sensory score for agglomerated goat milk powder was found to be maximum for sample-7, i.e., 7.55 and minimum in sample-6, i.e., 6.22. The average sensory score for consistency of spray dried goat milk powder was observed to be slightly more or less similar but in case of agglomerated goat milk powder, it was observed to be less in all treatments compared to commercial milk powder due to increase in addition of lecithin which led to decrease in fairness of powder. The sensory scores for consistency of spray dried and agglomerated goat milk powders are illustrated in Fig. 1.

Overall acceptability

The average sensory score for overall acceptability of spray dried goat milk powder was found to be maximum in sample-2, i.e., 7.50 and minimum score was obtained in sample-1, i.e., 7.10. Moreover, the overall acceptability for agglomerated goat milk powder was found to be maximum in sample-7, i.e., 7.53 and minimum in sample-6, i.e., 6.22. The results of scores awarded and analysis of variance showed that all the judges had the same opinion about overall acceptability of spray dried goat milk powder but judges gave low ranking for agglomerated goat milk powder. According to judge’s score, the commercial milk powder was superior to the agglomerated goat milk powder as shown in Fig. 1.
Table 1: Sensory score for spray dried and agglomerated Osmanabdi goat milk powder

<table>
<thead>
<tr>
<th>Product code</th>
<th>Attributes</th>
<th>Colour and appearance</th>
<th>Flavour</th>
<th>Consistency</th>
<th>Overall acceptability</th>
</tr>
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<tbody>
<tr>
<td>Spray dried goat milk powder</td>
<td></td>
<td>7.50</td>
<td>7.00</td>
<td>6.90</td>
<td>7.10</td>
</tr>
<tr>
<td>P1</td>
<td></td>
<td>7.90</td>
<td>7.30</td>
<td>7.40</td>
<td>7.50</td>
</tr>
<tr>
<td>P2</td>
<td></td>
<td>7.50</td>
<td>7.30</td>
<td>7.20</td>
<td>7.30</td>
</tr>
<tr>
<td>P3</td>
<td>Agglomerated goat milk powder</td>
<td>6.55</td>
<td>6.55</td>
<td>6.75</td>
<td>6.85</td>
</tr>
<tr>
<td>P4</td>
<td></td>
<td>6.95</td>
<td>6.85</td>
<td>6.80</td>
<td>6.80</td>
</tr>
<tr>
<td>P5</td>
<td></td>
<td>6.22</td>
<td>6.00</td>
<td>6.22</td>
<td>6.22</td>
</tr>
<tr>
<td>P6</td>
<td></td>
<td>7.54</td>
<td>7.33</td>
<td>7.55</td>
<td>7.53</td>
</tr>
<tr>
<td>P7</td>
<td>Mean</td>
<td>7.18</td>
<td>6.89</td>
<td>7.01</td>
<td>7.06</td>
</tr>
<tr>
<td>SD</td>
<td>0.57</td>
<td>0.46</td>
<td>0.43</td>
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<tr>
<td>CV (%)</td>
<td>7.87</td>
<td>6.63</td>
<td>6.15</td>
<td>6.13</td>
<td></td>
</tr>
</tbody>
</table>

Spray drying treatments; Sample-1 = 35% concentration and 170 °C temperature; Sample-3 = 45% concentration and 170 °C temperature.

Agglomeration treatments; Sample-4= 0% binder concentration and 60 °C temperature; Sample-5 = 0.8% binder concentration and 60°C temperature; Sample-6 = 0.32% binder concentration and 60 °C temperature; Sample-7 = Commercial cow milk powder. S = Significance

Conclusions
In the present investigation, sensory attributes of spray dried and agglomerated goat milk powder was evaluated. The following sample evaluated for sensory were: For spray dried powder treatments; sample-1 = 35% concentration and 170 °C temperature; sample-2 = 39% concentration and 171 °C temperature and sample-3 = 45% concentration and 170 °C temperature; for Agglomeration treatments; Sample-4= 0% binder concentration and 60 °C temperature; Sample-5 = 0.8% binder concentration and 60 °C temperature; Sample-6 = 0.32% binder concentration and 60 °C temperature; Sample-7 = Commercial cow milk powder. The preference for samples based on overall acceptability was: sample-7>sample-2>sample-3>sample-1>sample-4>sample-5>sample-6. It was observed from the data, spray dried milk powder was likely moderated where as agglomerated milk powder was like slightly.

References


