PREPARATION AND ANALYSIS OF FRUITS FLAVORED MILK

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Abstract

Aim: Preparation and analysis of fruit-flavored milk to evaluate its nutritional value as compared to plain milk

Method: Preparing fruit-flavored milk samples using two different fruits orange and strawberry and evaluating milk's quality using several factors to determine if it has a high nutritional value in fruit-flavored milk or plain milk. pH, acidity, specific gravity, TSS, fat, protein, and sensory attributes were investigated.

Result: The slices of orange and strawberry were dried at 55, 60, 65, 70, and 75 degrees Celsius with the air velocity held constant at 1.5 meters per second. Concentrations of 1, 1.5, and 2 g of powdered dried orange and strawberry per 100 ml of milk were added to the milk. Under different settings, the fat content was 1.87–2.07%, the protein content was 3.33–3.37%, the acidity was 0.15–0.19%, the total soluble solids (TSS) were 15–16Brix, the specific gravity was 1.05–1.063, and the pH ranged from 5.47–5.50. Further, when drying air temperatures increased, the ascorbic acid concentration in the dried pineapple reduced.

Conclusion: An indisputable characteristic for the blending of powder and milk was uncovered by a sensory examination of flavored milk.

Keywords: Drying, Flavoured milk, Orange, Protein, Powder, Sensory analysis

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1. INTRODUCTION

About 10% of the world's milk supply, which India produces, is ranked top in the world. In addition to being small-scale and dispersion, milk is a perishable commodity that must be treated effectively, either as liquid or for use in product preparation, or both. Most of the milk produced in the nation is concentrated into normal milk products, with the other half being used for fluid milk (Arepally, Ravula, and Reddy 2017).

These components of milk are utilized to create unique milk products such flavor-infused milk, milk with soft curds, fermented milk, standardized milk, and milk that has been blended with other types of milk to create humanized milk. Flavored milk is milk that has been combined with sugar, flavouring agents, and coloring preservatives. It includes every component of milk. It is an excellent source of minerals, carbs, and proteins provides the water and energy needed to digest meals, control body temperature, and avoid dehydration. Flavoured milk, which is a significant and unique source of proteins, fat, minerals, and calories, had a special and significant place in the diet. Flavoured milk is anti-atherogenic, it doesn't contain cholesterol, and is high in polysaturated fatty acids, and has been demonstrated to stop blood cholesterol from rising on a high-fat diet. Infants who are allergic to cow and buffalo milk as well as lactose intolerant people appear to benefit from it. The attempts have been made to create flavor-infused milk from cow milk that has been combined with safflower milk (Ravula et al. 2017).

Due to the high level of consumer acceptance of flavoured milk as a hydrating and nutritious milk beverage, it is increasingly important to the market milk sector. Flavored milk has gained a significant market share in the overall fluid milk industry in recent years. Producing flavor-infused milk has nutritional benefits. Since many individuals, including those with cardiac conditions, do not believe milk in its natural form to be suitable. Full-fat milk cannot be effectively digested by infants or those who are ill. Making low-fat milk with flavour can solve all these issues (Ravula et al. 2017).

Orange and strawberry plants are mostly grown for their fruit, which is eaten either raw or in packed fruit and in juice form. Drying extends the shelf life of food and is one of the first methods of food preservation utilized by humans. To satiate the appetites of food lovers, the drying technique makes seasonal food available all year round (Arepally, Ravula, and Reddy 2017; Ravula et al. 2017). On restoration, orange and strawberry powder transformed into their juices. Sweets, baby meals, fruit chutney, confectionery, biscuits and bakery, ice creams, soft drinks, food premixes for sweets, milk-based products, and other items are also used as flavouring agents. Milk that has had flavour and color added to it to make it more pleasant is referred to as flavoured milk. The minimal legal criteria required for the milk from which it is manufactured by flavoured milk in terms of milk fat percent. Nowadays, there are many other flavors for flavour milk available in the market, including the more well-liked chocolate, fruit, and sterilized varieties. The process of normalizing milk to the proper fat and SNF percent is one used in the production of milk with taste added to it (typically 2% fat and 9.5% Solid Not Fat). After that, pasteurized milk is bottled, cooled, and refrigerated. Strawberry, orange, lemon, pineapple, banana, and vanilla are common flavors that are used to make various kinds of flavoured milk. Oranges and strawberries are seasonal fruits, and they can only be stored for a limited number of weeks. Both fruits may be kept for a long time in powder form or dried form (Sadasivam and Manickam 1992). The present study's objective was to examine the impact of adding dry orange and strawberry powder at various concentration levels as an additive to milk for increased nutritional value.

2. METHODOLOGY

2.1Experimental Set Up:

Strawberry and orange were acquired from a local place for the drying trials. The sides and ends were removed, peeled off, and cut into 10 mm thick slices before drying. The hot air batch drier, which has a heating section, temperature controller (40-120 °C), and drying chamber, was used for the drying trials. The dryer was warmed for about an hour before the experiment began to establish equilibrium conditions with predetermined temperatures and air velocity for each run. The 100 g samples of sliced orange and strawberry were evenly distributed onto clean perforated trays before being placed in the dryer to dry at various air temperatures of 55, 60, 65, 70, and 75 °C with a constant air velocity of 1.5 m/s. A digital scale with a 0.001 g precision was used to measure moisture loss during the drying process until a consistent weight was reached.

When the moisture content dropped from an initial value of 85.851.19% to 6-7%, drying was halted. For preparing flavor-infused milk, the dried product was stored in polythene covers.

2.2Physio-Chemical Analysis

2.2.1 Analysis of pH

A pH meter (Hanna, HI 8417) calibrated with buffers of pH 7.0 and 4.0 was used to determine the pH of strawberry- and orange-flavored milk.

2.2.2 Analysis of ascorbic acid

The method described was used to determine the vitamin C content of dried strawberries and oranges (Ravula et al. 2017; Sadasivam and Manickam 1992).

2.2.3 Analysis of acidity

The acidity of strawberry and orange flavored milk was measured using a modified version of the procedure described by Teka (2013). We used this equation to get the titratable acidity:

$$\%\ \text{Acidity (Lactic acidity)} = \frac{\text{ml NaOH} \times 0.1\text{N NaOH} \times 0.090}{\text{Volume of Sample}} \times 100$$

2.2.4 Analysis of total soluble solid (TSS)

A portable refractometer (Model: HT119-ATC) was used to measure the strawberry- and orange flavored milk's total soluble solids (oBrix).

2.2.5 Analysis of specific gravity

The modified technique of Javaid et al. (2009) was used to calculate the specific gravity of strawberry- and orange flavored milk using a pycnometer. The sample's specific gravity was estimated using the formula below:

$$\text{Specific gravity (at } 20^{o}\text{C)} = \frac{\text{Weight of sample}}{\text{Weight of distilled water}}$$

2.2.6 Determination of fat

Javaid et al. (2009)'s description of the Gerber technique, which was slightly modified, was utilized to determine fat.

2.2.7 Determination of protein
With a few modifications, Javaid et al. (2009)'s Micro-Kjeldhal technique was used to assess the protein in strawberry-flavored milk. Using the method below and [Protein Factor=6.38, dairy products], the nitrogen% was calculated:

$$\text{Nitrogen (\%)} = \frac{1.4 \text{ x HCl sample} - \text{HCl Blank x Normality of HCl}}{\text{Weight of sample taken}} \text{ x } 100$$

% Protein = Nitrogen (%) x Protein Factor

2.3Preparing Flavor-Infused Milk
Locally available pasteurized toned milk (Fat 3.5%, SNF 9.5%) was taken for the preparation of flavour milk. The milk was heated in a stainless-steel container to boiling point. The milk was boiled before the 4g of sugar was added and fully dissolved. A temperature of less than 20 °C was reached for the milk. The refrigerator was used for cooling.

With different quantities of 1 g, 1.5 g, and 2 g of powder per 100ml of milk, orange and strawberry powder was added to the milk. Glass bottles with lids were used to pack and seal the flavouring milk. To find out how long the orange and strawberry-flavored milk will last, it was refrigerated.

2.4Sensory Evaluation
As a crucial part of quality control, sensory assessment of products is often a contentious subject in international trading. Most of the nation's quality and grades are based on sensory characteristics. Four characteristics may be used to categories the flavoured milk in the current study: color and appearance, flavour, taste, and general acceptance. A group of judges evaluated the newly created samples of flavour milk using their senses. A group of judges from the university's student body evaluated the sensory appeal of flavor-added milk. The variations among samples were identified using a nine-point hedonic scale. For each sample, an average judgement score of ten was obtained. Nine points were provided, with like very receiving 9, getting like very much 8, like moderately getting 7, getting slightly like 6, neither like nor dislike getting 5, dislike getting 4, getting moderately dislike 3, dislike very much 2, and dislike extremely 1.

2.5Statistical Analysis
SPSS 25.0 was used to statistically analyze the data collected. Results were expressed as mean values with standard deviation (±SD).

3. RESULT AND DISCUSSION
Dried orange and strawberry slices went from an initial moisture content of 85.85±1.19 w.b. to less than 7 kg water. Drying rates in a convective drier are measured in terms of kilowatt-hours per kilogram of material dried at 55, 60, 65, 70, and 75 degrees Celsius. The drying rates of pineapple slices were drastically altered by each of these heat treatments. As can be seen in Fig. 1, with constant air velocity, moisture content decreased dramatically with increasing drying time across the board for all drying air temperatures. Decreases in moisture content over time are consistent with diffusion being the governing force in intracellular mass transfer. Furthermore, raising the temperature of the drying air shortened the drying time.

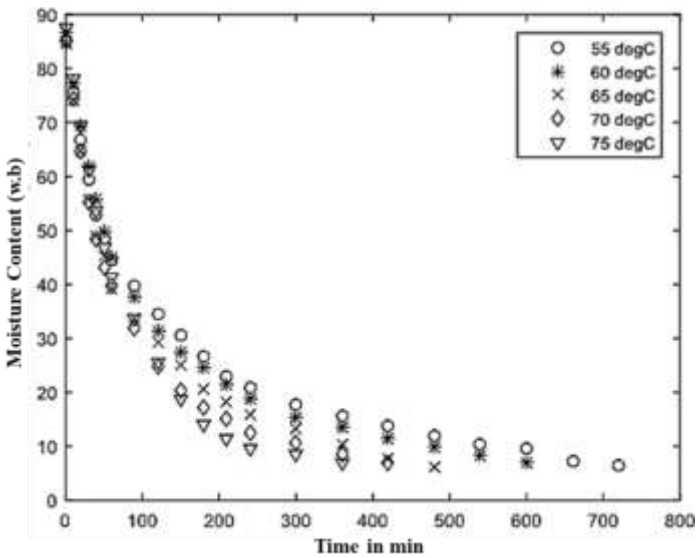

Figure 1. Plot of moisture content versus drying time at various drying air temperatures

3.1 Physiochemical Analysis

3.1.1 pH and acidity

Throughout the storage period, the pH of strawberry-flavored milk samples varied from 5.47 to 5.50. Orange had the highest pH at 5.50, whereas strawberry had the lowest. The previous research (Kamble et al. 2019) confirmed that the pH of milk flavored with piper betel varied between 6.27 and 6.55. Dhande et al. (2020) found that the pH of lemongrass-flavored milk was between 6.33 and 6.46, which is quite similar to the values we measured. Carrot-flavored milk beverages had a pH of 6.44 to 6.69 (Singh, Grewal, and Sharma 2005), which is higher than the values we measured. All samples of strawberry-flavored milk showed a considerable decrease in pH as storage time lengthened. It's possible that the product's acidity has increased owing to fluctuations in the storage environment's pH level. An increase in the number of microorganisms and the products they produce might be responsible for the minor pH drop (Hassan et al. 2015). While in storage, strawberry milk's acidity level varied from 0.15 to 0.19%. Sample 2 started off with the lowest acidity (0.15%), but by the end of storage, all samples had reached the same maximum of 0.19%. Dhande et al. (2020)'s findings, that wheatgrass-flavored milk had an acidity of 0.16 to 0.18%, are connected to our investigation. Strawberry flavored milk has an acidity that is similar to that of chikoo flavored milk (0.18%) and greater than that of banana flavored milk (0.20%), according to research by Dalim et al. (2012). Hassan et al. (2015) found that acidity in fruit-flavored milk varied from 0.20 to 0.28% after 7 days of storage, although the values we got for strawberry-flavored milk are lower. The research showed that when acidity levels increased, the pH of every sample decreased. When bacteria ferment lactose in milk, the resulting lactic acid contributes to the acidity rise (Hassan et al. 2015).

3.1.2 Total soluble solid

Throughout their storage time, strawberry and orange flavored milk maintained a total soluble solid (TSS) of 15 to 16 ^{o}Brix. TSS of the ready-to-drink milk was originally lowest in the orange sample and highest in the strawberry sample, but they both reached equal levels by the final day of storage.

3.1.3 Specific gravity

Straw berry flavored milk has a specific gravity of between 1.05 and 1.063 while kept in the fridge. After a longer period of time in storage, orange and orange samples both had a greater specific gravity. Dalim et al. (2012)'s research that found the specific gravity of Chikoo and banana flavored milk beverages to be 1.061 and 1.063, respectively, corroborated our findings. Kamble et al. (2019) reported that piper betel flavored milk had a specific gravity of between 1.066 and 1.074, which is lower than the values we measured. After 7 days in storage, there was no discernible difference between any of the samples (Kamble et al. 2019).

3.1.4 Fat content

Strawberry and orange flavored milk, as well as their respective fat contents, are listed in Table 1. Milk with orange and strawberry flavors had a fat level of 1.87 to 2.07 percent after being stored. Strawberry-flavored milk kept the greater fat % and lower sugar content of the orange-flavored milk. We were unable to acquire a number higher than 3.05%, which is lower than the 3.05-3.17% fat percentage of lemongrass flavored milk (Dhande et al. 2020). The fat level of milk made with ginger juice was 2.05%, which is quite close to the value found by Palthur et al. (2014b) (Palthur, Devanna, and Anuradha 2014). When testing several dietetic herbal milks, Palthur et al. (2014a) (Palthur, Anuradha, and Devanna 2014) found fat concentrations of 2.16 percent, which is somewhat higher than our own results. Over longer periods of time, the fat content of all samples is shown to decrease. Potentially causing alterations in fat composition is the addition of sugar. Rose, vanilla, cardamom, strawberry, kesar, pineapple, and mango flavored milks all had somewhat lower fat contents than unflavored milk, according to a study by Shelke *et al.* (2008). The sugar addition resulted in a larger amount of flavored milk in the end.

3.1.5 Protein content

During the periods of storage, strawberry and orange flavored milk had protein concentrations of 3.33–3.37%. The orange, on the other hand, has a larger concentration of protein (3.37 percent) than the strawberry, which has a lesser concentration (3.33 percent). Protein content in Piper betel flavored milk was reported to be between 3.34 and 3.65 percent by Kamble et al. (2019), corroboration of our finding. Dalim et al. (2012) found that the average protein concentration of chikoo-flavored milk was 3.56%, therefore our demonstration was a little lower than theirs. Dhande et al. (2020)'s protein content range of 3.20–3.31 was lower than our own. When compared to one another, the samples now in storage show no discernible variation. It has been suggested that flavoring agents added to milk might account for the protein fluctuation (Repate *et al*. 2010).

Table 1. The physico-chemical characteristics of strawberry and orange flavored milk		
Nutritional content	**Strawberry**	**Orange**
pH	5.47±0.10	5.50±0.12
Total fat (%)	1.93±0.06	1.87±0.06
Acidity (%)	0.19±0.19	0.19±0.01
TSS (°Brix)	16±0.12	15.67±0.58
Protein (%)	3.33±0.06	3.37±0.82
Specific gravity	1.053±0.01	1.056±0.01

3.1.6 Ascorbic acid

Figure 2 shows the impact of drying air temperature on ascorbic acid. It was discovered that the vitamin C content of a dried sample degraded at an increasing rate as the drying air temperature rose. There was a greater concentration of ascorbic acid at 55 °C and a lower concentration at 75 °C. Results are comparable with those found in "Santos and Silva (2009) for pineapple and kaya et al. (2010) (Kaya, Aydın, and Kolaylı 2010) for kiwi". In addition, the data show that the influence of temperature on vitamin C was more significant than the effect of time on the breakdown of ascorbic acid during drying.

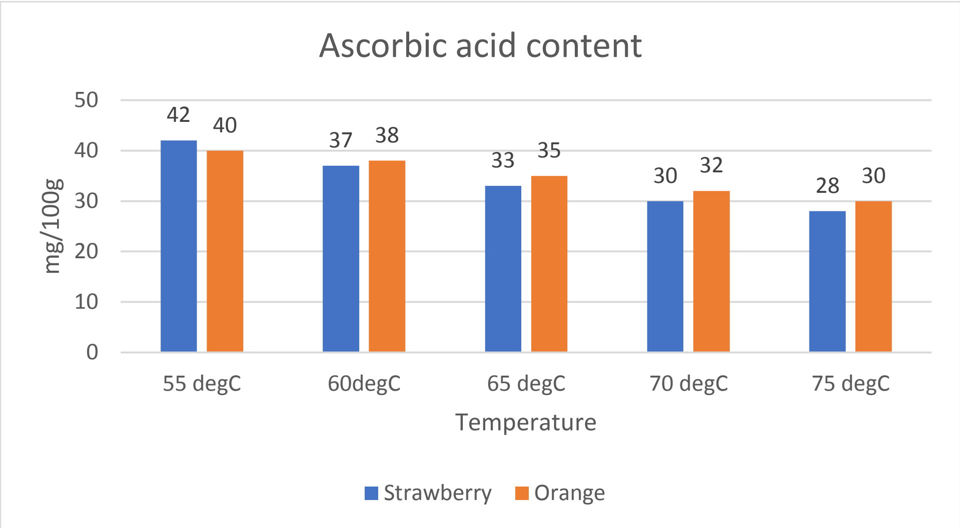

Figure 2. Effect of drying air temperature on ascorbic acid content in dried strawberry and orange powder

3.2 Sensory Evaluation

Milk with orange and strawberry flavors was evaluated based on its color, appearance, flavor, taste, and general acceptability to obtain a sensory score.

Table 2. Sensory score for orange and strawberry flavoured milk was carried out on the basis of attributes of color and appearance, flavour, taste, and overall acceptability								
Temperature	**Color & appearance**		**Flavour**		**Taste**		**Overall acceptance**	
	Orange	Strawberry	Orange	Strawberry	Orange	Strawberry	Orange	Strawberry
55 °C	8.5	8.7	8.1	8.5	8	8.2	7.8	8
60 °C	8.2	8.5	8	8.2	8.3	8.4	7.9	7.9
65 °C	8.1	8.2	8.3	8.3	8.5	8.6	8.5	8.1
70 °C	7.9	8	7.5	7.6	8	8.2	7.2	7.5
75 °C	7.3	7.1	7.3	7.4	7.6	7.8	7.1	7.2

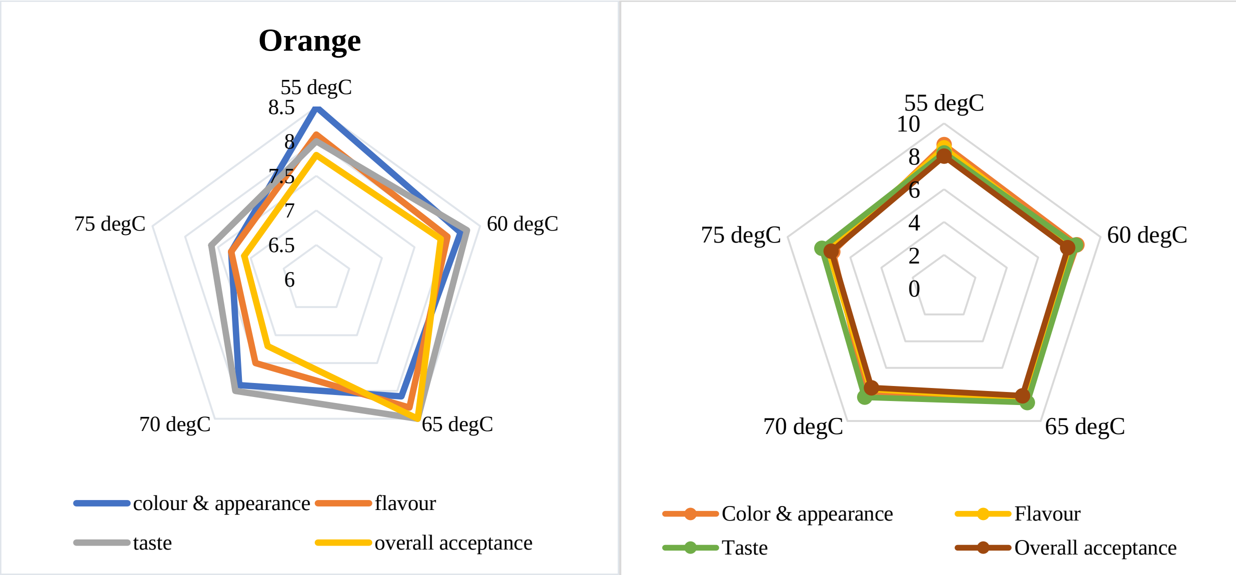

Figure 3. Sensory evaluation of orange and strawberry flavoured milk.

3.2.1 Color and appearance

The color and appearance of milk with orange and strawberry flavors were judged to be 8.5, 8.2, 8.1, 7.9, 7.3, and 8.7, 8.5, 8.2, 8, 7.1 on the hedonic rating scale at the temperatures of 55, 60, 65, 70, and 75°C, respectively, based on data gathered through sensory assessment by a panel of 10 members. Fig. 3,4 depicts the color change at various temperatures that was seen. At a temperature of 55 °C, the panel discovered the superior color. As drying temperature rises, drying progresses more quickly. Consequently, the dried orange and strawberry slices' color changed to a deeper shade (table 2).

3.2.2 Flavour

At temperatures of 55, 60, 65, 70, and 75 °C, correspondingly, the flavor of orange and strawberry flavor milk was determined to be 8.1, 8, 8.3, 7. 3.3 and 8.5, 8.2, 8.3, 7.6, 7.4 on the hedonic rating scale (table 2) (Figure 3). Results showed that milk with flavors of orange and strawberry had an excellent flavor. However, sensory panelists found that 65 °C had greater flavor than the other temperatures. Furthermore, when thin strawberry and orange slices were heated to 70 and 75 °C, it may result in protein denaturation and browning or burned flavor. Consequently, the flavoring in the milk had burned out.

3.2.3 Taste

The balance of organic acid and sugar concentration mostly determines taste. At temperatures of 55, 60, 65, 70, and 75 °C, correspondingly, the taste of orange and strawberry flavor milk was determined to be as 8, 8.3, 8.5, 8 7.6, and 8.2, 8.4, 8.6, 8.2, 7.8 on the hedonic rating scale. The impact of various concentrations of dried orange and strawberry powder on flavor at various temperatures is shown in Fig. 3. A temperature of 65 °C produced the superior taste. At a temperature of 75 °C, the taste of the flavor milk was scorched, which may have contributed to the disagreeable taste. Fresh orange and strawberry juices often contain a significant quantity of acids, which sometimes gives them a sour taste.

3.2.4 Overall acceptance

Fig.3 shows the impact of various dried orange and strawberry powder concentrations on overall acceptability at various temperatures. The judges' overall approval ratings for orange and strawberry-flavored milk were found to be highest at 65 °C and lowest at 75 °C.

3.3 Storage Period

The greatest amount of time that strawberry and orange-flavored milk could be stored was 1 gram of powder per 100 ml of milk. At a concentration of 2 grams of powder per 100 ml, the storage time was shorter. This might be because flavor-infused milk spoils because chemical reactions happen more quickly at greater concentrations.

4 CONCLUSION

There are a wide variety of foods and beverages that benefit from the addition of orange and strawberry powder as a flavoring agent. In the current study, fresh oranges and strawberries were collected, washed, and sliced to the appropriate dimensions. Slices of orange and strawberry were dried in a tray drier. The orange and strawberry flavored milk was created by grinding dried orange and strawberry slices into a powder and then adding various amounts of the powder to pasteurized, sweetened milk. Over time, strawberry flavored milk lost some of its physicochemical qualities. There was no statistically significant difference between orange and strawberry samples (P>0.05) in terms of pH, acidity, specific gravity, fat, and protein. It was shown that when drying air temperature increased, ascorbic acid concentration decreased. At 65 degrees Celsius, the strawberry, and orange milk was of a high sensory quality. Since flavored milk is a relatively new product, the results of this research will provide light on how to ensure the product's long-term physicochemical and sensory quality stability in the dairy business.

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6 CONFLICT OF INTEREST

None

7 FUNDING

None

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