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Impact of Lactation Stage and Flavoring on Qualitative Valuation of She-Camel Milk and yogurt from Consumers Perception

Azza Mekki Mohamed Holly[1]; Saliha Hammad Kafe Teya[2]; Sallam Adulfadeil Bakheit[3]; Idris Adam Idris Abdalla[3]; Jumaa Barram Jadalla[3]*

[1]. Faculty of Education, University of Kordofan, Sudan
[2]. Department of Food Science and technology, Faculty of Natural Resources and Environmental Studies, University of Kordofan, Sudan
[3]Department of Animal Production, Faculty of Natural Resources and Environmental Studies, University of Kordofan, Sudan

[3*] Corresponding author *(jumaaaringola2000@gmail.com)

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Corresponding Author

Jumaa Barram Jadalla

E-mail: *jumaaaringola2000@gmail.com*

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ABSTRACT

This study was conducted in Elobeid, North Kordofan State, Sudan with the objective of elucidating consumers' perception on fresh and flavored camel milk and on yoghurt prepared from the milk. Sixty she –camels at different parity (first to five) and lactation stages (early 1-4 months), medium (5-8 months) and late (9-12 months) were grouped into three groups. The camels were milked twice a day and the panelists were asked to taste the samples fresh or after being flavored using Saffron (*Corcus sativus*) Zaafran. The yoghurt prepared from fresh and flavored milk was also presented to and evaluated by the panelists. More data were collected using questionnaires. The data were analyzed via SPSS as descriptive analysis and Chi square test. The results showed that majority of the respondents were used to consuming camel milk and they were able to judge and show milk quality. The respondents also preferred milk at early stage of lactation due to taste of the milk being sweet rather than salty taste at medium and late stages of lactation. The respondents preferred milk without flavor or sweeter though small portion of the respondents preferred sweetener and flavor addition. The yoghurt prepared from fresh and flavored milk was similar though it was considered salty compared with yoghurt prepared from cow's milk. Pasteurization and boiling were accepted treatments by consumers. It was concluded that camel milk at early stage of lactation was believed being better and consumed readily and it was recommended that more studies be conducted in this field.

INTRODUCTION

Food security is currently an outstanding issue for debate since human population of the world is increasing at alarming rate associated with problems created by exploitation of world resources and climate change. The issue of food security has arisen also because of dependence on convention food sources that are decreasing and increasingly unable to meet the rapidly growing needs. In order to address this issue, there is a need to explore new world of resources. Animal products are most promising resources that can bridge the gap between food demand and supply. Among animal products, milk is the most important produce that can play key role in this regard. It is the product that is consumed without taboos and prejudges.

Milk and milk products are most important human food source. Conventionally, bovine milk is consumed worldwide. For little extend goats, sheep and in some places, equine are milked, and their milk is used. Camel can serve the best useful addition to the food supply chain in terms of milk, meat, and other products. The camel is an important animal component of the fragile desert eco-system. With its unique bio-physiological characteristics, the camel has become an icon of adaptation to challenging ways of living in arid and semi-arid regions. There are, officially, 46 national entities in the world declaring camel stock. Among them, 20 are in Africa, 25 in Asia and one in Europe (Ukraine). Regarding the geographical distribution of the two involved species, only dromedaries are found in African countries and in Near and Middle Eastern and Southern Asian countries, and only Bactrians inhabit Central Asia. (Faye, 2020). More than 60% of the dromedary camel population is concentrated in the arid areas of Northeast African countries like Somalia, Sudan, Ethiopia and Kenya. Camel milk has been acknowledged for a long time to provide a potential treatment for a series of diseases such as dropsy, jaundice, anti-hypertensive, asthma, and leishmaniasis or kala-azar. It has been reported that camel milk contains the low quantity of β-casein and the lack of β-lactoglobulin which cause allergic reaction, in lactose intolerant person Konuspayeva, *et al.,* (2009). Nevertheless, it contains insulin-like and protective protein used for the treatment of many ailments like diabetes, autism, and diarrhea and possesses anti-tumors properties Gul *et al.,* (2015). Moreover, camel milk is endowed with very strong immune system and remedy for peptic ulcers anti-malignant. Korashy *et al.,* (2012).

Chemical composition of camel milk, Camel's milk is generally an opaque white color and has a faint sweetish odor and sharp taste; sometimes it can be salty Abbas, (2013). Its opaque white color because of the fats are finely homogenized throughout the milk whereas, the changes in taste are caused by the type of fodder and availability of drinking water (Kumar *et al.,* 2015). Its density ranges from 1.026-1.035 and the pH from 6.2-6.5, both are lower than those of the cow's milk and maximum buffering capacity of skim milk is at pH 4.95 (Gul and Farooq, 2015). Camel milk has different sensory properties compared with cow's milk, and flavoring of camel milk with chocolate improved its acceptability among elementary school children (Hashim, 2002).

Camel milk has been used to treat tuberculosis and other lung ailments in Russia, and tuberculosis, dropsy, jaundice, and anemia in India. Traditionally, camel milk has been used for diseases treatment and Agrawal (*et al.,* 2007) also reported that it was used to treat diabetes. that camel milk improved long-term glycemic control and reduced insulin dose in patients with type-1 diabetes. In Sudan, *garris*, a traditionally fermented camel milk product, was used to cure

leishmaniasis and the protozoal disease of the belly (Dirar,1993). Products made from camel milk included the traditionally fermented products *garris* and koumiss (Dirar, 1993), Domiati cheese (Mehaia, 1993), fresh soft white cheese (Mehaia, 1993), hard cheese (Mohamed *et al.,* 2005), and ice-cream (Hammad,1992). In contrast to camel milk, goat milk products, especially cheeses and yogurt, were found very popular in the Mediterranean peninsula and in the Middle East (Tamime and Robinson, 1999). Caprine milk produces a very delicate yogurt with soft texture (Stelios and Emmanuel,2004), whereas camel milk was shown to have greater resistance to bacterial growth leading to less active cultures, and thus causing quality problems in its fermented products. For those reasons improving camel milk acceptability by favoring is necessary.

MATERIALS AND METHODS

The study area

The study was carried out at the Department of Animal Production, Faculty of Natural Resources and Environment Studies University of Kordofan, in El-Obied town area that lies at an altitude of 560 meters above sea level with a mean annual rain fall of 280 mm and mean annual temperature range of 30-35 with peaks of above 40^0 C during the month of April, May and June prior to the rainy season and minimum temperatures vary between 18-22^0 C during the winter season, which extends from November to February. The rainy season extend from July to October with the greatest monthly rainfall in August (Technoserve1987). The locality has an area of 800km and a population of about 0,5 million persons according to the 2010 national census. The locality represents the urban center of Kordofan region, as it encompasses the town of El-Obied, the regional capital and the second largest agricultural market in the country. Kordofan is a vast semi- arid region in western Sudan extending to about 400000 km, or 16% of the country's total area, falling within the low rainfall savannah (latitudes 11^0-16':16^0-30' N, Longitudes 27^0-32^0E). The region has been characterized by precarious environmental conditions. Sheikan lies on the low rainfall savanna on sand of the region with an annual rainfall of less than 300 mm and hence marginally cultivated (MARF, 1995).

The area is characterized by undulating sand dunes intermingled by spots of compacted clay soil locally termed as *gardud* which is hard to cultivate by hand tools (MOA 1995). The dominant vegetation is a varying mixture of grasses and herbs with scattered shrubs and trees intersected with bare areas (Techno serve 1987).

Data collection

Panel Test

Sensory evaluation of camel milk samples from three she-camel groups based on stage of lactation early (1-4 months), medium (5-8months) and late (9-12 month) flavored was offered to evaluators selected from panelists who were selected among the University workers. The yogurt samples were also offered to the group of panelists who were used to consuming yogurt prepared from cow's milk. Yogurt samples were evaluated for firmness, smoothness, sourness, body, and flavor. The panelists were trained to rate the intensity of stimuli using a 10- cm unstructured line scale anchored at both ends with low intensity and high intensity. The panelists marked each scale to indicate their rating for each attribute and the intensity was measured starting from the left side of the scale.

A total of 50 panelists consisting of workers of the university were recruited based on their liking and consumption of yogurt 2 to 3 times per week, interest in participation, and availability. The Panelists were instructed how to evaluate the samples and asked to rinse their palates with tap water after each sample. Yogurt samples were presented in white plastic cups under fluorescent light. The panelists rated the appearance, color, firmness (texture or body), smooth

Statistical Analysis

Data analysis was conducted using SPSS Statistical Software program (version 20,). Sensory data were statistically tested using ANOVA to determine if statistical difference existed at ($P \leq 0.05$) and the least significance difference (LSD) was used for means comparison.

RESULTS AND DISCUSSION

Questionnaire Results

The respondents/panelists personal characteristics showed that the highest ratio who were at 30-49 years of age (46%) and the lower whom their age were 20-30 years (23.3%) with 66.7% females and 33.3 % males. The educational level showed 20% of the respondents being secondary certificate holders, 72% university graduates and 12% as postgraduates. The majority (53.3%) reported having no camels in the area where they live. Though the respondents consumed camel milk before, only ratio small percentage (6.7%) who used camel milk regularly.

Taking the camel milk in the form of manufactured products was not common as that of cow's and goat's milk. were with the ratio of those who reported using garis, yoghurt, ice-cream, butter, fats were 33.3, 26.7. 13.3, 10, 3.3 and 9.3% respectively.

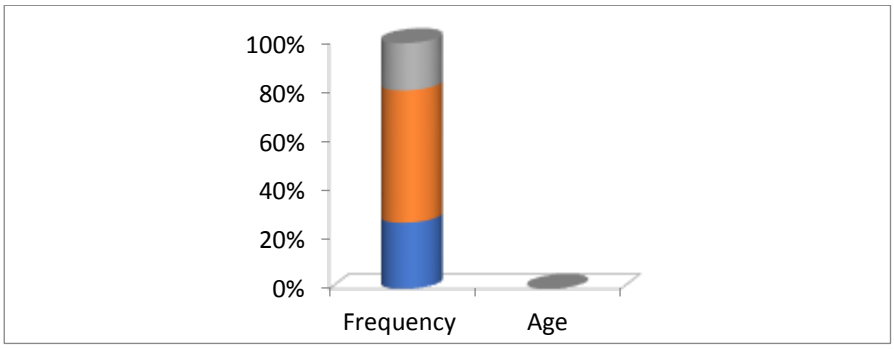


Figure (1): Personal characteristics of the respondents (age groups)

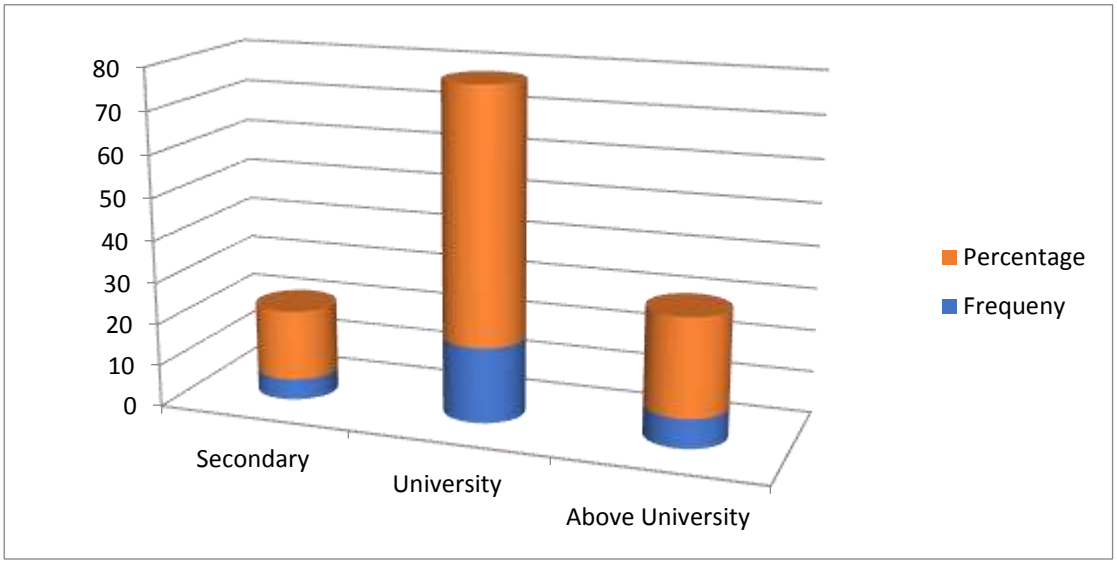
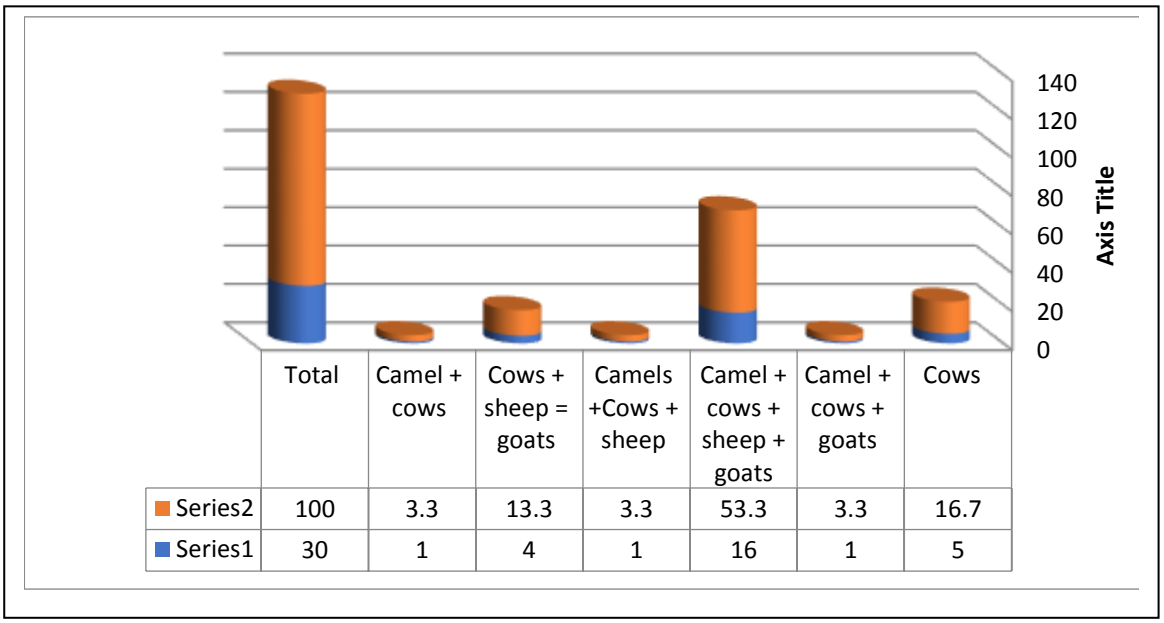


Figure (2): The educational levels of the respondents



	Total	Camel + cows	Cows + sheep = goats	Camels +Cows + sheep	Camel + cows + sheep + goats	Camel + cows + goats	Cows
Series2	100	3.3	13.3	3.3	53.3	3.3	16.7
Series1	30	1	4	1	16	1	5

Figure (3).Panelists experience in consuming milk from different sources

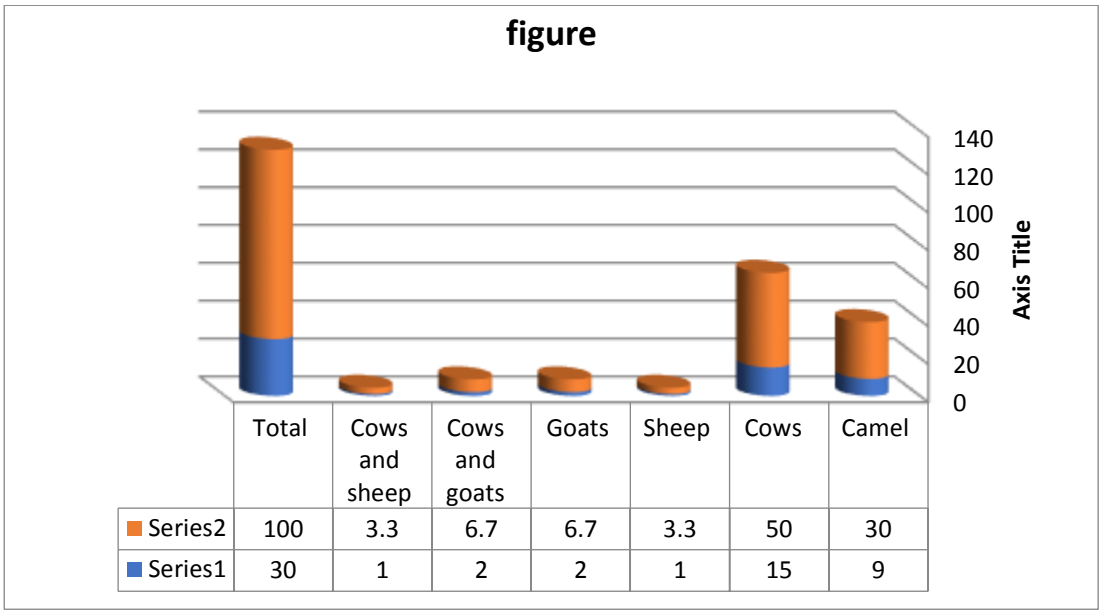


Figure (4). Respondents acceptability for milk and products

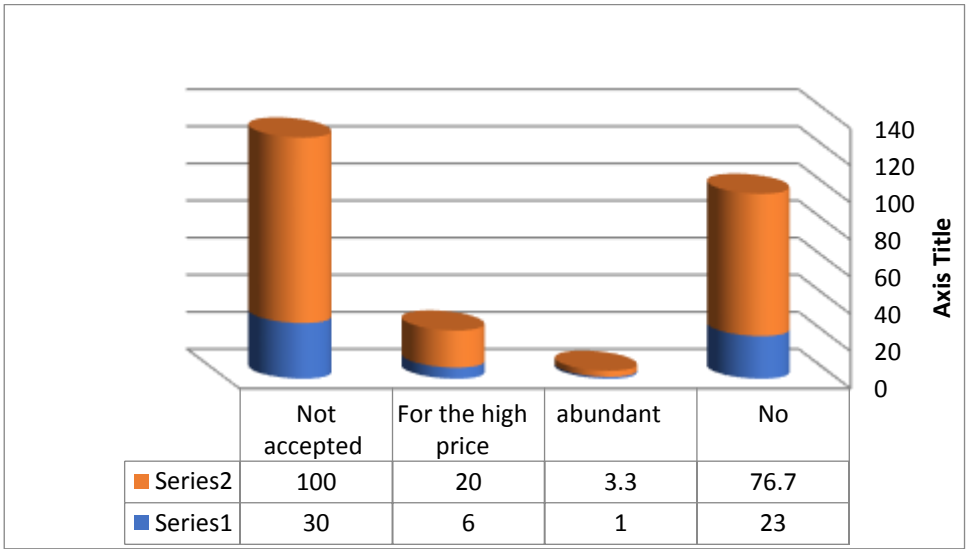


Figure (5). Respondents preference for camel milk products

Table (1). Preference of camel milk by respondents

Options	Frequency	Percentage
natural milk	18	36
sweet milk	3	6
jewel and flavoring milk	8	18
Indifferent	21	42
Total	50	100

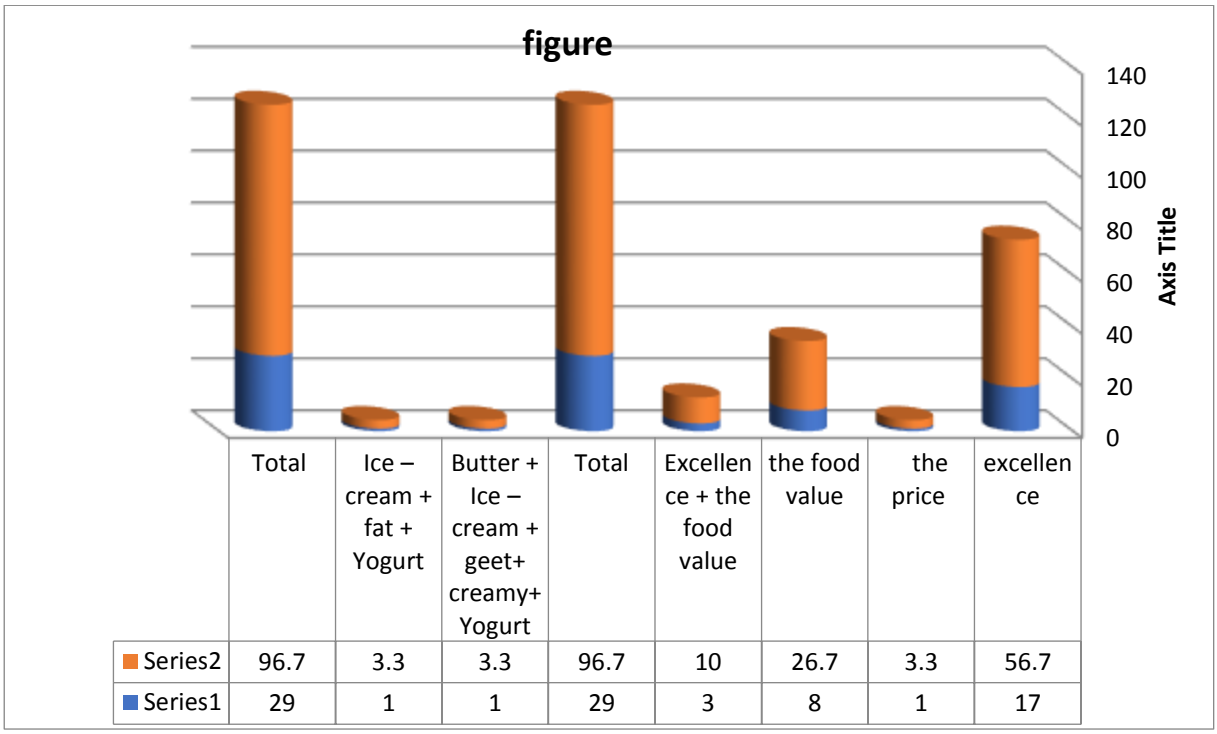


Figure (6). Evaluation of panelists to she camel milk and its products

Consumers' judgments on Camel milk and Yogurt

The respondents were requested to give their judgments on color, taste, textures, flavor, acceptability and quality of camel milk from the three groups based on lactation stage and yoghurt prepared from it. The milk was given fresh or flavored with saffron (*Corcus sativus*). The results are presented in table (2). Milk color was the best at early lactation stage and its value declined with advancement of lactation stage. The taste was more preferred at early stage but not at medium or late stage. It was similar and the panelists considered it salty medium or late stage. The flavoring did not affect milk acceptability irrespective of stage of lactation and general acceptability was better at early and median lactation stage. Flavoring improved taste, flavor and general acceptability than fresh unflavored for all stages of lactation but the color was considered inferior to being unflavored.

Yogurt prepared from she–camel milk was the best when the milk was taken from camels at early lactation stage controls and it was the best when the milk was flavored. The texture was best when yoghurt was prepared from milk taken at early stage followed by that made from medium lactation stage and finally when the camels at their late lactation.

The study found that the lactation stages had their effects on physical characteristics (color and taste) and also the concentration of substances in the chemical milk composition. Also the milk was supposed to be at the: first lactation stage better than mid and the late lactation stage. Findings of this study are in agreement with reports that were found changed composition and quality that attributed that change to dominant fatty acids in camel milk at early stage (palmtic and oleic acid) (Attia *et al*., 2001). Camel milk also contained higher concentration of long-chain fatty acids compared to cow milk (Konuspayeva *et al*., 2008). Similarly, average values of unsaturated fatty acids (43 %) are higher in camel milk, especially essential fatty acids (Haddadin *et al*., 2008). The amount of saturated fatty acids (Konuspayeva *et al*, 2008) is higher in cow milk (69.9 %) than in camel milk (67.7 %).

CONCLUSIONS

The results indicated that the lactation stage affected negatively the taste, flavor and general acceptability of camel milk and flavoring with saffron improved all quality attributes. It was found that the quality was changed concomitant with change of milk camel chemical composition.

Similarly yoghurt made from she-camel milk was also with good quality at early stages of lactation and declined with advancement of lactation stage.

Table (2): The Sensory evaluation of camel milk

Physical test	lactation stages	flavored	Fresh milk	SE
Color	Early	3.74±0.18	3.64±0.11	0.10**
	Median	3.45±0.15	3.25±0.12	0.11**
	Late	3.54±0.19	3.14±0.13	0.18**
Taste	Early	3.37±0.25	3.17±0.15	0.12**
	Median	2.69±0.19	2.65±0.14	0.13**
	Late	2.59±0.23	2.55±0.21	0.15*
Textures	Early	3.95±0.24	3.88±0.21	0.18**
	Median	3.96±0.15	3.96±0.19	0.23**
	Late	3.68±0.26	3.68±0.18	0.19*
Flavor	Early	3.59±0.25	3.39±0.20	0.19**
	Median	3.54±0.33	3.45±0.18	0.20**
	Late	3.47±0.25	3.36±0.22	0.20*
Acceptability	Early	3.73±0.21	3.65±0.19	0.24*
	Median	3.66±0.18	3.51±0.17	0.21*
	Late	3.48±0.21	3.28±0.20	0.18*
Quality	Early	3.89±0.23	3.78±0.21	0.10**
	Median	3.92±0.25	3.88±0.24	0.24**
	Late	3.98±0.11	3.89±0.18	0.18**

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