American Journal of Food Science and Nutrition Research
2017; 4(5): 158-164
http://www.openscienceonline.com/journal/fsnr
ISSN: 2381-621X (Print); ISSN: 2381-6228 (Online)

Impact of Adding Various Sweeteners on the Chemical Composition, Starter Activity and Sensory Properties of Cow, Oat, Barley and Sesame Milk Mixtures

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To cite this article

Mohamed Ismail Abou-Dobara, Magdy Mohamed Ismail, Mohammad Abdu Mossa, Nawal Mohamed Refat. Impact of Adding Various Sweeteners on the Chemical Composition, Starter Activity and Sensory Properties of Cow, Oat, Barley and Sesame Milk Mixtures. *American Journal of Food Science and Nutrition Research*. Vol. 4, No. 5, 2017, pp. 158-164.

Received: April 14, 2017; **Accepted**: April 27, 2017; **Published**: August 15, 2017

Abstract

The aim of this study was to investigate the chemical composition, starter activity (ABT-5) and sensory properties of cow, oat, barley and sesame milk and their mixtures. Also, effect of adding 5% sucrose, 5% honey, 2.5% fructose and 1.5% sorbitol to mixtures of cow and oat milk (50%:50%), cow and barley milk (50%:50%) and cow and sesame milk (50%:50%) on the above mentioned characteristics was studied. The acidity and redox potential (E_h) values of cow milk were higher than those of oat milk whereas these values were higher in barley and sesame milk than cow milk. The acidity, pH, and E_h results of mixed milk treatments were at an intermediate position. The highest total solids (TS) and total protein (TP) contents were found in cow milk followed by sesame milk then barley milk while oat milk possessed the lowest. Sesame milk had the highest fat values. Adding sucrose, honey and fructose to mixed milk markedly increased acidity and E_h while decreased pH values. There were no clear effects on acidity, E_h and pH values of various mixed milk treatments by adding sorbitol. Addition the mentioned sweeteners to milk increased total solids and slightly lowered fat and TP contents. Starter activity was higher in barley and sesame milk while lower in oat milk than cow milk. Adding different sweeteners especially honey to mixed milk samples enhanced the starter activity. Vegetarian milk recorded the lowest sensory evaluation scores. Mixing 50% cow milk with oat, barley, and sesame milk succeeded to improve the sensory attributes. More improvement appeared on the sensory properties of mixed milk by adding the sweeteners especially honey and sucrose.

Keywords

Oat Milk, Barley Milk, Sesame Milk, ABT Culture

1. Introduction

Plant milk substitutes are water extracts of legumes, oil seeds, cereals or pseudocereals that resemble cow's milk in appearance. There is a wide variety of traditional plant-based beverages around the world, for example, Horchata, "tigernut milk" in Spain; Sikhye, a beverage made of cooked rice, malt extract and sugar in Korea; Boza, a fermented drink made of wheat, rye, millet and maize consumed in Bulgaria, Albania, Turkey and Romania; Bushera, a fermented sorghum or millet malt based beverage from Uganda, and traditional soy milk originating from China [1], [2], [3], [4].

The consumption of vegan milk has considerably increased throughout the world which may be attributed to many medical reasons. Vegan milk (also is called plant-based milk substitutes) is free from lactose consequently, it is non-allergenic and suitable for people have lactose intolerance which is allergic to cow milk. On the other hand, the majority of plant-based milk substitutes can be made easily, quickly and economically at home. Also in countries where mammal milk is scarce and expensive, plant milk substitutes serve as a more affordable option. Technologically, plant milk substitutes are suspensions of dissolved and disintegrated plant material in water, resembling cow's milk in appearance. They are manufactured by extracting the plant material with water, separating the liquid and formulating the final product. Homogenization and thermal treatments are necessary to improve the suspension and microbial stabilities of commercial products that can be consumed as such or be further processed into fermented dairy-type products. The nutritional properties depend on the plant source, processing and fortification [5]. Therefore, the aims of this study were (1) to investigate the changes of the chemical composition, starter activity and sensory properties of cow, oat, barley, and sesame milk, (2) to evaluate the influence of adding different types of sweeteners to cow, oat, barley, and sesame milk on the above mentioned characteristics.

2. Materials and Methods

2.1. Materials

Fresh cow's milk was obtained from El-Serw Animal Production Research Station, Animal Production Research Institute, Agriculture Research Center. Sugar, honey, rolled oats (*Avena sativa* L.), barley (*Hordeum vulgare* L.) and sesame (*Sesamum indicum*) were purchased from a local grocery in Damiette Governorate. Fructose and sorbitol were obtained from El-Gomhouria Chemical Company, Egypt. ABT-5 culture which consists of *S. thermophilus*, *L. acidophilus* + *Bifidobacterium* was obtained d from Chr. Hansen's Lab A/S Copenhagen, Denmark. Starter cultures were in freeze-dried direct-to-vat set form and stored at – 18°C until used.

2.2. Methods

2.2.1. Preparation of Oat, Barley and Sesame Milk

(i). Preparation of Oat Milk

Rolled oats were soaked in water (1:1) at 75°C for 10 minutes. Then the soaked oats and water were blended in a blender at high speed for 5 min with adding water again to final ratio 1:3. The liquid solution obtained was filtered by using a cotton cloth. The solution obtained was the oat milk. Finally, oat milk was cooled to room temperature.

(ii). Preparation of Barley Milk

Barley grains were soaked in water (1:1) at 75°C for 6 hours. Additional water (2 parts) was added to the soaked barley and blended in a blender at high speed for 5 min. The plant-based milk (barley milk) was filtered through cotton cloth and separated from the spent barley grain. Finally, barley milk was cooled to room temperature.

(iii). Preparation of Sesame Milk

The decorticated sesame seed was firstly grinded then hot water (75°C) was added (1 sesame: 2 water). The mixture was blended in a blender at high speed for 10 min. The resulted sesame milk was filtered through cheesecloth to separate coarse particles. For pasteurization, sesame milk was filled in a beaker and heated to 90°C/5 min in boiling water bath with manual stirring. After finishing the pasteurization process, sesame milk was cooled to room temperature.

2.2.2. Methods of Analysis

(i). Chemical analysis

Total solids, fat and total nitrogen contents of milk samples were determined according to AOAC [6]. Titratable acidity in terms of % lactic acid was measured by titrating 10g of sample mixed with 10ml of boiling distilled water against 0.1 N NaOH using a 0.5% phenolphthalein indicator to an end point of faint pink color. pH of the sample was measured at 17 to 20°C using a pH meter (Corning pH/ion analyzer 350, Corning, NY) after calibration with standard buffers (pH 4.0 and 7.0). Redox potential was measured with a platinum electrode [model P14805-SC-DPAS-K8S/325; Ingold (now Mettler Toledo), Urdorf, Switzerland] connected to a pH meter (model H 18418; Hanna Instruments, Padova, Italy).

(ii). Sensory properties judging

The sensory properties of milk were determined by a panel of judges who were familiar with the product using the hedonic scale where 1-10 represents dislike extremely to like extremely [7]. The panelists analyzed the samples for color, smell, texture, taste, appearance and mouth feel. The values obtained were analyzed using a t-test to determine the degree of difference between the samples. Each sample was replicated thrice.

3. Results and Discussion

3.1. Effect of Adding Different Types of Sweeteners on the Chemical Composition of Cow Milk Mixed with Oat, Barley or Sesame Milk

As shown in the Tables 1, 2 and 3, the results of the physiochemical chemical composition of cow, oat, barley, or sesame milk were quite different. This can be explained on the basis that cow milk is animal milk whereas the others milk are vegetarian sources. The acidity and redox potential (E_h) values of cow milk were higher than those of oat milk. Quite the contrary, these values were higher in barley and sesame milk than cow milk. Barley milk recorded the greatest levels of acidity and E_h among various treatments. The acidity percentages of cow, oat, barley, and sesame milk (samples A, B, H, and N respectively) were 0.16, 0.09, 0.24 and 0.22% respectively. The findings of pH took the opposite trend of acidity and E_h values. The acidity, pH and E_h results of samples C (50% cow milk: 50% oat milk), I (50% cow milk: 50% barley milk) and O (50% cow milk: 50% sesame milk) were at an intermediate position. The highest total solids (TS) and total protein (TP) contents were found in cow milk followed by sesame milk then barley milk while oat milk possessed the lowest. The fat content of samples had different order as follow: sesame milk > cow milk> barley milk> oat milk. Values of TS, fat, and TP of mixed milk samples (C, I and O) ranged from those of cow milk and oat, barley, and sesame milk respectively. Generally, the chemical composition results of oat, barley and sesame milk obtained in our study were close to these described in the literature. Vijetha et al. [8] showed that pH, fat and protein contents of oat and barley milk were 6.46- 5.48, 0.08- 0.7% and 1.03-1.18% respectively. Afaneh et al. [9] reported that sesame milk had 13.91% TS, 2.97% protein, 6.43% fat, 0.48% ash and 4.04% carbohydrate.

On the other hand, adding 5% sucrose, 5% honey, and 2.5% fructose to cow milk mixed with oat, barley, and sesame milk (50%: 50%) markedly increased acidity and E_h while decreased pH values. Honey addition caused the clearest effects as compared with sucrose or fructose. Increasing of milk acidity as a result of adding honey may be attributed to fructooligosacchrides in honey [10]. There were no clear effects on acidity, E_h and pH values of various mixed milk treatments by adding 1.5% sorbitol. Values of pH were 6.60, 6.59, 6.45, 6.55 and 6.61 for samples C, D, E, F, and G respectively. As it is expected, adding sucrose, honey, fructose, and sorbitol to the mixed milk increased total solids content. Because of high amounts added, the increasing levels of total solids were higher with addition sucrose and honey than those of fructose and sorbitol. Inversely, fat and total protein contents of mixed milk slightly lowered as a result of adding sucrose and honey whereas addition fructose and sorbitol had no clear effect. Lay Ma et al. [11] reported that with increasing sucrose amounts in whole condensed milk, total solids values also increased while fat, protein and minerals concentrations decreased.

Table 1. *Effect of adding different types of sweeteners on the chemical composition of cow and oat milk mixture.*

Samples	Acidity (%)	pH	E_h (mV*)	TS (%)	Fat (%)	TP (%)
A	0.16	6.63	33.1	12.28	3.8	3.72
B	0.09	6.52	22.4	10.66	0.3	1.13
C	0.12	6.60	27.5	11.70	1.9	2.46
D	0.13	6.59	27.8	15.82	1.8	2.22
E	0.17	6.47	34.0	15.74	1.7	2.19
F	0.14	6.55	30.4	13.02	1.9	2.30
G	0.12	6.61	27.4	12.56	1.8	2.44

*mV: millivolts

A: Cow milk; B: Oat milk; C: 50% Cow milk + 50% Oat milk; D: 50% Cow milk + 50% Oat milk + 5% Sucrose; E: 50% Cow milk + 50% Oat milk + 5% honey, F: 50% Cow milk + 50% Oat milk + 2.5% Fructose; G: 50% Cow milk + 50% Oat milk + 1.5% Sorbitol

Table 2. *Effect of adding different types of sweeteners on the chemical composition of cow and barley milk mixture.*

Samples	Acidity (%)	pH	E_h (mV*)	TS (%)	Fat (%)	TP (%)
A	0.16	6.63	33.1	12.28	3.8	3.72
H	0.24	6.38	39.6	10.74	0.9	1.40
I	0.19	6.49	35.5	11.12	2.4	2.75
J	0.20	6.46	37.2	15.58	2.2	2.48
K	0.22	6.40	38.5	15.66	2.3	2.50
L	0.20	6.45	36.8	12.78	2.4	2.63
M	0.19	6.47	35.8	12.07	2.5	2.70

*mV: millivolts

A: Cow milk; H: Barley milk; I: 50% Cow milk + 50% Barley milk; J: 50% Cow milk + 50% Barley milk + 5% Sucrose; K: 50% Cow milk + 50% Barley milk + 5% honey, L: 50% Cow milk + 50% Barley milk + 2.5% Fructose; M: 50% Cow milk + 50% Barley milk + 1.5% Sorbitol

Table 3. *Effect of adding different types of sweeteners on the chemical composition of cow and sesame milk mixture.*

Samples	Acidity (%)	pH	E_h (mV*)	TS (%)	Fat (%)	TP (%)
A	0.16	6.63	33.1	12.28	3.8	3.72
N	0.22	6.43	38.4	11.42	5.9	2.63
O	0.19	6.48	35.3	11.88	4.8	3.11
P	0.20	6.47	37.4	16.07	4.6	2.91
Q	0.21	6.42	37.9	15.86	4.6	2.94
R	0.20	6.44	36.4	12.91	4.7	3.02
S	0.19	6.48	35.6	12.11	4.9	3.08

*mV: millivolts

A: Cow milk; N: Sesame milk; O: 50% Cow milk + 50% Sesame milk; P: 50% Cow milk + 50% Sesame milk + 5% Sucrose; Q: 50% Cow milk + 50% Sesame milk + 5% honey, R: 50% Cow milk + 50% Sesame milk + 2.5% Fructose; S: 50% Cow milk + 50% Sesame milk + 1.5% Sorbitol

3.2. Effect of Adding Different Types of Sweeteners on Starter Activity of Cow Milk Mixed with Oat, Barley or Sesame Milk

For determination of starter activity as affected by milk type or sweeteners addition, the changes of acidity (as lactic acid percentages), pH and E_h values of milk inoculated with ABT-5 cultures were measured at 30 min intervals during fermentation period (180 min). Results were presented in Figures 1-9.

Generally, a gradual increase in titratable acidity and E_h values in different milk treatments was noticed during incubation time. The highest increasing was found after 90 min. Conversely, pH values declined. The changes in acidity, E_h, and pH of milk could be attributed to the number and/or metabolic activity of acid producing micro-organisms. As starter grows, they produce acid which causes an increase in acidity and E_h and a decrease in pH [12]. These results are in agreement with those reported for fermented milk “Lebens” [13].

Growth and activity rates of starter bacteria (*S. thermophilus*, *L. acidophilus*, and *Bifidobacterium*) were low in oat milk, therefore, the development levels of acidity and E_h during fermentation were lower in oat milk than those of cow milk while the drop in pH was faster in the latter than the former. Incorporation of 50% cow milk with oat milk accelerated the progress in acidity and redox potential within the fermentation. These outcomes contradicted with Marklinder and Lonner [14] who mentioned that oat is a suitable substrate for fermentation with LAB after suitable processing. Oats bases treated enzymatically have been produced [15]. They are used as substrates with dairy starter cultures for fermentation of lactic acid [15]. Therefore a great interest for the consumption of products based on oats is increasing that contain both soluble and insoluble fibers and have positive effects on blood cholesterol levels.

In full contrast to the effect of oat milk on starter activity, both acidity ratios and the development of acidity rates through fermentation were considerably higher in barley or sesame milk than that of cow milk. Barley milk showed the highest acidity levels during 180 min of fermentation. This indicates that barley and sesame milk contain nutritional components acting as prebiotic for starter bacteria. Barley is rich in vitamins A, C, B_1, B_2, folic acid, and B_{12}; calcium; iron; potassium and chlorophyll [16], [17]. Unlike most plants, it provides all nine essential amino acids. It is one of the richest sources of antioxidants and contains the flavones C-glycoside, saponarin, and lutonarin. Pallina et al., [18] observed that the overall growth of *Lactobacillus reuteri* in barley flour was good and reached higher densities in untreated compared with heat-treated flours.

Regardless of the milk type, acidity and E_h values and the increase in both during fermentation were higher in milk treatments supplemented with 5% sucrose. This may be attributed to the stimulation effect of sucrose on starter bacteria. However, antibacterial action of honey which due to the action of flavonoids such as galangin [19] but the levels of acidity development within fermentation were higher in milk samples fortified with honey. This may be due to the activation of ABT culture by honey which may be caused by oligosaccharides. Oligosaccharides found in honey were detected to enhance the viability of starter culture as prebiotics [20]. These results are in agreement with those of Ayad et al. [21] who mentioned that viable count was significantly higher in yoghurt like product supplemented with honey than control. Also, Zidan [22] reported that the development of acidity through fermentation was higher in the mixture of cow and coconut milk fortified with 5% honey than control.

With the same effect of sucrose and honey but with a lesser extent, addition fructose or sorbitol to cow milk mixed with oat, barley, and sesame milk improved the starter activity. Rates of acidity increasing during fermentation were higher in fructose and sorbitol treatments than control. On the whole, the stimulation effect of sweeteners on starter bacteria was the following order: honey > sucrose > fructose > sorbitol.

3.3. Effect of Adding Different Types of Sweeteners on the Sensory Properties of Cow Milk Mixed with Oat, Barley or Sesame Milk

Sensory evaluation is an important indicator of potential consumer preferences. The results of sensory attributes evaluation of different milk treatments are illustrated in Tables 4, 5 and 6. On a general note, cow milk gained the highest scores of color, appearance, smell, taste, texture, body and mouth feel as compared with oat, barley and sesame milk. On the other side, the panelists granted sesame milk higher grades of sensory properties judging than those of oat and barley milk. This may be due to the high-fat content of sesame milk which not only improves the taste and mouth feel properties of milk but also increases the total solids concentration and therefore improve the texture and body. The other reason for the decline in the results of sensory properties of oat and barley was cereal taste left in the mouth after consumption of these milks. These outcomes contradicted with Vijetha et al. [8] who found that the oats flakes milk received good sensory scores on the basis of its color, consistency, flavored, texture and taste.

Blending 50% cow milk with oat, barley and sesame milk improved all sensory characteristics of these vegetarian milks. This effect was clearer with barley milk than oat or sesame milk. Increasing fat content in oat and barley milk by mixing with cow milk may be was the main reason for improvement smell, taste, texture, body and mouth feel properties. Similar trends were found by EL- Boraey et al. [24] who stated that incorporation of soymilk with buffalo's or cow's milk highly improved its sensory evaluation scores. Samples of 25% soymilk+75% buffalo milk or 25% soymilk+75% cow milk obtained the highest sensory evaluation scores for mixtures of soy, buffalo and cow milk. Also, in our previous study [12], the sensory properties of soy, peanut and rice milk improved by mixing with 50% cow milk. The blending of cow milk with rice milk had three effects on sensory evaluation of the resulted mixtures. The first was decreasing of color and appearance grades, the second was the improvement of smell, taste and mouth feel scores and the third was no clear effect on texture and body evaluations.

Addition sucrose (5%) and honey (5%) highly succeeded to improve the different sensory properties of oat, barley and sesame milk especially taste, mouth feel, texture, and body. Adding fructose and sorbitol recorded the same effect but slightly less than sucrose and honey. The sensory properties panelists showed that the cereal taste which decreased scores of oat and barley milk changed to favorite sweet taste while texture and body of milk had become more slightly thicker as a result of total solids rising. These results are in line with those reported by Giyarto et al. [24] who added 10% sugar to peanut milk in production of fermented peanut milk drink by *Lactobacillus acidophilus* SNP2 to overcome the beany taste.

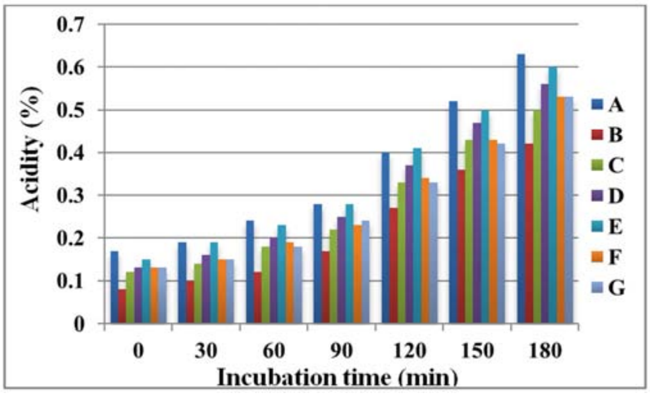

Figure 1. Effect of sweeteners on changes in acidity of cow and oat milk.

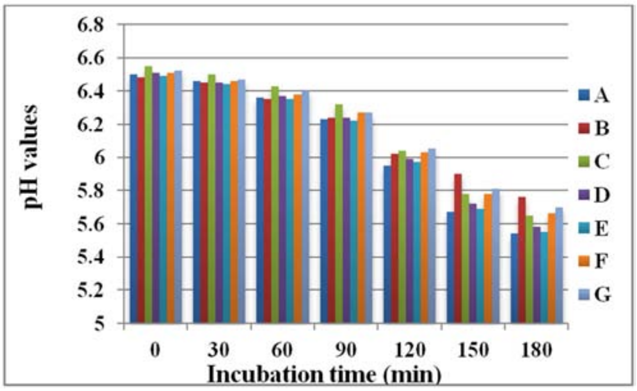

Figure 2. Effect of sweeteners on changes in pH values of cow and oat milk.

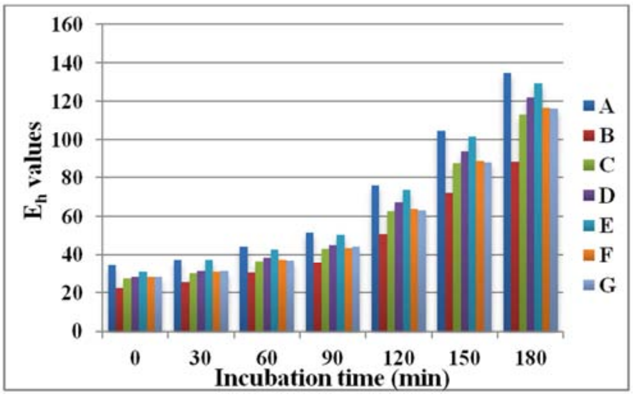

Figure 3. Effect of sweeteners on changes in E_h values of cow and oat milk.

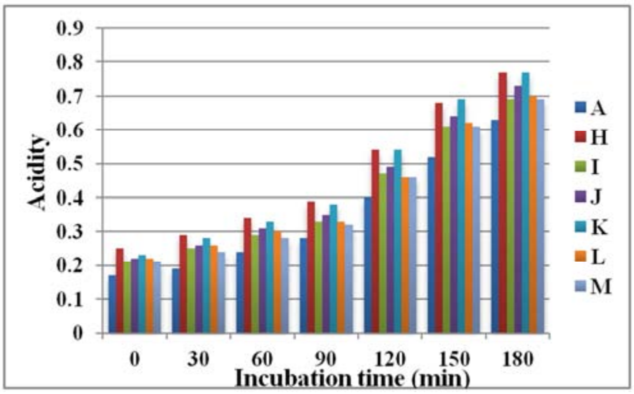

Figure 4. Effect of sweeteners on changes in acidity of cow and barley milk.

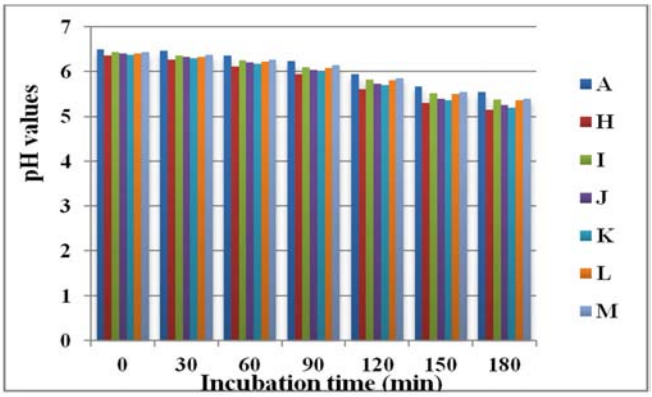

Figure 5. Effect of sweeteners on changes in pH of cow and barley milk.

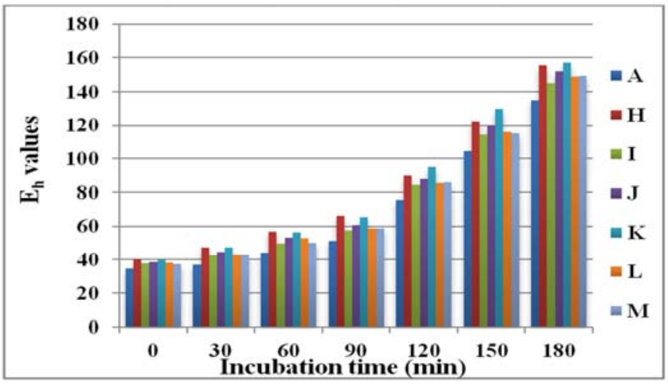

Figure 6. Effect of sweeteners on changes in E_h values of cow and barley milk.

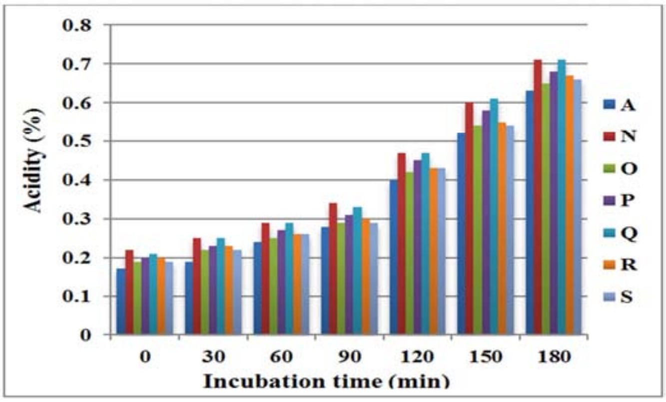

Figure 7. Effect of sweeteners on changes in acidity of cow and sesame milk.

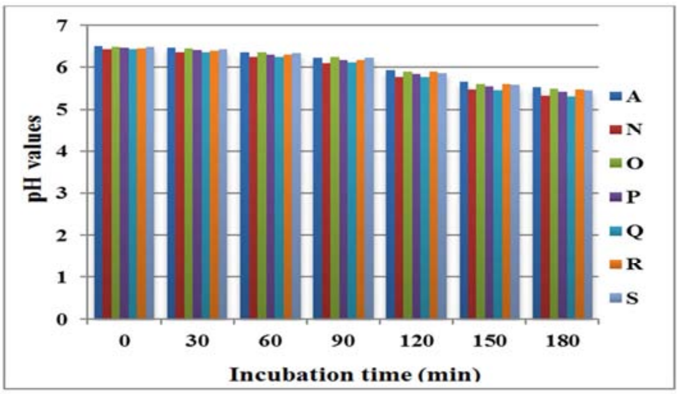

Figure 8. Effect of sweeteners on changes in pH of cow and sesame milk.

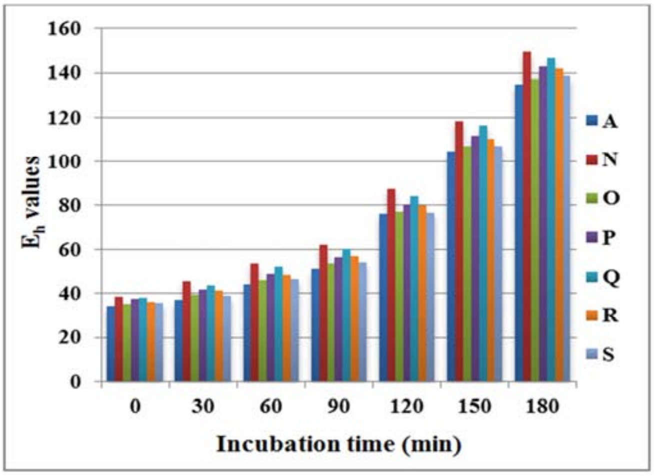

Figure 9. *Effect of sweeteners on changes in E_h values of cow and sesame milk.*

Table 4. *Effect of adding different types of sweeteners on the sensory properties of cow and oat milk mixture.*

Samples	Quality attribute					
	Color	Appearance	Smell	Taste	Texture & Body	Mouth feel
A	8.50	9.00	9.50	9.50	9.50	9.50
B	8.00	8.00	8.00	8.25	8.25	8.25
C	8.25	8.50	8.00	8.50	8.50	8.50
D	8.25	8.50	8.25	9.25	9.25	9.50
E	8.25	8.50	8.25	9.50	9.50	9.50
F	8.25	8.50	8.25	9.25	9.25	9.25
G	8.25	8.50	8.25	9.25	9.25	9.25

Table 5. *Effect of adding different types of sweeteners on the sensory properties of cow and barley milk mixture.*

Samples	Quality attribute					
	Color	Appearance	Smell	Taste	Texture & Body	Mouth feel
A	8.50	9.00	9.50	9.50	9.50	9.50
B	7.50	7.50	7.50	8.00	8.00	8.00
C	8.00	8.00	8.10	8.50	8.50	8.50
D	8.00	8.00	8.25	9.00	9.00	9.25
E	8.00	8.00	8.25	9.00	9.00	9.25
F	8.00	8.00	8.10	9.00	9.00	9.20
G	8.00	8.00	8.10	9.00	9.00	9.20

Table 6. *Effect of adding different types of sweeteners on the sensory properties of cow and sesame milk mixture.*

Samples	Quality attribute					
	Color	Appearance	Smell	Taste	Texture & Body	Mouth feel
A	8.50	9.00	9.50	9.50	9.50	9.50
B	8.25	8.50	8.50	8.50	8.50	8.50
C	8.25	8.75	9.00	9.00	9.00	9.00
D	8.25	8.75	9.50	9.50	9.50	9.50
E	8.25	8.75	9.50	9.50	9.50	9.50
F	8.25	8.75	9.45	9.40	9.40	9.40
G	8.25	8.75	9.45	9.40	9.40	9.40

4. Conclusion

Mixtures of 50% cow milk + 50% oat milk or 50% cow milk + 50% barley milk or 50% cow milk + 50% sesame milk recoded good chemical composition, starter activity, and sensory evaluation scores values. These mixtures combined benefits of animal and vegetarian milk. Adding 5% sucrose, 5% honey, 2.5% fructose, and 1.5% sorbitol to the mentioned mixtures highly improved the chemical and sensory properties and showed more activation to bacteria of starter ABT-5 (*S. thermophilus*, *L. acidophilus* and *Bifidobacterium*). Cow milk mixed with oat, barley, or sesame milk and sweetened with sucrose, honey, fructose and sorbitol could be used in manufacturing of fermented dairy products like yogurt and Rayeb milk.

References

[1] Cortés C, Esteve M, Frıgola A, Torregrosa F. Quality characteristics of horchata (a Spanish vegetable beverage) treated with pulsed electric fields during shelf-life. Food Chem. 2005; 91: 319-325.

[2] Prado FC, Parada JL, Pandey A, Soccol CR. Trends in non-dairy probiotic beverages. Food Re. Int. 2008; 41: 111-123.

[3] Kim H, Bang J, Kim Y, Beuchat L, Ryu JH. Reduction of *Bacillus cereus* spores in sikhye, a traditional Korean rice beverage, by modified tyndallization processes with and without carbon dioxide injection. Lett. Appl. Microbiol. 2012; 55:218-223.

[4] Chen S. Preparation of fluid soymilk. In**:** Proceedings of the World Congress on Vegetable protein Utilization in Human Foods and Animal Feedstuffs, 1989; pp. 341-351. Applewhite, T. N., Ed., American Oil Chemists Society, Champaign, Illinois.

[5] Mäkinen OE, Wanhalinna V, Zannini E, Arendt EK. Foods for special dietary needs: Non-dairy plant based milk substitutes and fermented dairy type products. J Critical Reviews in Food Sci. and Nut. 2016; 56: 339-349.

[6] AOAC. Association of Official Analytical Chemists. Official Methods of Analysis. 2000; 17th ed, Washington, DC, USA.

[7] Tunde-Akintunde TY, Souley A. Effect of processing methods on quality of soymilk. Pakistan J of Nut. 2009; 8 (8): 1156-1158.

[8] Vijetha BV, Reddy L, Natarjan AM. Development of cereal based flavored milk and estimation of β-glucan in oats and barley extract. Int. J. Fund. Appl. Sci. 2014; 3: 11-16.

[9] Afaneh I, Abu-Alruz K, Quasem JM, Sundookah A, Abbadi J, Alloussi S, Ayyad Z. Fundamental elements to produce sesame yoghurt from sesame milk. American J. Applied Sci. 2011; 8: 1086-1092.

[10] Akalin AS, Gonc S, Unal G, Fenderya S. Effects of fructooligo-saccharide and whey protein concentrate on the viability of starter culture in reduced-fat probiotic yoghurt during storage. J Food Sci. 2007; 72: 222-227.

[11] Lay Ma UV, Ziegler GR, Floros JD. Effect of Sucrose on physical properties of spray-dried whole milk powder. J Food Sci. 2008; 73: 431-438.

[12] Abou-Dobara MI, Ismail MM, Refaat Nawal M. Chemical composition, sensory evaluation and starter activity in cow, soy, peanut and rice milk. Journal of Nutritional Health & Food Engineering 2016; 5: 1-8.

[13] Benkerroum N, Tamime AY. Technology transfer of some Moroccan traditional dairy products (*lben*, *jben* and *smen*) to small industrial scale. Food Microbiology 2004; 21: 399–413.

[14] Marklinder I, Lonner C. Fermentation properties of intestinal strains of Lactobacillus, of a sour dough and of a yoghurt starter culture in an oat based nutritive solution. Food Microbiology, 1992; 9:197–205.

[15] Martensson O, Staaf J, Duecas-Chasco M, Irastorza A, Oste R, Holst O. A fermented, ropy, non-dairy oat product based on the exopolysaccharides producing strain Pediococcusd amnosus. Advances in Food Sci. 2002; 24: 1-4.

[16] Bawazir AE. Investigations on the chronic effect of Talbina (barley water) on hormone (cortisol and testosterone), reproductive system and some neurotransmitter contents in different brain areas of male Albino rats. American-Eurasian Journal of Scientific Research 2010; 5: 134-142.

[17] Yamaura K, Nakayama N, Shimada M, Bi Y, Fukata H, Ueno K. Antidepressant-like effects of young green barley leaf (Hordeum vulgare L.) in the mouse forced swimming test. Pharmacognosy Research 2012; 4: 22–26.

[18] Pallina A, Agbackb P, Jonssona H, Roos S. Evaluation of growth, metabolism and production of potentially bioactive components during fermentation of barley with *Lactobacillus reuteri*. Food Microbiology 2016; 57:159–171.

[19] Cushnie TPT, Lamb AJ. Detection of galangin-induced cytoplasmic membrane damage in *Staphylococcus aureus* by measuring potassium loss. Journal of Ethnophamacol 2005; 101: 243-250.

[20] El-Baz AM, Zommara MA. Characteristics of carbonated stirred yoghurt-bifidum milk fortified with honey and vitamin C. Egyptian Journal of Dairy Science 2007; 35: 45-51.

[21] Ayad HE, Darwish AMG, Darwish SM, El-Soda M. Production of novel functional yoghurt-like products. Egyptian Journal of Dairy Science 2010; 38: 183-199.

[22] Zidan MEAS. Studies on functional products manufactured from milk alternatives. M. Sc. Thesis, Dairy Department, Faculty of Agriculture, Damietta University, Egypt 2016.

[23] EL- Boraey NA, Ismail MM, Elashrey Hoda FA. Chemical composition, sensory evaluation, rheological properties and starter activity of admixtures of buffalo’s, cow’s and soymilk. American Journal of Food Science and Nutrition Research 2015; 2(4): 119-127.

[24] Giyarto, Djaafar TF, Rahayu ES, Utami T. Fermentation of peanut milk by *Lactobacillus acidophilus* SNP-2 for production of non-dairy probiotic drink. The 3rd International Conference of Indonesian Society for Lactic Acid Bacteria (3rd IC-ISLAB), 21-22 January, 2011, Yogyakarta, Indonesia.