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Changes in Physico-Chemical and Sensory Characteristics of Concentrated Yogurt Made from Goat Milk during Storage

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ABSTRACT: The objective of the study was to evaluate the changes in physico-chemical and sensory characteristics of concentrated yogurt made from goat milk during storage. Fresh milk of Peranakan Etawah goats was processed into stirred-type fresh yogurt by adding probiotic yogurt cultures. Yogurt was processed into concentrated yogurt using *in-bag straining* method, cut into blocks, immersed in different vegetable oils (olive, corn, canola and sunflower oils) in capped jars, then stored for up to 30 days under cool temperature. Variables observed consisted of superficial growth of yeast, changes in color, off-flavour, consistency, pH and titratable acidity. Results showed that pH and titratable acidity tended to increase during storage, but the differences were not significant among different immersing oils. No apparent growth of superficial yeast, changes in color and consistency were detected in concentrated yogurt up to day 30 of storage. However, a slight off-flavour was detected at day 30 which could be due to rancidity of oils. It can be concluded that shelf-life of concentrated yogurt can be extended by immersing in vegetable oils, and the decision of which oils to use will depend on the price and local availability.

Key Words: concentrated yogurt, goat milk, shelf-life, vegetable oil

INTRODUCTION

Goat milk in Indonesia is second to cow's milk in term of production and consumption. Although the biggest portion of goat milk is still being consumed in a fresh form, a wide opportunity is open to process goat milk into various milk products including fermented milk products. Nowadays, yogurt is a common fermented cow's milk products produced either by industrial or small/home scale manufacturers in the country. Yogurt from goat milk is a popular product in many countries (Tamime *et al.*, 2011). Fresh yogurt can be further processed in concentrated/condensed/strained yogurt by different methods of whey removal (Sumarmono *et al.*, 2014).

Arguably, the easiest and most practical method to manufacture concentrated yogurt is by hanging fresh yogurt in a cloth bag for 15 to 20 hours at 10^{o}C to allow a partial removal of water. The resulting product contains aproximatelly 25% total solid, slightly acidic, thick and creamy but smooth consistency (Ozer, 2006), although NergizSeçkin (1998) reported that nutrients such as water soluable vitamins, minerals and also lactose were loss with the water. Nevertheless, in concentrated form, yogurt has wider food aplicability such as sandwich spread and dressing for salads.

Lengthening the shelf-life of concentrated yogurt is one of major concern, although this product has longer shelf life than fresh yogurt due to lower moisture content and higher lactic acid content. Al-Kadamany *et al.* (2003) reported that concentrated yogurt underwent decrease in acidity (pH) and increase in titratable acidity during storage. Previously, Abu-JdayilMohameed (2002) reported that the apparent viscosity of concentrated yogurt produced from cow's milk was increased when stored for 15 days. Keceli *et al.* (1999) reported that concentrated yogurt can be preserved by storing the product in virgin olive oil. This technique was reported to provide

unaerobic condition, hence prevented the growth of yeast over the surface of the products. Recently, Thabet *et al.* (2014) also reported the preservative effect of cinamon oil on concentrated yogurt It seems promising to use different vegetable oils such as corn oil, canola oil and sunflower oil to preserve concentrated yogurt during storage. Therefore, the objective of this study was to determine the physico-chemical and sensory characteristics of concentrated yogurt made from goat milk immersed in vegetable oils during storage.

MATERIAL AND METHODS

Milk preparation and yogurt processing

Fresh milk produced by Peranakan Etawah goats was obtained from local goat breeders in Banyumas, Central Java, and transported in a coolbox. The milk was pasteurised at 63^{0}C for 30 minutes and then cooled to 40^{O}C. A previously activated powdered yogurt starter containing a mixes of *L bulgaricus, S thermophylus, L acidophilus, L. casei* and *Bifidobacteria* was added to the pasteurised goat milk and incubated at 40 ^{o}C for 5 hours. Fresh yogurt was stirred using a mixer for two minutes, cooled in a refrigerator for one hour before further processed into concentrated yogurt.

Manufacture of concentrated yogurt

The previously described procedures of concentrated yogurt manufacturing using in-bag straining technique (Sumarmono et al., 2014) was applied in this experiment. In sort, cold stirred yogurt was placed in a cheese cloth and hung inside a specially designed pvc pipe (d=3 inches, without vacuum pump). The whey was allowed to drain for 24 hours in a cold room (± 10^{o}C).

Figure 1. Concentrated yogurt from goat milk stored in glass jars immersed in different vegetable oils

Treatments and variables

Freshly made concentrated yogurt was cut into blocks of 2x2 cm and placed in 300 ml glass jars. Four different vegetable oils (Ol=olive, Co=corn, Ca=canola, and Su=sunflower oils) were poured to the jars until all blocks of concentrated yogurt were submerged. The jars were tighly capped and stored in a cool room (8-10^{o}C). Observations of variables were conducted at day 15 and 30 of storage. Variables observed included superficial growth of yeast, changes in color, off-flavour, consistency, and also chemical characteristics which were pH and titratable acidity. Each treatment has 6 replicates, hence there were 24 experimental units. Observation of supervisial growth of yeast, changes in color, off-flavour, and consistency was done by an expert panels. Measurement of pH was done by using a pH-meter and titratable acidity (% lactic acid) were determined by procedures described in BongMoraru (2014).

Data analysis

Descriptive analysis was applied data of growth of yeast, color, off-flavour, and consistency, whereas variance analysis was applied on data of pH and titratable acidity. Data processing was done using Minitab Statistics software version 15.

RESULTS AND DISCUSSION

Based on panel's observation on sensory characteristics of concentrated yogurt (Table 1), no apparent changes were detected in the growth of yeast, color and consistency after 30 days of storage. No superficial growth of yeast indicated that olive, corn, canola and sunflower oils were effective in preventing the growth of yeast, and most probably mould and bacteria. Oil provides anaerobic condition that prevents the growth of yeast over the surface of concentrated yogurt. Previously, Keceli *et al.* (1999) reported similar results on virgin olive oil. However, a slight off-flavour was detected at day 30, which can be associated with oxidation of the oils.

It is shown in Figure 2 that titratable acidity of concentrated yogurt tended to increase with storage, but the effect of different vegetable oils was not significant (P>0.05). In term of pH (Figure 3), concentrated yogurt stored for 30 days tended to have lower pH than that stored for 15 days, and the effect of different vegetable oils on pH was also not significant (P>0.05). Compared to previous report by Şenel *et al.* (2011) the means of titratable acidity in this experiment is higher (2.66±0.13 vs 1.86%), and means of pH is lower (3.08±0.08 vs 3.89). Higher degree of acidity in this experiment could contribute to the longer shelf-life of concentrated yogurt.

Table 1. Sensory characteristics of concentrated yogurt from goat milk immersed in vegetable oils during storage

Storage time:	Day 15				Day 30			
Media (oil):	Ol	Co	Ca	Su	Ol	Co	Ca	Su
Superficial growth of yeast	(=)	(=)	(=)	(=)	(=)	(=)	(=)	(=)
Changes in color	(=)	(=)	(=)	(=)	(=)	(=)	(=)	(=)
Off-flavour	(=)	(=)	(=)	(=)	(+)	(+)	(+)	(+)
Changes in consistency	(=)	(=)	(=)	(=)	(=)	(=)	(=)	(=)

Ol: olive oil; Co: corn oil; Ca: canola oil; S: sunflower oil
(=) no/undetectable; (+) slightly detectable

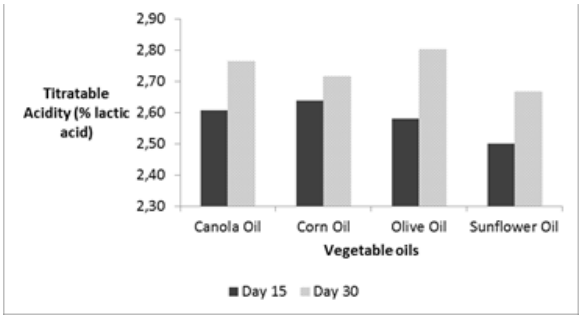

Figure 2. Titratable acidity of concentrated yogurt stored in different vegetable oils during storage.

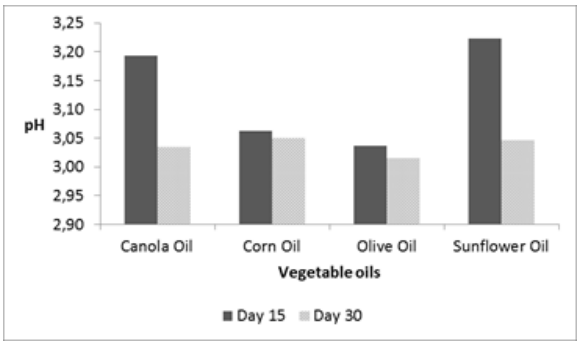

Figure 3. pH of concentrated yogurt stored in different vegetable oils during storage.

Prevention the growth of yeast and changes in color and consistency, and minimising the occurence of off-flavor in addition to acidic nature of concentrated yogurt from goat milk are the contributive factors to the lengthening shelf-life of the products up to 30 days or even longer. As has been reviewed by Nsabimana *et al.* (2005), fresh concentrated yogurt can only be stored for two weeks.

CONCLUSION

Based on several physico-chemical and sensory characteristics, storing blocks of concentrated yogurt in vegetable oils in a tighly capped jars is promising technique to prolong the shelf-life of concentrated yogurt made from goat milk. Because no apparent differences among vegetable oils, the decision of which oils to use will depend on the price and local availability.

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