The properties of yogurt coconut shake and coconut shake

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Abstract

This study was conducted to investigate the effect of pH, addition of whipping agent and homogenization process on physicochemical properties, probiotic counts and sensory profile of yogurt coconut shake (YCS). YCS with different parameters; pH, addition of whipping agent and homogenization process, were prepared for analysis. YCS1 which was added with whipping agent and undergo homogenization resulted on highest percent in ash, protein, and fat content compared to other samples of YCS at 0.77%, 2.05%, and 1.50% respectively. Yogurt presence in coconut shake revealed that all YCS samples were more acidic compared to CS samples. YCS samples which undergo homogenization, had higher viscosity than non-homogenized YCS. YCS3 which without whipping agent and undergo homogenization had resulted on higher viscosity at 14.02 mPas. The difference in addition of whipping agent and homogenization process, effected the percentage of overrun among all YCS samples. Time taken for YCS can stay in homogenized state was ranged from 14.0 to 20.5 min. There was no significant effect of whipping agent addition and homogenization process among YCS samples in term of foam formation. YCS2; yogurt coconut shake with addition whipping agent and non homogenized formulation, had reached the highest number of probiotic strains counts at 5.11×10^{7} cfu/mL. The sensory acceptability of samples, stated that YCS was averagely accepted by panelists in University Putra Malaysia and YCS3 which YCS without whipping agent and undergo homogenization process, was more preferable compared to other YCS samples.

Keywords : Coconut shake (CS), Yogurt coconut shake (YCS), Probiotic, Whipping agent, Homogenization

1. Introduction

Coconut shake is a cold beverage prepared from from young coconut water and flesh which characterized by having the frothy appearance while being consumed. It can be more nutritious and delicious with the addition acidic taste of yogurt. Yogurt has been introduced as a healthy and safe food. The Codex Alimentarius Commission of the Food and Agriculture Organization (FAO) and World Health Organization (WHO) set broader international standards for yogurt in the Codex Standard for Fermented Milks (2003). According to that document,

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yogurt was the result from fermentation by *Streptococcus thermophilus* and *Lactobacillus delbruekii* ssp. *bulgaricus* cultures, and contain a minimum of 2.7% milk protein, less than 15% milk fat, and at least 0.6% titratable acidity. The Codex standard (2003) specifies that at least 10^6 colony forming units (CFU) per gram must be presented, if a claim regarded on live microorganisms was made on the package.

Coconut (*Cocos nucifera* Linn.) is belonging to Palmae family which classified as monocotyledons. The shell's filling commonly a clear liquid called "coconut water" which rich in sugar, vitamin and minerals. The Standards Task Force of the Asian and Pacific Coconut Community, APCC (1994) defined the term 'coconut water' as the natural aqueous liquid endosperm of the drupe of *Cocos nucifera* L. The water from tender coconut has a sweet taste and is a refreshing drink. The coconut water found inside the young coconut as biological pure, tasty and full of salts, sugars and vitamin that are very beneficial for athletes. Besides, coconut water was evaluated as rehydration fluid in diarrhea. Oral rehydration has been recommended in patients with diarrhea to replace the fluid loss from gastrointestinal tract (Khan *et al.,* 2003).

The yogurt coconut shake's would be attractive to consumer by including the benefit of probiotic in the yogurt. There are several scientific evidences to support the beneficial of probiotics towards human being. According to the definition adopted by World Health Organization in 2002, probiotic bacteria are living microorganisms, when administered in adequate amounts confer a health benefit to the host. Probiotic are living microorganisms which colonized the gastrointestinal tract and provide benefit towards the health of the consumer (Tannock *et al.,* 2000).

A high population of probiotic organisms in the colon contributes to good intestinal health. This is due to the ability of these cultures to tolerate acid and bile (Gilliland, 1978; Kanbe, 1992; Lankaputhra and Shah, 1994) which enable them to present and sustain in the intestinal tract. Consequent consumption of products such as yogurt containing viable probiotic organisms adds benefit to human gut health.

Coconut shake is familiar in Malaysia compare to yogurt coconut shake, which is can be considered as a new type of beverage recently emerged. There are no scientific study has been done on the physicochemical properties and sensory profile of yogurt coconut shake. The study of yogurt coconut shake was documented for the first time because the official standard of identify for coconut shake's identification has not yet specify in Malaysia. Thus, the aims of this research to investigate the effect of different in pH, addition of whipping agent and homogenization process to physicochemical properties, probiotic counts and sensory profile of yogurt coconut shake (YCS).

2. Materials and Methods

2.1 Sample preparation

2.1.1 Yogurt preparation

Liquid milk was produced by reconstitute 120 g whole milk powder (Fonterra, New Zealand) and 60 g skim milk powder (SUNLAC, New Zealand) in 1 L of drinking water. The liquid milk was heated to 42°C. An amount of 12% of sugar was added into the liquid milk and followed with heating treatment or pasteurization using steam jacketed–kettle (Silverson, England) at 72°C for 20 min. Then the liquid milk was cooled to 28°C in the cold room. Next, the milk was inoculated with one sachet of starter culture which was a mixture of *Streptococcus thermophilus, Lactobacillus delbrueckii* subsp*. bulgaricus, Lactobacillus casei, Lactobacillus acidophilus* and *Bifidobacterium longum* (Yogurmet, Canada)*.* The inoculated liquid milk was incubated in the oven at ±32°C until pH of yogurt ranged from 4.4–4.6. After incubation, samples were cooled until the temperature around 20 to 24°C as per room temperature.

2.1.2 Yogurt coconut shake preparation

Three batches of yogurt coconut shake sample were prepared in different conditions; pH, addition of whipping agent and homogenization process. This sample preparation included a control sample; coconut shake without probiotic culture. The preparation step had been summarized in Figure 1. The formulation for both coconut shake and yogurt coconut shake can be referred in Table 1.

Table 1 Formulation coconut shake (CS) and yogurt coconut shake (YCS) preparation

Materials	Formulation for coconut shake (%)(w/w)	Formulation for yogurt coconut shake (%) (w/w)
Young coconut water	40	28
Young coconut flesh	20	14
Ice cube	30	21
Sweetened condensed milk	5	3.5
Sugar	5	3.5
Yogurt	0	30

The methods to prepare all samples were summarized in diagram below:

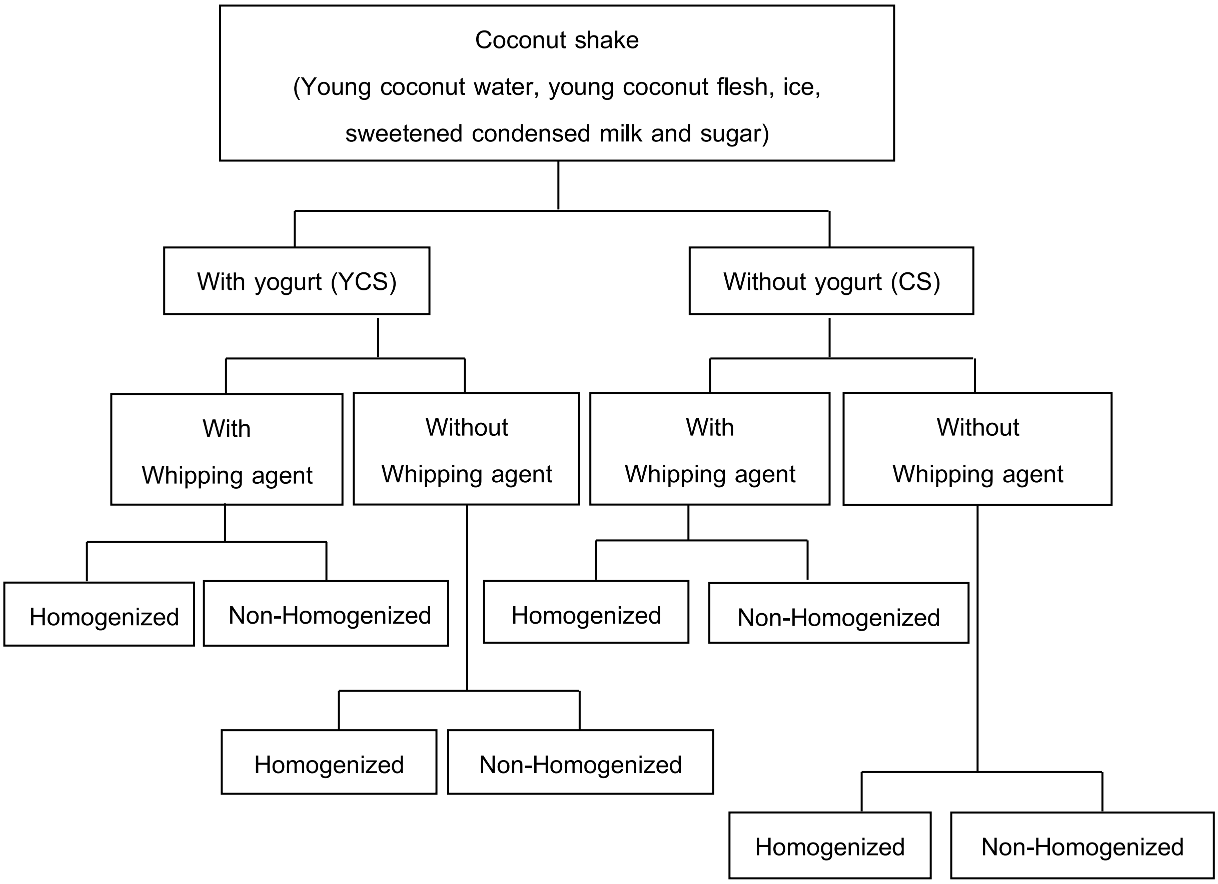

Figure 2 Diagram of the methods to prepare all samples

YCS1 : Coconut shake with yogurt, whipping agent and homogenization

YCS2 : Coconut shake with yogurt, whipping agent and non homogenization

YCS3 : Coconut shake with yogurt, without whipping agent and homogenization

YCS4 : Coconut shake with yogurt, without whipping agent and non homogenization

CS1 : Coconut shake without yogurt, with whipping agent and homogenization

CS2 : Coconut shake without yogurt, with whipping agent and non homogenization

CS3 : Coconut shake without yogurt, without whipping agent and homogenization

CS4 : Coconut shake without yogurt, without whipping agent and non homogenization

2.1.3 Effect of pH

To demonstrate the pH effect on the ability of milk to produce foam. The coconut shake samples were prepared with and without yogurt, whipping agent, homogenized and non homogenized.

2.1.4 Effect of whipping agent

The yogurt coconut shake samples; were mixed with addition of 1% of pasteurized egg white (My Egg White, Malaysia).

2.1.5 Effect of homogenization

The yogurt coconut shake mix was homogenized at 1000 rpm using hand held homogenizer**.**

2.2 Analysis of physicochemical properties

2.2.1 Analysis of Proximate Content

The moisture, ash and protein contents were analyzed according to AOAC methods (2002). Fat content was determined using Gerber method (British Standard Institution, 1955). Samples were analysed in triplicate.

2.2.2 Determination of pH

The pH was measured according to AOAC method (1990). The pH value was measured by pH meter (3505 pH Meter, Jenway, UK). The instrument was calibrated using standard buffer solution at pH 4 and 7.

2.2.3 Determination of viscosity

Viscosity was measured by using Rheometer (Anton Paar, US). The measurements of viscosity were done in duplicates and average values were calculated.

2.2.4 Determination of overrun

The overrun measurement was taken per sample. The weight of 100 mL of mixed liquid of sample was recorded in the same container. After the homogenization process was performed, the weight of 100 mL of foam was recorded. The overrun was calculated based on formula.

$$\text{Overrun}(\%) = \frac{(\text{weight 100 ml of liquid} - \text{weight 100 ml of foam}) \times 100}{\text{weight of 100 ml of foam}}$$

2.2.5 Determination of stability

The stability of sample was measured by placing the sample in the container. Then, the time for the sample can retain to the original condition without any changes in their appearance was recorded in minutes.

2.2.6 Determination of foaming

The percentage of foam was taken per sample. The mixture of sample without blending process was placed in a 250 ml measuring cylinder and the height measurement was recorded. After the homogenization was done, the sample was again placed in measuring cylinder. Then, the final height measurement of sample was recorded. The percentage of foam was calculated based on formula described below:

$$\%\ \text{Foam} = \frac{\text{Final height} - \text{original height} \quad \text{x } 100}{\text{Original height}}$$

2.3 Probiotic Enumeration

Ten mililiter of each coconut shake sample was suspended in 100 ml of 0.1% peptone water and homogenized in a stomacher for 2 min. The homogenized suspension was serially diluted by pipetting 1ml of homogenized suspension into 9 ml of 0.1% peptone water. An amount of 0.1 ml of each dilution was pipetted onto duplicate MRS agar plates using spread plate method. Then, all media plates were incubated at 37°C for 72 hours. MRS agar plates were incubated anerobically and the anaerobic conditions was created using anaerobic container which was equipped with gas generating kit. After incubation, the growth of the colonies were observed and the colonies were counted using colonies counter (Galaxy 230, Victoria). The total proliferation of bacteria were expressed as colony forming units per mililitre (cfu/ml).

2.4 Sensory Evaluation

The sensory evaluation was conducted using preference test with hedonic scale. The samples were stored in cold room at 7°C for 2 to 3 hours before sensory evaluation assessment. An amount of 30 panelists which came from a different gender and race were served with eight small cups of different yogurt coconut shake samples. They were instructed to determine how much they like or dislike the samples in likert-type rating scale; dislike extreamly (1), dislike very much (2), dislike slightly (3), dislike moderately (4), neither like nor dislike (5), like slightly (6), like moderately (7), like very much (8), like extreamly (9). There were 6 aspects that had been measured in this study, those were smell, creamy taste, mouthfeel, texture, sweetness and overall liking.

2.5 Statistical Analysis

The data obtained were evaluated together with standard deviation. The statistical significant differences were calculated by using MINITAB 16 version, by aid of one-way ANOVA. A probability values were considered at significant (p<0.05) to indicate different data statistically.

3. Results and Discussion

3.1 Physicochemical of coconut shake and yogurt coconut shake

In this study, physicochemical properties of yogurt coconut shake (YCS) and coconut shake (CS) were determined and analyzed. The yogurt coconut shake samples were denoted by YCS1, YCS2, YCS3 and YCS4 whereas coconut shake denoted by CS1, CS2, CS3 and CS4. Table 2 showed the composition of moisture content, ash content, crude protein and crude fat in coconut shake and yogurt coconut shake. It was found that no significant difference (p>0.05) effect of whipping agent addition and homogenization process in moisture and fat content for all CS samples. For ash content, there was significant highest (p<0.05) value of CS samples at 0.53% (CS1) while the lowest was in CS3 at 0.43%, however no significant effect resulted on CS2, CS3, and CS4 statistically. There was significant difference (p<0.05) on condition of whipping agent's presence in protein content of CS samples, where CS1 had contributed the highest value at 3.44%, significantly followed by 2.31% (CS2), and 0.76% (CS3) and 0.70% (CS4) non-significantly. CS with whipping agent (CS1 and CS2) contributed to highest protein and ash content compared to without whipping agent.

There were no significant effect (p>0.05) in addition of whipping agent and homogenization process of proximate composition in all YCS samples (Table 2). From the result obtained, sample with whipping agent addition (YCS1 and YCS2) resulted on slightly high percentage in all proximate analysis; moisture, ash, protein, and fat contents, compared to non-whipping agent addition samples (CS3 and CS4).

Table 2 Proximate composition of coconut shake and yogurt coconut shake

Samples	Moisture %	Ash %	Protein %	Fat %
CS1	80.10 $\pm$ 0.03[a]	0.53 $\pm$ 0.02[a]	3.44 $\pm$ 0.20[a]	0.50 $\pm$ 0.14[a]
CS2	78.58 $\pm$ 1.66[a]	0.47 $\pm$ 0.01[b]	2.31 $\pm$ 0.34[b]	0.45 $\pm$ 0.21[a]
CS3	80.98 $\pm$ 0.09[a]	0.43 $\pm$ 0.01[b]	0.76 $\pm$ 0.27[c]	0.55 $\pm$ 0.21[a]
CS4	81.04 $\pm$ 0.01[a]	0.44 $\pm$ 0.01[b]	0.70 $\pm$ 0.25[c]	0.45 $\pm$ 0.07[a]
YCS1	71.27 $\pm$ 0.08[a]	0.77 $\pm$ 0.05[a]	2.05 $\pm$ 0.57[a]	1.50 $\pm$ 0.42[a]
YCS2	71.54 $\pm$ 0.21[a]	0.71 $\pm$ 0.03[a]	1.62 $\pm$ 0.20[a]	0.80 $\pm$ 0.14[a]
YCS3	71.21 $\pm$ 0.27[a]	0.70 $\pm$ 0.01[a]	1.56 $\pm$ 0.12[a]	1.15 $\pm$ 0.50[a]
YCS4	71.02 $\pm$ 0.03[a]	0.69 $\pm$ 0.06[a]	1.18 $\pm$ 0.01[a]	0.55 $\pm$ 0.21[a]

Note: Mean values across the same column with a different superscript letters were significant different at p<0.05

In proximate composition, for ash and fat content analysis, all YCS samples values were higher than CS samples (Figure 2(B), 2(D)). The presence of yogurt in coconut shake affected ash and crude fat content level. Popa and Ustunol (2011), stated that the gross chemical composition is about 3.5% of fat in every 100 g of yogurt and yogurt drink. According to Chandler (1991), milk based product which was defined as the fluid secreated by the mammary glands of mammals contain no fibre. Apart from that, moisture content of CS samples resulted higher than YCS samples (Figure 2(A)). The presence of low water content in yogurt had caused the decreased of moisture content value compared to CS samples due to the difference of pH. This study revealed that YCS samples were not represent changes that significantly affected the addition of whipping agent and homogenization process. Figure 2(C) had shown the protein content level of CS samples with whipping agent addition (CS1 and CS2), resulted on highest percentage compared to YCS samples with whipping agent addition (YCS1 and YCS2). This condition might be due to the presence of egg albumen that acted as whipping agent in CS1 and CS2. However YCS without addition of whipping agent (YCS3 and YCS4) shown to be having highest protein content level compared to the rest of CS samples (CS3 and CS4); samples with no addition of whipping agent. The crude protein content in these samples might be influenced by the addition of yogurt and coconut flesh itself as the basic ingredients. This explained why YCS3 and YCS4 had shown higher crude protein content.

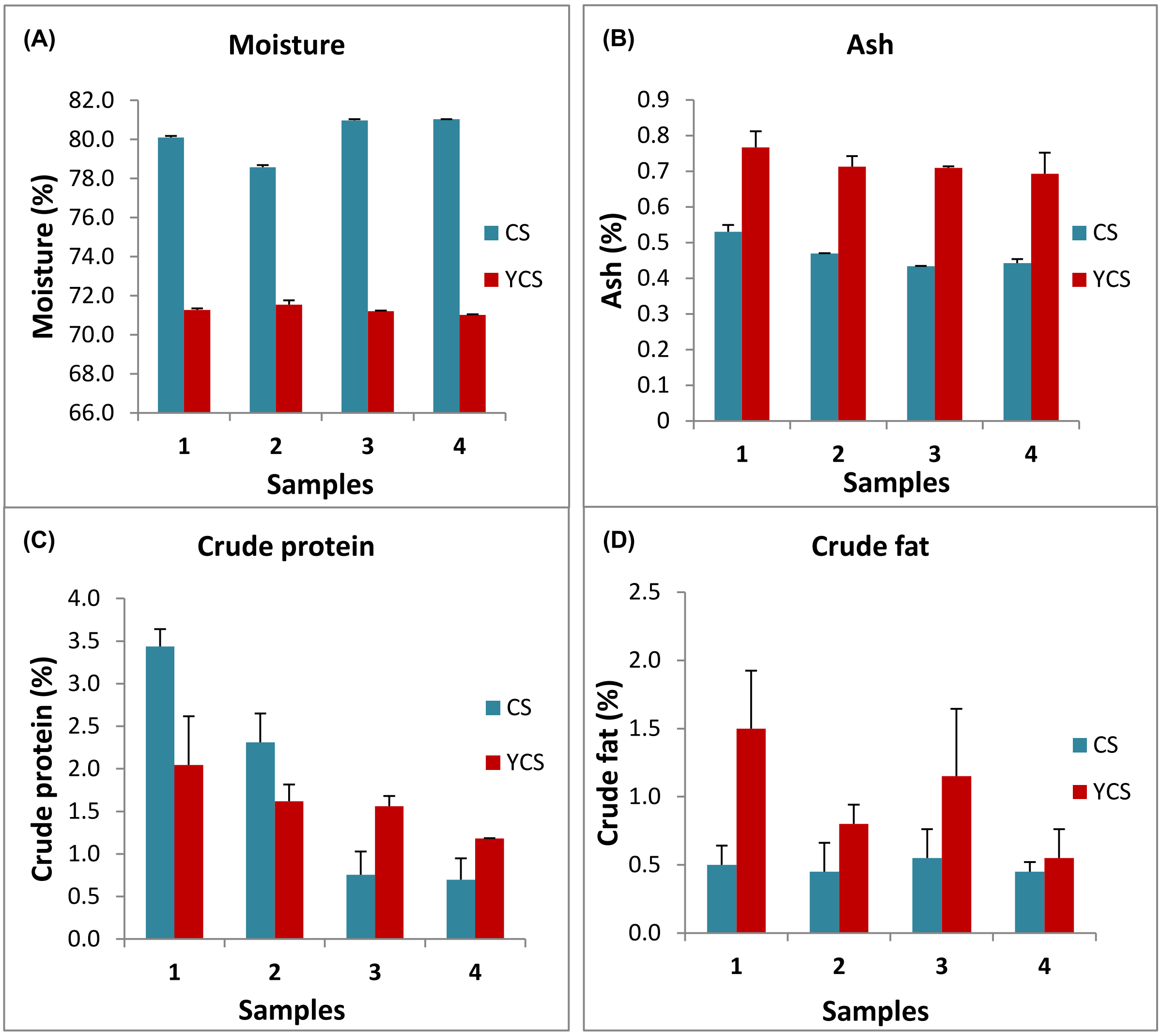

Figure 2 Comparison of (A) Moisture, (B) Ash, (C) Crude protein and (D) Crude fat, between all CS and YCS samples

Physical properties of CS and YCS samples were determined and the values were tabulated in Table 3. CS1 had shown the significant high value of pH at 5.10 followed by CS4, CS2, and CS3 at 5.07, 5.06, and 5.04 respectively. Highest pH recorded by CS with whipping agent and homogenization (CS1) while lowest pH recorded by CS without whipping agent and non-homogenization (CS3).

There was a significant different (p>0.05) in addition of whipping agent and non-homogenization process on viscosity and highest viscosity recorded was 12.85 mPas (CS1) whereas the lowest value at 8.55 mPas (CS4).

It was shown a significant effect (p<0.05) of whipping agent addition and homogenization process to the percentage of overrun among CS1, CS2, CS3 and CS4 samples. The lowest percentage of overrun was 6.23% in CS4; sample without whipping agent and did not undergo homogenization, wherease highest percentage of overrun was 23.67% in CS1; sample with whipping agent and undergo homogenization. There are no significant

(p>0.05) effect in addition of whipping agent and homogenization process among the CS samples towards stability and foaming (Table 3).

Results obtained for viscosity analysis shown a significant high value (p>0.05) of YCS3 (homogenized YCS) at 14.02 mPas and the lowest value at 10.90 mPas of YCS4 (non-homogenized YCS) (Table 3). Viscosity related to fat content and overrun as well. Viscosity effect on iceream mixes reported; were positively increased their fat content; provided a negative value of overrun readings; were influenced by the homogenization process positively (Innocente et al. 2009).

Overrun was related to the percentage of finished sample (in volume) that came out to be compared with how much volume was put in at the beginning. As shown in Table 3, it was found a significant effect (p<0.05) of homogenization process in percentage of overrun among all the YCS samples. Both sample YCS1 and YCS3 which undergo homogenization had higher overrun percentage than sample YCS2 and YCS4 which did not undergo homogenization. The lowest percentage of overrun was 2.06% in YCS2 and the highest was 13.45% resulted in YCS1.

Table 3 Physical properties of coconut shake and yogurt coconut shake

Samples	pH	Viscosity (mPas)	Overrun (%)	Stability (Min)	Foaming (%)
CS1	5.10 ± 0.01^{a}	12.85 ± 0.21^{a}	23.665 ± 1.42^{a}	21.50 ± 2.12^{a}	1.05 ± 0.35^{a}
CS2	5.06 ± 0.01^{ab}	11.65 ± 0.21^{a}	10.277 ± 0.17^{c}	19.00 ± 2.83^{a}	0.85 ± 0.07^{a}
CS3	5.04 ± 0.01^{b}	12.10 ± 0.28^{a}	14.883 ± 0.04^{b}	20.50 ± 0.71^{a}	0.85 ± 0.21^{a}
CS4	5.07 ± 0.01^{ab}	8.55 ± 0.64^{b}	6.234 ± 0.34^{d}	17.00 ± 1.41^{a}	0.75 ± 0.07^{a}
YCS1	4.91 ± 0.02^{a}	11.65 ± 0.35^{b}	13.45 ± 0.52^{a}	15.00 ± 1.41^{a}	0.85 ± 0.08^{a}
YCS2	4.71 ± 0.04^{a}	11.60 ± 0.14^{b}	2.05 ± 0.66^{b}	14.00 ± 1.41^{a}	0.60 ± 0.14^{a}
YCS3	4.83 ± 0.04^{a}	14.02 ± 0.16^{a}	11.82 ± 1.14^{a}	16.50 ± 2.12^{a}	0.60 ± 0.14^{a}
YCS4	4.78 ± 0.01^{a}	10.90 ± 0.42^{b}	5.38 ± 0.39^{b}	20.50 ± 3.54^{a}	0.65 ± 0.07^{a}

Note: Mean values across the same column with a different superscript letters were significant different at p<0.05

In physical properties analysis, Figure 3(A) showed pH level of all CS samples are higher than YCS samples. It can be concluded that YCS samples was more acidic compared to the CS samples. The pH value for YCS samples were ranged from 4.7 to 4.9. The decreasing pH value of YCS was due to the small amount of lactic acid production resulted from the fermentation of lactose by *Lactobacillus* bacteria. Hekmat and McMahon (1992) reported that pH of yogurt will affect the growth and viability of *L. acidophillus*. According to the Australian Food Standards Code (Standard H8), yogurt must have a pH of <4.5 and it must be prepared with *S. thermophilus* and *L. delbrueckii* ssp. *bulgaricus* or other suitable lactic acid bacteria.

The presence of yogurt in YCS will decrease the pH of egg white that acted as the whipping agent in this study. The pH of the egg white foam will be decreased to near the isoelectric point of the egg white protein and at the isoelectric point, the proteins will be least stable and more sensitive to denaturation. The changing of pH will influenced the formation of foam, this supported by Nakamura and Sato (1964), they had obtained a great foaming capacity at the neutral and acidic pHs except at the exceedingly acidic pH (pH 1.0). With an egg white solution as a whipping agent, Hammershoj and Larsen (1999) established that the foam overrun was the highest at pH 4.8 and the lowest at pH 10.7.

Viscosity level of YCS was founded higher than CS samples during their physical properties analysis (Figure 3(B)). There were several factors that will influenced the viscosity of the sample such the concentration presence of substance, fat content, attractive force and the particles size. Homogenization one of the factor which effect the viscosity of samples by makes the fat globules in the samples are broken up into smaller, more consistently dispersed particles. Viscosity of both YCS and CS samples, recorded higher in homogenized samples (CS1, CS3, YS1, YS3) compared to non homogenized samples (CS2, CS4, YS2, YS4). According to Randhahn and Reuter (1978), the viscosity milk and cream increases with the homogenization as the size of the fat globules decreases. This produces a much smoother and creamier end product. Homogenization giving a uniform appearance, which will not seperate and accomplished using homogenizer. In this equipment, the milk is forced through the small openings at a higher pressure and fat globules are broken up due to shearing forces. Viscosity level also related to fat content in a sample; crude fat content in YCS samples recorded higher percentage than CS samples. This finding was supported by (Innocente et al. 2009), stated that there was a positive linear relationship between fat content and viscosity founded in ice cream mixes.

Figure 3(C) had shown the overrun percentage in CS samples were recorded higher values than YCS samples. It was related to the viscosity of samples. Although many factors influenced the overrun including viscosity, fat, emulsifier, stabilizer contents and processing conditions, viscosity has been reported to be an important factor (Sofjan and Hartel, 2004). A higher viscosity observed in yogurt coconut shake with undergo the homogenization process (YCS1 and YCS3) had relatively lower overrun. The finding was in agreement with a previous report stated by Yang and Foegeding (2010), there were two negative linear relationship produced between foam overrun and viscosity of solution for EWP and WPI of a log-log scale.

In this study, no significant differences recorded in stability for both CS and YCS samples (Figure 3(D)). However, the presence of yogurt might influenced the time taken for separation to be occurred.

Both CS and YCS samples recorded that no statistical difference on foaming percentage in this study (Figure (E)). There are many proteins are able to form foams, but egg proteins are the most effective. Yang and Baldwin (1995), stated that good foaming properties of the egg white are important in baked goods and certain confectionaries. Egg white is an excellent foaming agent due to its mixture of different proteins, which all contribute to the different functionalities required (MacDonell, 1955; Stadelman and Cotterill, 1994). However, since there were pasteurized egg albumen used as whipping agent in this study, it might reduced the foaming ability. Pasteurization of egg albumen decreased the foaming ability and resulted in the reduction of quality and volume, this condition were due to denaturation of ovotransferrin on pasteurization at 53ºC.

The homogenization process also contributed to the foaming percentage level. Egg albumen formed unstable and dried type of foams after prolonged whipping which resulted in a drained material of poor whipping quality (Forsythe and Bergquist, 1951; Nakamura and Sato, 1964a). Homogenization effects on the physical state of ovomucin which slightly reducing the fiber lenght (Forsythe and Bergquist, 1951).

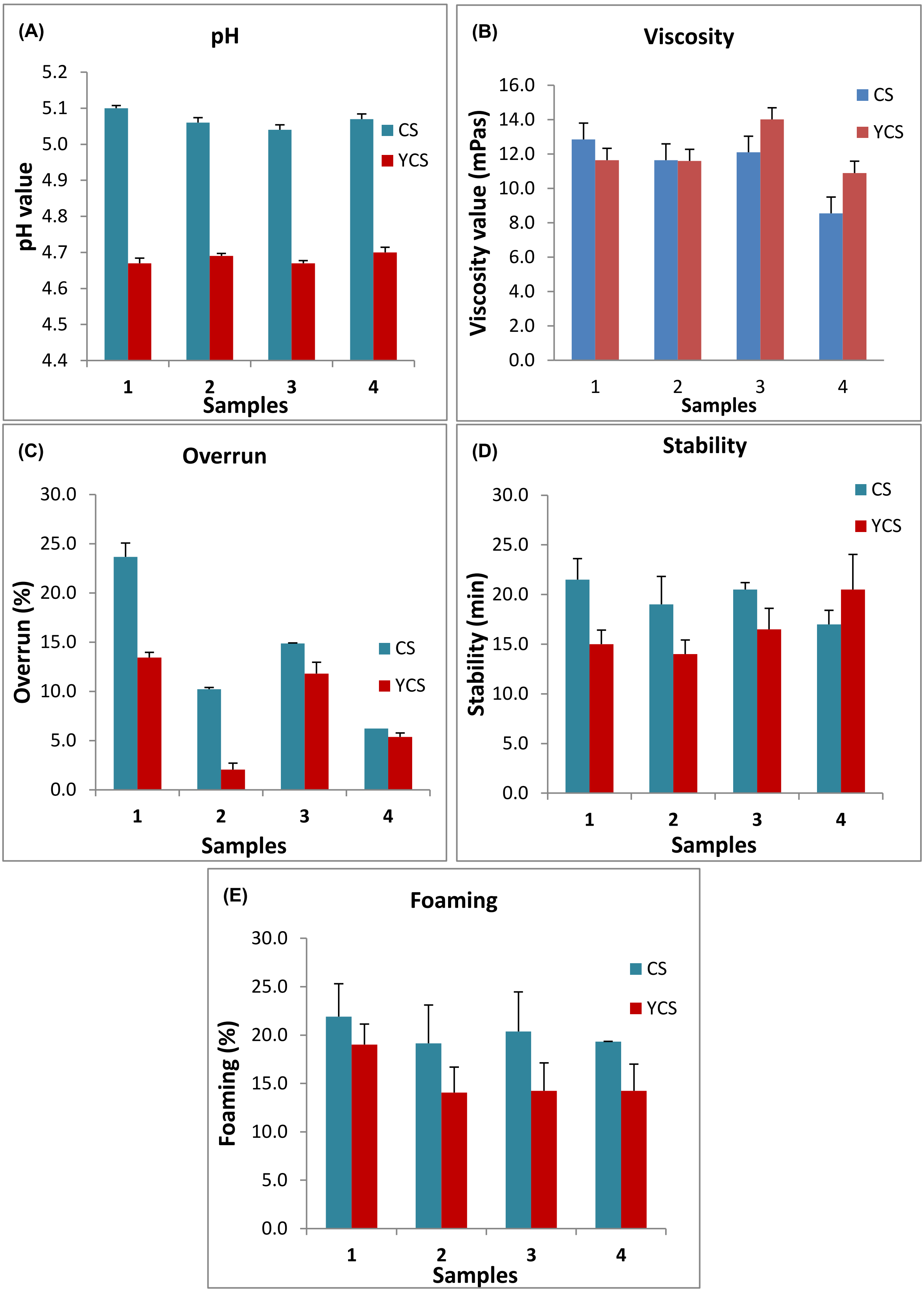

Figure 3 Comparison of (A) pH, (B) Viscosity, (C) Overrun, (D) Stability and (E) Foaming, between all CS and YCS samples

3.2 Probiotic counts of yogurt coconut shakes

Figure 4 showed the average total number of probiotic count in yogurt coconut shake after incubation process at 37ºC. Standard analysis of variance (ANOVA) was used to analyze the number of probiotic count in yogurt coconut shake samples. There were significant difference (p<0.05) of probiotic count founded between all samples in term of homogenization process where homogenization process had influenced the different number of probiotic count in yogurt; both sample YCS1 and YCS3, which undergo homogenization resulted on low probiotic count compared to other samples that do not undergo homogenization (YCS2 and YCS4). YCS2 which added by whipping agent and not undergo homogenization had reached the highest number of probiotic strains count at 5.11×10^7 cfu/mL. YCS with addition whipping agent and undergo homogenization, YCS1 founded as the lowest number of probiotic count at 3.26×10^7 cfu/mL.

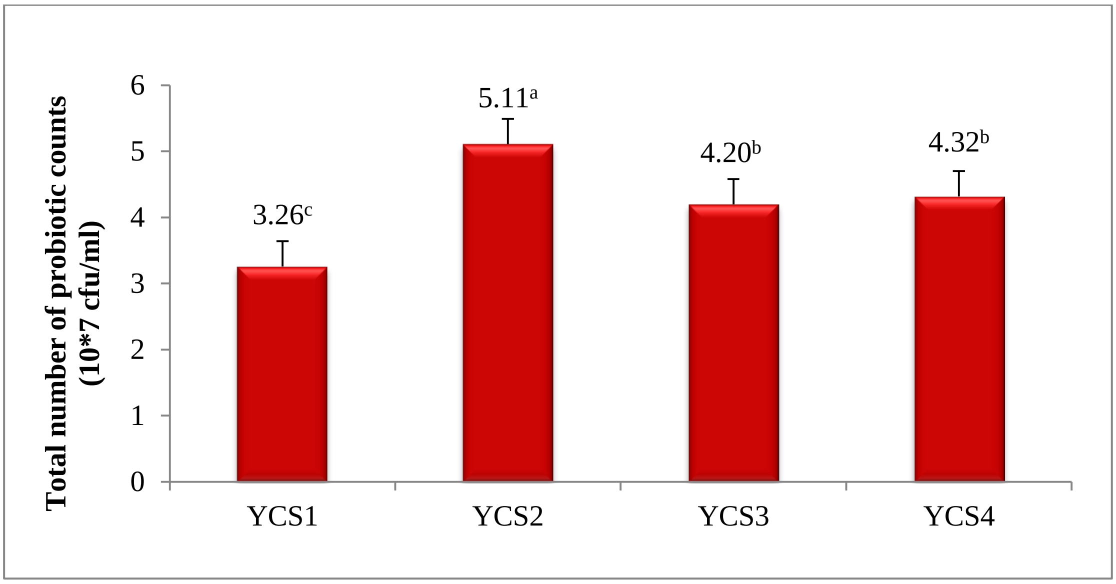

Figure 4 Total number of probiotic counts in all YCS samples; YCS1, YCS2, YCS3 and YCS 4. Mean values with different superscript letters are significant different at p<0.05

Viability also depends on the nutrient availibity, growth factors and inhibitor, sugar concentration or osmotic pressure, dissolved oxygen and permeation of oxygen through the packaging, the inoculation level, incubation temperature, fermentation time and storage temperature (Bentony *et al*., 1994). However, the main factors for the loss of viability of probiotic organisms had been associated with slight decrease in pH and accumulation organic acids, as a result of growth and fermentation (Hood and Zottola, 1988). During yogurt preparation, addition of starter cultures usually resulted a slower growth of probiotic strains.

Roy (2005), mentioned that there will be a possibility for a negative proliferation to occur because the starter cultures might produced substances that finally became an inhibitor not only towards pathogens and spoilage microorganisms but also towards probiotics. Rapid growth of starter cultures also led to an unadequate nutrients availability for probiotic thus declined the growth pattern. The exposure of cultures to dissolved oxygen due to whipping procedure caused the accumulation of toxic metabolites such as superoxide, hydroxyl radicals and hydrogrn peroxide, which eventually led to cell death of the probiotic microorganisms commonly caused by a partial or complete lacked of electrons transport system.

3.3 Sensory acceptability of CS and YCS

The sensory acceptability of CS was conducted using preference test with hedonic scale. An amount of 25 panelists who were UPM students had served with eight small cups of different coconut shake samples; YCS1-YCS4 and CS1-CS4. The hedonic scale used in preference test was likert-type scale which was dislike extremely (1), dislike very much (2), dislike slightly (3), dislike moderately (4), neither like nor dislike (5), like slightly (6), like moderately (7), like very much (8), like extreamly (9). In this analysis, there were 6 aspects that had been measured; smell, creamy taste, mouthfeel, texture, sweetness and overall liking. According to Figure 5, CS samples shown to have no significant different (*p*>0.05) among YCS samples which differ in term of addition of whipping agent and undergo the homogenization process for all attributes such as smell, creamy taste, mouthfeel, texture and overall liking. CS2 which added with whipping agent and did not undergo homogenization got the highest score for creamy taste, mouthfeel, texture and overall liking except for smell attribute which 6.72, 6.16, 6.36, 6.24 and 6.60 respectively. From the result obtained, UPM students more preferred CS2 compared to others CS samples.

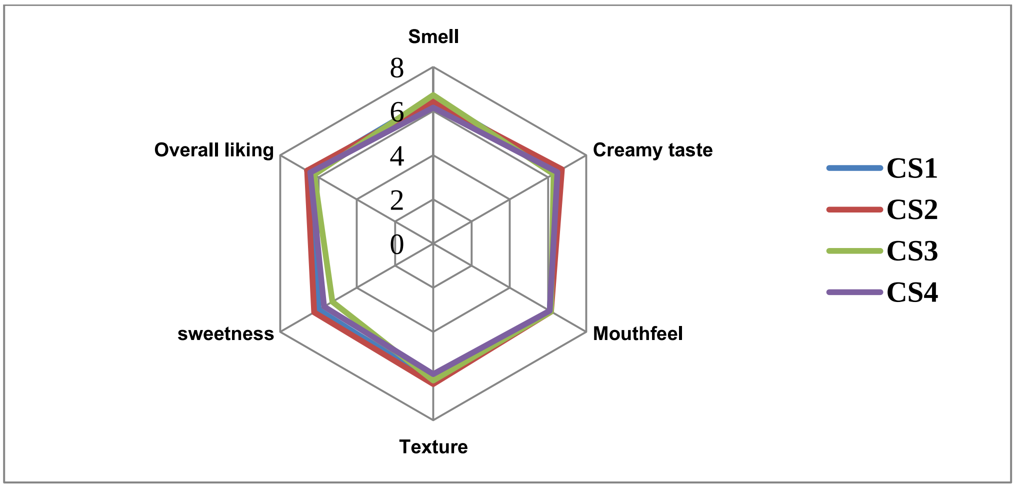

Figure 5 Hedonic scaling of the sensory attribute of coconut shake samples; CS1, CS2, CS3 and CS4

From the result obtained, Figure 6 had shown that there was no significant difference (*p*>0.05) in YCS that contained a whipping agent addition and undergo homogenization process (YCS1) towards following attributes; creamy taste, mouthfeel, texture and overall liking. It had shown that YCS3 which YCS without whipping agent and undergo homogenization got the highest score for creamy taste, mouthfeel, texture and overall liking which were 6.04, 5.88, 6.04 and 5.56 respectively. They mostly like the smell of both sample YCS1 and YCS4 which was 5.68. Hence, the sensory analysis resulted most of panelists (UPM students) were slightly preferred YCS samples, especially YCS3; sample without whipping agent and undergo homogenization, since overall liking attribute was scaled up to 6.

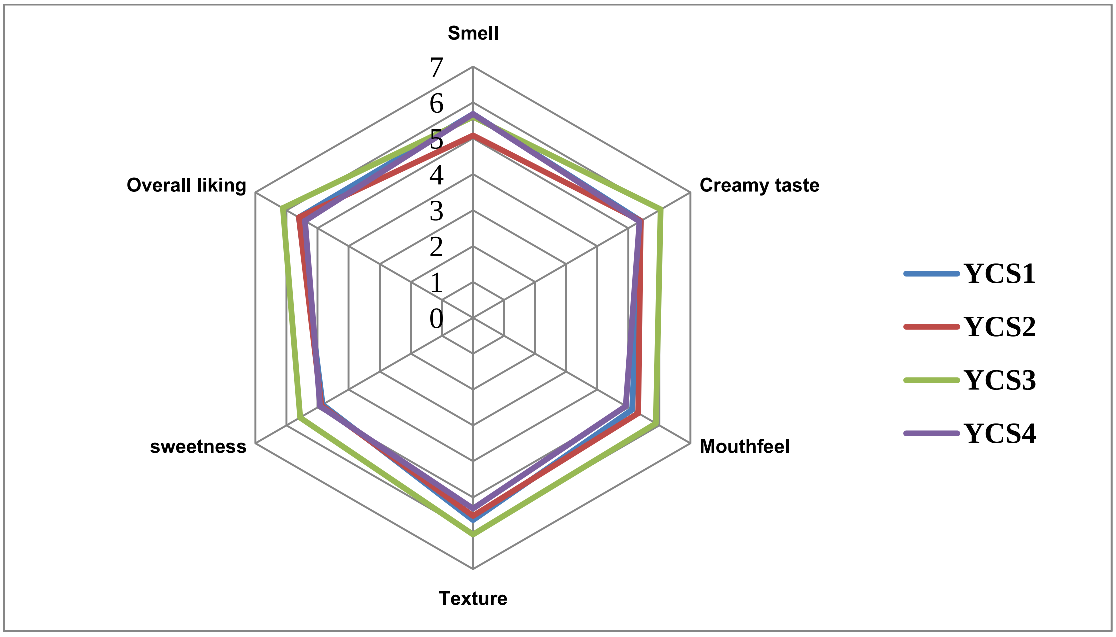

Figure 6 Hedonic scaling of the sensory attribute of YCS samples; YCS1, YCS2, YCS3 and YCS4

The present of yogurt in coconut shake give some sour smell that might influenced the score for smell attribute. Since the addition and/or multiplication of probiotic microorganisms could produce undesirable characteristics in the products (Dias and Mix, 2008; Komatsu *et al.*, 2008). Unfortunately, the scale of sensory acceptability did not reached scale 7 for YCS samples which indicated the sample was moderately like by the panelist. However, yogurt coconut shake can be modified in term of formulation and processing in order to be well accepted by the consumer and this recommendation should be applied in future study.

4. Conclusion

As conclusion, in term of presence of yogurt, it was revealed that all YCS samples were more acidic compared to CS samples. Homogenization effected the viscosity in YCS samples by reducing the viscosity value as well as the total probiotic counts. The addition of whipping agent and homogenization process were founded to effect the percentage of overrun for all YCS samples. YCS can be highly accepted in future and a slight modification must be carried out since YCS has a potential to be a healthy beverage. As a recommendation, young coconut must be ranged 7 to 8 months to be used for future study. More researchers are required to determine other factors that possibly influence the physicochemical properties of YCS for instance; the effect of yogurt on coconut shake ratio, effect of homogenization duration, effect of different type of milk used and effect on different whipping agents.

Acknowledgements

The authors would like to express the gratitude to Faculty of Food Science and Technology, Universiti Putra Malaysia (UPM) for financial support of this study.

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