Original Research Article

STUDY OFPHYSICO-CHEMICAL AND STORAGE QUALITIES OF "*AWARA*" PRODUCED FROM SOYMILK USING TAMARIND FRUIT PULP EXTRACT USEDAS COAGULANT

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ABSTRACT

The study investigated the physico-chemical and storage qualities of "*Awara*" produced from soymilk with tamarind (*Tamarindus indica* L.) fruit pulp extract as coagulant. The experimental design was 5 x 6 completely randomized design. The "*awara"* products were prepared using coagulant at 4%, 6%, 8%, 10% and 12% vol. concentrations and heated in appropriate volume of soymilk (12litres) to obtain "*awara*" products designated sample B, C, D, E and F respectively. Control sample A was prepared from reconstituted skimmed milk powderwith 4% coagulant. For storage studies, ambient stored samples were analyzed at 0 day and 1 week intervals. All samples were subjected to standard analytical methods. Resultsshowed that the percentage yield of *awara*products ranged from 7.89-20.29% with control sample A having the highest value of 20.29% while sample B had least value (7.89%). The range of textural parameters was 0.74-65.71 representing the minimum and maximum values of elasticity and hardness respectively. In hardness, F (65.71%) with the highest value is significantly different to all the samples and each sample is significantly different to the other at (P>0.05). Total Titratable acidity values ranged between 0.059-1.53% representing B and D respectively. pH value ranged from 4.4-6.6 in day 0 and 2.7-4.1 in week 1 with A having highest value both in day 0 and week 1. There was a decrease in total bacteria and fungi counts in day 0 with increased addition of coagulant. The result of the microbiological showed that the *awara* samples cannot keep more than one day.

Keywords: Awara; Physico-chemical; Storage stability; Coagulant

1. INTRODUCTION

Awara is a non-fermented soymilk product, which is a soft-cheese-like plant based food produced by curding fresh hot soymilk (from soybean) with either a salt or an acid [1].

*Awara*or soya bean cake in Nigeria is also known as *Tofu* in Asia which is considered an important dietary snack food throughout Asia. It is one of the most important and popular food product from soybean in Eastern and Southern Asian countries [1].

Awara is known and popular in Northern parts of Nigeria, whereas it is called *Beske* in the Western parts of Nigeria [2]. *Awara* is low in calories but rich in essential and non-essential amino acids, contain levels of iron and other trace minerals, low in saturated fats, high in vitamins, contains antioxidants and has no cholesterol [3]. *Awara* (soy cheese) is therefore, a healthy, rich and less expensive source of nutrients especially for the developing countries and Nigeria in particular [4].

Awara is easy to digest and could be substituted for meat, cheese and certain dairy products such as yoghurt, in the diets for dairy-sensitive individuals, vegans and elderly [5]. It acts like sponge and has the miraculous ability to absorb any flavour that is added to it.

Soybean (*Glycine max*) has been proven suitable for the production of *awara*. It is a legume of an exceptionally high protein content ranging between 38% and 42% with lysine constituting a substantial proportion. Soybean is considered as a good source of plant protein to man. It is also cheaper and could serve as an alternative to animal protein sources. It contains up to 40% protein compared with 1.0% to 5.6% protein content of most animal milk [6]. Soybean is one of the most important legumes of the tropics. It has gained an increase in its utilization as a stable crop due to its high nutritional and excellent functional properties. It is also rich in carbohydrates (27.1%) and oil (20.6%) as reported by [7].

Different types of coagulants are used locally for the coagulation of milk. These coagulants are reported to impart both physical and chemical properties as well as the sensory effects on the quality of the curds [3]. Traditionally, the curdling agent used to make *tofu/awara* is calcium sulphate. The coagulant produces a soy protein gel, which traps water, soy lipids, and other constituents in the matrix, forming curds. The curds are then generally pressed to remove the excess water and then cut into cubes [5]. Coagulants such as vinegar, tamarind fruit extract, lemon juice, alum, or citric acid including corn steep water are used to bring about the curdling of the soymilk, thus precipitating the casein-like protein. The curds formed are pressed to remove excess water, cut into blocks and fried in deep hot oil [8].

Attempts have been made in the past by several researchers to use natural coagulants for *awara* production. [2] comparatively used fruits such as soursop, passion fruit, baobab, pineapple and tamarind extracts to produce *awara* from soymilk. [9] used vinegar, lemon juice, tamarind fruits extracts, alum and citric acid for *awara* production from fermented banjara bean and soybean. [10] used *Moringa oleifera* seed cake extract, tamarind seeds, alum salt (aluminum sulphate) and lime juice for *awara* production from soybeans. Also, [11] used a vegetable plant Sodom apple (*Calotropis procera*) extract and calcium chloride as coagulants for *awara* production.

Tamarind (*Tamarindus indica* L.) fruit (pulp) is a seasonal, highly perishable and underutilized agricultural food material, hence finds limited application in food systems. Additionally, despite several works on different coagulating agents including *Tamarindus indica*, there is no documented attempt at the standardization of tamarind (*Tamarindus indica* L.) fruit pulp extract as sole coagulant in *awara* production. Thus, this research sought to standardize tamarind fruit pulp extract as coagulant in *awara* production by evaluating yield, physico-chemical and storage qualities of *awara* product.

2. MATERIAL AND METHODS

2.1 **Materials**

The soybean (yellow variety) was obtained from Kanawa farm at Federal Polytechnic, Bauchi in October, 2022. Tamarind fruits was purchased at Bayara market, Bauchi metropolis and taken to the Department of Food Science and Technology, Federal Polytechnic Bauchi, for analysis. Skimmed milk powder (Lactorich) was purchased at Central market, Bauchi metropolis. The research work was carried out in the Laboratories of the Department of Food Science and Technology, Federal Polytechnic Bauchi, Bauchi State.

2.2 **Preparation of coagulant**

The tamarind fruit extract (coagulant) was processed according to [2] with modification (Figure 1). 2kg of tamarind fruit pulp was steeped in 5.45litres of clean warm water (45^{0}C) for 6-8h. It was followed by vigorous shaking to extract maximum quantity of the pulp. It was then sieved with muslin cloth and the filtrate (5 litres) packaged in sterile plastic bottles and stored in the refrigerator for further use as coagulant.

2.3 **Preparation of Soymilk**

Soymilk was prepared by a modified Japanese bland soymilk procedure described by [12] as shown in Figure 2. One kilogram of cleaned soybeans was dehulled, winnowed and washed using clean water. The washed beans was blanched in hot water at 90^{0}C for 15 minutes, washed and milled using an attrition mill. Hot water (5litres) was added to make slurry. This was sieved using muslin cloth with addition of 5 litres water, to obtain 12litres of soymilk which was used for *awara* production.

2.4 **Formulation of *awara*Samples**

A laboratory experiment was established using a completely randomized design with five treatments, two replications and a control. 12litres each of processed soymilk was coagulated with 4% vol., 6% vol., 8% vol., 10% vol. and 12% vol. concentrations of coagulant to give samples B, C, D, E and F of *awara* products respectively. Control sample (soft unripened cottage cheese) was prepared from skim milk using 4% vol. coagulant.The formulation adopted for *awara* samples was according to that described by [2] and [13] with modification.

2.5 **Production of *Awara* Products (Samples)**

Awara was produced according to method of [14] with slight modification (Figure 3). Twelve (12) litres of soymilk was transferred into a stainless pot where it was heated to boiling point (100^{0}C) with constant stirring. The coagulant at varying concentrations of 4% vol., 6% vol., 8% vol., 10% vol., and 12% vol. were added to the same quantity (12litres) of boiling soymilk each. Accordingly, a concentration of 480ml/12000ml, 720ml/12000ml, 960ml/12000ml, 1200ml/12000ml and 1440ml/12000ml of coagulant and soymilk respectively, was formulatedto produce sample B, C, D, E and F. After addition of the coagulant to the hot soymilk, it was mixed and allowed to solidify to form curds. The curds were then removed from heating, sieved with muslin cloth and further compressed to remove whey to make firm curds. Afterwards the curds were cut into rectangular bars and deep fried. Control sample A was produced according to same method described above with 1kg of skim milk reconstituted to 4litres of milk with water, and coagulated with 4% vol. coagulant to give A (160ml/4000ml) (Figure 4).

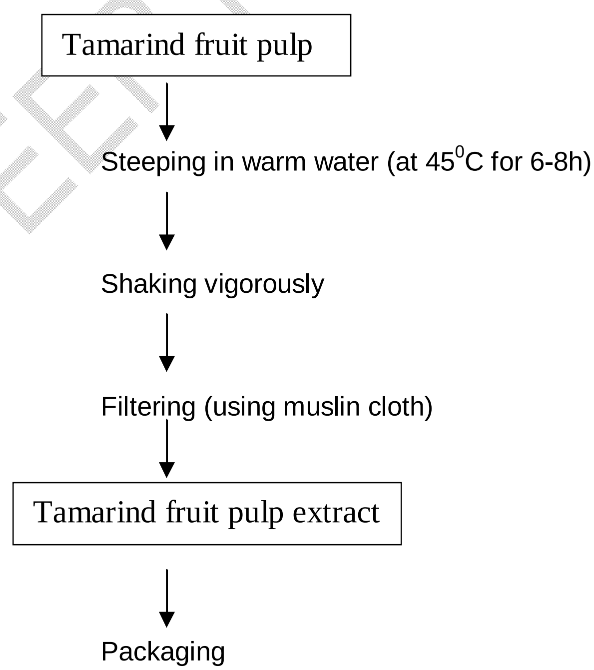

Figure 1: Flow chart for processing of coagulant from tamarind fruit pulp

Source: [2] with modification

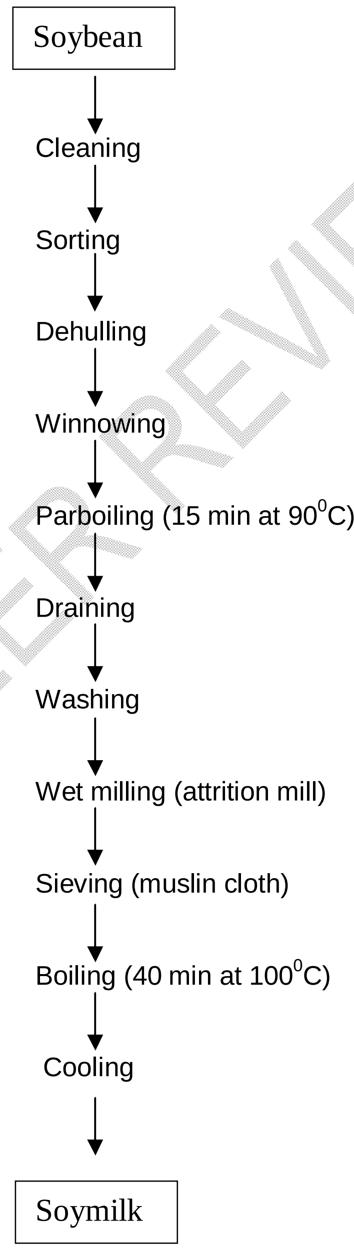

Figure 2: Flowchart for the production of soymilk

Source: [12] modified

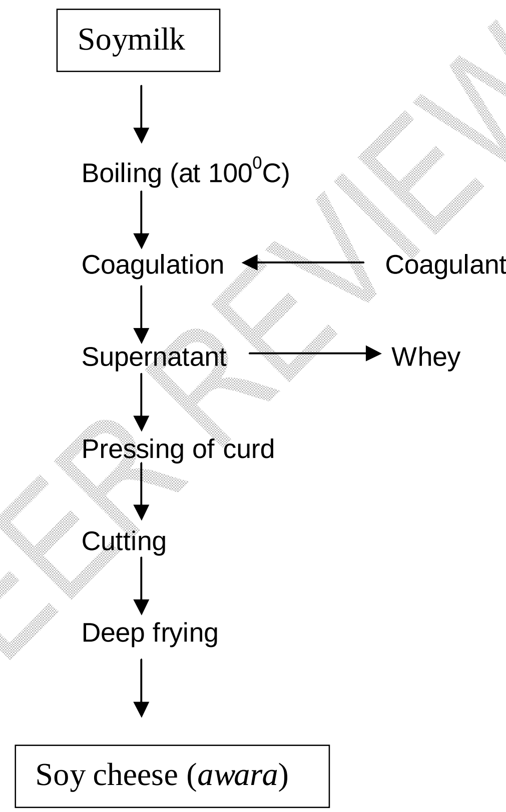

Figure 3: Flow chart showing the production of soy cheese (*awara*) from soymilk

Source: [14] with slight modification

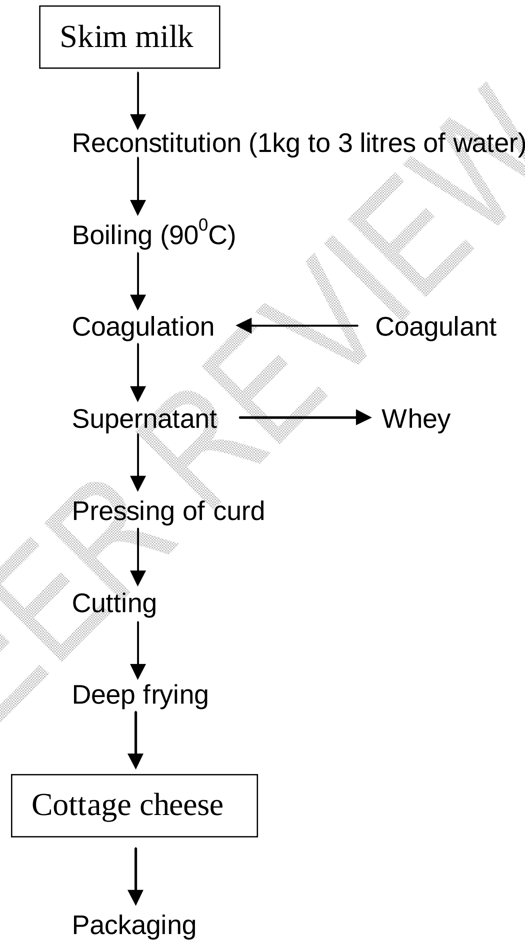

Figure 4: Flow chart for processing of cottage cheese from skim milk (control sample).

Source: [14] with slight modification.

2.6 **Determination of Yield of *Awara***

Percentage yield of each *awara* sample was calculated from the quantities of curds produced in respect to the quantity of soymilk used, as described by [15]. The weight of the 12000mls of soymilk was noted by subtracting the weight of empty vessel from the weight of vessel plus milk. The curds was weighed (excluding the weight of the cheesecloth). The yield of curd was calculated by dividing the weight of curds by the weight of milk and multiplying by 100.

$$\text{Percentage yield of } awara = \frac{\text{Weight of curd}}{\text{Weight of soymilk}} \times \frac{100}{1}$$

2.7 **Determination of Physico-chemical properties of *Awara***

The total titratable acidity, pH, textural properties which include elasticity, hardness, firmness and cohesiveness were determined using standard method of [16].

2.8 **Determination of Total Microbial Counts**

The Total Microbial Count (TMC) also known as the Total Viable Count (TVC) was determined using the procedure described by [17]. 23.4g of potato dextrose agar was weighed and dissolved in 300ml of distilled water in a conical flask. 5.6g of nutrient agar was also weighed and dissolved in 200ml of distilled water. 9ml of distilled water was pipetted into 5 test tubes each for the samples, and plucked with cotton wool. The prepared agars, distilled water, petri-dishes and pipettes was sterilized in the autoclave (Model: YX-280A. GULFEX MEDICAL AND SCIENTIFIC ENGLAND) at 121^{0}C for 15 minutes at 15psi. After sterilizing, the test tubes was labeled 10^{-1} to 10^{-5} and the petri-dishes was also labeled appropriately. 10g of each sample was weighed into a homogenate containing 50ml of distilled water in a beaker. This was stirred using a stirrer to a homogenous solution which was later filtered to get a clear solution. 1ml of the homogenate was serially diluted into the 9ml of test tubes labeled 10^{-1}. After homogenizing, 1ml was taken from here and transferred to the 10^{-2} and continued up to the 10^{-5} dilution for each sample. 0.1ml aliquot from the 10^{-5} dilution was transferred into labeled petri-dishes in duplicate for each sample. The potato dextrose agar and nutrient agar were allowed to cool, after which each was poured into the petri-dish containing 0.1ml aliquot for each sample. The petri-dishes were rocked gently and allowed to solidify. The plates were then incubated by placing the nutrient agar plates (for bacteria) inside the incubator (M'c Jefferson – UK) at 37^0C for 24 hours and the potato dextrose agar plates(for fungi) were put on the shelf at room temperature for 72 hours. At the end of the incubation period, the colonies on each plate was counted with a colony counter (J-2 Colony Meter PEC MEDICAL USA) and results calculated as colony forming units (CFU) per ml.

Formula:

$$c = \frac{n}{vd}$$

Where c = colony forming unit per ml (cfu/ml)

n = number of colonies

d = dilution blank factor

v = volume transferred to plate

3. RESULTS AND DISCUSSION

3.1 Percentage Yield and Total Titratable acidity of *Awara* Samples

"Table 1" shows the percentage yield and total titratable acidity of *awara* samples from soymilk. The range of percentage yield of *awara* is 7.89-20.29%, with B (7.89%) being the lowest and A (20.29%) the highest respectively. C (13.10%) and D (13.38%) are in close range while E (10.83%) and F (11.53%) also relates closely. While the same quantity of soymilk (12 litres) was used for B, C, D, E and F, 4 litres of skim milk was used for A (control).

Percentage yield is the quantities of curds produced in respect to the quantity of soymilk used, expressed in percentage [15]. The highest yield expressed by the control sample (A) is likely an indication of casein content of cow milk which is absent in soymilk and higher amount of calcium in cow milk than soymilk. The outcome of these reactions is to a large extent determined by amounts and proportions of the various components in milk, with the protein composition contributing significantly in this regard.

The slight increase in yield from B to D is proportional to decreased acidity (pH) of the samples. This agrees with the assertion of [13] that; the addition of more acid causes coagulation of more milk solids and thus increases the yield. The result is lower than the yield reported for cottage cheese (18.75-19.98%) by [13] except the control sample which is slightly above this range.

The total titratable acidity values of *awara* samples presented in Table 1 shows a range of total titratable acidity between 0.06% and 1.53% for B and D respectively. The values expressed for the samples represent % lactic acid of the *awara* products.

Titratable acidity, which measures the total acid concentration in a food is determined by titration of intrinsic acids with a standard base [18]. Titratable acidity and pH are two interrelated concepts in food analysis that deal with acidity. Each of these quantities deals with acidity but analyzed separately and with each providing its own particular insights on food quality. For example while pH is important to assess on the ability of a microorganism to grow in a specific food, titratable acidity is a better predictor than pH of how organic acids in the food impact flavor [18].

The titratable acidity of *awara* measured as % lactic acid revealed a slight difference between the control sample A, and B with the latter being the least. The increase in acidity of samples with increasing coagulant concentration correlates with the level of acidity of the coagulant.

According to [13], the increase in titratable acidity and reduction in pH of cottage cheese during storage is correlated with each other. The addition of more acid for the production and manufacturing of cottage cheese as per the treatment plan cause the increase in titratable acidity and decrease in pH. The above assertion by [13] agrees with the result obtained for titratable acidity and pH of the samples. Titratable acidity increased with decrease in pH of the samples with more addition of the coagulant. Sample D was highest in titratable acidity and lowest in pH.

Table 1: Result of percentage yield and total titratable acidity (TTA) of a*wara* samples

Sample	Percentage yield (%)	TTA (% lactic acid)
A	20.29	0.08
B	7.89	0.06
C	13.10	0.08
D	13.38	0.15
E	10.83	0.08
F	11.53	0.09

Key: A = Soft Cottage Cheese produced with 4% vol. coagulant(Control) + 100% skim milk

B = *Awara* produced with 4% vol. coagulant + 100% vol. soymilk

C = *Awara* produced with 6% vol. coagulant + 100% vol. soymilk

D = *Awara* produced with 8% vol. coagulant + 100% vol. soymilk

E = *Awara* produced with 10% vol. coagulant + 100% vol. soymilk

F = *Awara* produced with 12% vol. coagulant + 100% vol. soymilk

3.2 **pH of *Awara* Sample**

The result of pH of *awara* samples is presented in "Table 2". The result shows values of pH taken in day 0; that is immediately after production and week 1 after storage of product for one week. For day 0, pH value ranged from 4.4 – 6.6. Sample A had 6.6, followed by B, E and F (5.1), C (5.0) and D (4.4). While the result of week 1 shows a drop in pH values which ranged from 2.7-4.1. Sample A (4.1) was the highest followed by B and C with same value

(3.2), E (3.1), F (2.9) and D (2.7). It was observed that A had the highest pH both in day 0 and week 1 regardless the drop in value.

pH is defined as the negative logarithm of the molar concentration of hydrogen ions. The ability of a microorganism to grow in a specific food is an important example of a process that is more dependent on hydroxonium ion concentration than on titratable acidity [19]. The result of pH of the samples taken for day 0 and week 1 of storage shows a trend of decrease both with increase in coagulant concentration and storage. The decrease in pH correlates with increased titratable acidity of the samples. Sample D expressed least pH and highest acidity both in day 0 and week 1. [20] reported that pH content for cottage cheese is not higher than 5.2 and the experimental results show lower values for both day 0 and week 1. Only the control sample is higher than that reported for cottage cheese by [20] in day 0. Titratable acidity and pH is highly influenced by lactic acid producing bacteria.

Table 2: Result of pH of *awara* samples

Sample	Day 0	Week 1
A	6.6	4.1
B	5.1	3.2
C	5.0	3.2
D	4.4	2.7
E	5.1	3.1
F	5.1	2.9

Key: A = Soft Cottage Cheese produced with 4% vol. coagulant(Control) + 100% skim milk

B = *Awara* produced with 4% vol. coagulant + 100% vol. soymilk

C = *Awara* produced with 6% vol. coagulant + 100% vol. soymilk

D = *Awara* produced with 8% vol. coagulant + 100% vol. soymilk

E = *Awara* produced with 10% vol. coagulant + 100% vol. soymilk

F = *Awara* produced with 12% vol. coagulant + 100% vol. soymilk

3.3 **Textural Characteristics of *Awara* Samples**

The physical property expressed as textural characteristics of *awara* samples are presented in “Table 3”. The textural characteristics are indicated by firmness, elasticity, hardness and cohesiveness. The result of firmness ranged from 10.23-18.62% with D and C expressing lowest and highest respectively. The result shows that A and F; A and E; A and C; A and B; A and D are significantly different at (P = .05) respectively. Also, B and F, E, C, D are significantly different at (P = .05). Furthermore, C and F, E, D are significantly different at (P = .05). Similarly, D and F, E are significantly different at (P = .05). Overall, the samples are significantly different to each other except E and F.

In elasticity, F (0.94mm) and E (0.79mm), C (0.81mm), B (0.74mm), A (0.78mm) are significantly different at (P = .05) where F is highest and B lowest in value.

In hardness, F (65.71%) with the highest value is significantly different to all the samples and each sample is significantly different to the other at (P = .05).

Similarly, same pattern is also observed in cohesiveness where F (1.98mm) with highest value is significantly different to all the samples at (P = .05).

Texture is one of the major criteria which consumers use to judge the quality and freshness of many foods. When a food produces a physical sensation in the month (hard, soft, crisp, moist, dry), the consumer has a basis for determining the foods quality (fresh, stale, tender, ripe) [21]. Texture is an important quality factor of cottage cheese. Good quality texture cottage cheese is liked by the consumer. Texture is the combination of different parameters and these parameters includes hardness cohesiveness, firmness, elasticity, gumminess, springiness and chewiness [13].

Firmness or compactness is the degree of compression between molar teeth before the item falls apart [22]. The result showed that sample C has the highest firmness and could be an indication that the curd compacted the most during pressing and dewatering. This could also be attributed to the amount of force applied during pressing and dewatering of the curd. The result suggest that increased level of coagulant in the samples had no significant impact on the values of firmness.

Elasticity is defined as the tendency of the product to recover upon unloading the shape and dimensions it had before loading. If there is no permanent deformation after unloading, the elasticity is said to be complete elasticity [21]. The increased elasticity in the sample with the highest concentration of coagulant (12%) could suggest impact of tamarind coagulant on the strength of protein matrix of the curd.

Hardness is the force required to deform the product to given distance, i.e. force to compress between molars, bite through with incisors, compress between tongue and palate [21]. The force required for the compression of cheese samples (up to 30%) of it's original height is termed as hardness. According to [23] there is a positive correlation between protein and hardness of cheeses, as protein increases the number of force required for its compression increases. The values obtained for hardness is higher than that reported by

[13] which was 0.78-0.86N. This could be due to the type of coagulants used, methods of production, source of raw materials and unit of measurement.

Cohesiveness is defined as the degree to which the sample deforms before rupturing when biting with molars [21]. Cohesiveness largely depends upon chemical composition of cheese [13]. According to [23] dry matter influence cohesiveness of cheese samples and there is a direct relationship of dry matter and cohesiveness. The result shows that F5 expressed the highest amount of cohesiveness which has the highest coagulant. The increase in coagulant increased the protein content and yield, also the dry matter increased thus increasing the cohesiveness of cheese [13]. This assertion agrees with the result obtained.

Generally on the textural properties, increase in treatment resulted in increased textural qualities with the exception of firmness.

Table 3: Result of the textural characteristics of *awara* samples

Sample	Firmness (%)	Elasticity (mm)	Hardness (%)	Cohesiveness (mm)
A	16.93^{b}±0.08	0.78^{c}±0.01	52.94^{e}±0.06	1.80^{d}±0.01
B	15.98^{c}±0.00	0.74^{c}±0.01	55.98^{d}±0.01	1.85^{c}±0.01
C	18.62^{a}±0.39	0.81^{bc}±0.01	49.78^{f}±0.28	1.78^{d}±0.01
D	13.77^{d}±0.30	0.87^{ab}±0.01	63.39^{b}±0.25	1.91^{b}±0.02
E	10.22^{e}±0.32	0.79^{bc}±0.01	59.78^{c}±0.16	1.89^{b}±0.00
F	10.50^{e}±0.69	0.94^{a}±0.08	65.71^{a}±0.39	1.98^{a}±0.01

Values are means ± standard deviations of duplicate determinations. Means in same column with same superscripts do not differ significantly ($p>0.05$)

Key: A = Soft Cottage Cheese produced with 4% vol. coagulant(Control) + 100% skim milk

B = *Awara* produced with 4% vol. coagulant + 100% vol. soymilk

C = *Awara* produced with 6% vol. coagulant + 100% vol. soymilk

D = *Awara* produced with 8% vol. coagulant + 100% vol. soymilk

E = *Awara* produced with 10% vol. coagulant + 100% vol. soymilk

F = *Awara* produced with 12% vol. coagulant + 100% vol. soymilk

3.4 **Total Bacteria and Fungi Counts of *Awara* Samples (cfu/ml) (Day 0 and Week 1)**

The data presented in Table 4 shows the total bacterial and fungal counts of *awara* samples for day 0 and week 1. The result for bacterial count shows that in day 0, samples A, B and C had plates that were too numerous to count. Samples D, E and F has 1.48×10^{8}, 9.3×10^{7} and 8.9×10^{7} cfu/ml of bacteria respectively, indicating a slight decrease with increased coagulant concentration. In week 1 however, only B had a count of 8.5×10^{7} cfu/ml of bacteria whereas A, C, D, E and F had bacteria colonies that were too numerous to count on the plates.

Bacteria count showed a slight decrease in day 0 from D to F, whereas A to C shows a too numerous to count colonies. This revealed a reduction in bacteria numbers with increased coagulant addition. This result correlates with the pH of samples, showing that the lower the pH (more acidity of samples), the lower the number of bacteria colony growth of the samples. The first three samples of A, B and C which had too numerous to count colonies equally shows higher pH values (less acidity of samples).

Week 1 shows bacteria counts that are too numerous to count colonies for all the samples except B. The *awara* samples seem to fall within medium acid foods owing to their pH values. Medium acid foods include all foods which fall within the pH range of 5.0 to 4.5 [24]. The medium and low acid foods are subject to spoilage by the mesophilic spore-forming bacteria, the thermophilic spore forming organisms, non-sporing organisms and naturally occurring enzymes [24]. Some microorganisms of significance in foods, such as yeasts and lactic acid bacteria, grow best over the range of pH 3.0-6.0 and are often termed acidophilus [25].

The increase in number of bacteria during storage (week 1) could be attributed to favorable conditions such as higher ambient temperature observed (30-35^{0}C) during the period of storage. In addition factors like the storage container (airtight bottles) which created heat and subsequently increased moisture inside the bottles could have favored bacteria growth and as well as molds within the storage period.

The total fungi count of *awara* samples presented in Table 4 gave the following count for Day 0. Samples A, B, C, D, E and F has 4.7×10^{7}, 1.1×10^{8}, 5.8×10^{7}, 5.4×10^{7}, 4.2×10^{7} and 2.2×10^{7} cfu/ml of fungi respectively. It can be observed that F (2.2×10^{7}cfu/ml) is lowest and B (1.1×10^{8}cfu/ml) is highest in fungi count in day 0. There was gradual decrease in fungi count from B (1.1×10^{8}cfu/ml) to F (2.2×10^{7}cfu/ml). In week 1, all the samples gave counts that were too numerous to count. This was evident in visible spoilage of the *awara* products noticed in week 1.

Fungi count witnessed a general decrease in colony count (cfu/ml) with increasing concentration of coagulant in the samples in day 0. Result obtained for week 1 however, shows a too numerous to count colonies for all the samples. This indicate that the *awara* samples in addition to the storage conditions favor fungi growth within the storage period of one week. The decrease in counts of the samples with increased coagulant concentration is a possible pointer to the fact that the coagulant has some inhibitory effect on fungi. Both bacteria and fungi counts at day 0 showed least (8.9×10^7 and 2.2×10^7 cfu/ml respectively) at 12% coagulant concentration. However, the results were slightly higher than the maximum limit of recommended standard of 1.0×10^6 cfu/ml.

According to [26], the data of total viable count (TVC) of cottage cheese depending on storage time is not available. [26] measured acidity, pH and total viable count (TVC) of cottage cheese produced from skim milk (0.1% fat) and (1%, 2% and 3% partially skimmed milk) stored for 48 hrs. He found that shelf-life of cottage cheese at room temperature (29.5-30^{0}C) was only one day. He reported that the quality of cheese samples deteriorated rapidly at room temperature. This is similar to the result obtained in this study as the products also deteriorated under ambient conditions within the storage period as seen in the result of week 1.

Table 4: Result of total bacterialand fungalcounts of *awara* samples (Day O and Week 1)

Sample	Bacterial Count (cfu/ml)		Fungal Count (cfu/ml)	
	Day 0	Week 1	Day 0	Week 1
A	TNC*	TNC	4.7×10^7	TNC
B	TNC	8.5×10^7	1.1×10^8	TNC
C	TNC	TNC	5.8×10^7	TNC
D	1.48×10^8	TNC	5.4×10^7	TNC
E	9.3×10^7	TNC	4.2×10^7	TNC
F	8.9×10^7	TNC	2.2×10^7	TNC

*TNC = Too numerous to count

Key: A = Soft Cottage Cheese produced with 4% vol. coagulant(Control) + 100% skim milk

B = *Awara* produced with 4% vol. coagulant + 100% vol. soymilk

C = *Awara* produced with 6% vol. coagulant + 100% vol. soymilk

D = *Awara* produced with 8% vol. coagulant + 100% vol. soymilk

E = *Awara* produced with 10% vol. coagulant + 100% vol. soymilk

F = *Awara* produced with 12% vol. coagulant + 100% vol. soymilk

4. CONCLUSION

The results based on the different attributes analyzed, particularly with respect to microbiological qualities, the least total count obtained for bacteria and fungi at day 0 was at 12% coagulant concentration and were slightly higher than the maximum limit of recommended standard. Therefore, sample of "*awara*" product F with12% coagulantconcentration was most preferred in most attributes. Hence, the product should be consumed one day after production.

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